FindFace Multi

Release 1.2

NtechLab

Aug 07, 2024

CONTENTS

FindFace Multi is a multifunctional multi-object video analytics software, based on FindFace Enterprise Server, a cutting-edge AI recognition technology. FindFace Multi is a turnkey solution that you can harness in such areas as retail, banking, social networking, entertainment, sports, event management, dating services, video surveillance, public safety, homeland security, and others.

FindFace Multi can detect, identify, and analyze the following objects in the video:

- Human faces, along with recognition of such facial attributes as gender, age, emotions, glasses, face mask, beard, and many others. The integrated 2D anti-spoofing system ensures that it is a live person in front of a camera and eliminates the possibility of fraud using images on paper or mobile device screens.
- Human bodies (silhouettes), along with recognition of clothing type and color.
- Cars, with recognition of such car attributes as make, model, body style, color, license plate number, and others.

After FindFace Multi identifies and analyzes an object, it notifies responsible officials about its appearance within fractions of a second. Additional information about the object, such as a person's gender, age, car license plate number, etc., is displayed in the relevant recognition event.

FindFace Multi supports the integration of third-party solutions via *HTTP API* and *webhooks*, so you can enhance your current system or application with multi-object recognition functionality.

Core features

- AI-based platform.
- Comprehensive cards that can accommodate aggregated information about a person and car/vehicle. Possibility of creating relations between cards of the same type or different types.
- Fast and robust real-time video monitoring against a card index.
- Multi-object identification and analytics: faces, bodies (silhouettes), cars.
- Support for live video and archives, most video formats and codecs that FFmpeg can decode.
- Advanced camera management, including ONVIF support, the possibility of changing video orientation, fine-tuning a camera for each object type, video recording (if enabled).
- Multi-object verification: faces, bodies, cars.
- AI recognition of gender, age, emotions, glasses, beard, face mask, and other face attributes.
- AI face liveness detector.
- AI recognition of an exact person and vehicle.
- AI recognition of clothing type and color.
- AI recognition of special vehicles, a car's make, model, body style, color, and license plate number.
- Database search for faces, bodies, cars.
- Possibility of counting faces, bodies, and cars on connected cameras and measuring distance between bodies. Single- and multi-camera counting support.
- Video surveillance. Video Recorder.
- Possibility of monitoring the presence of people in given areas, using rules and monitoring schedules.
- Automatic clustering of objects of the same origin (face/body images belonging to the same person, images of the same car), enriched with the end-to-end integration with the card index.

Deployment environment

- Developer-friendly installer and user-friendly interface.
- Single- and multi-host deployment.
- Increased performance and fault-tolerance in high load systems with numerous cameras and clients.
- Network or on-premise licensing.
- CPU- and GPU-based acceleration for your choice.
- Mobile app.

System security

- Advanced user management.
- Authentication based on a password, certificate, and face recognition for guaranteed system protection.
- Card security.
- Comprehensive, friendly, searchable audit logs.
- Backup and recovery utilities.
- Possibility of monitoring user sessions and blocking devices without deactivating user accounts.

Ethical data usage

- Full compliance with personal data protection laws (GDPR and similar).

Make the most of your system

- Social interaction analysis.
- Know your customer analytics (KYC).
- Detailed reports on face recognition events, episodes, search events, clusters, counters, cameras, cards, audit logs, KYC analytics, and areas.
- Face liveness detector as a standalone service.

Useful little things

- Quick card index creation.
- Complete card customization.
- Deduplication support for events and cards.
- Extended set of search filters.
- Scheduled database cleanup.

Integration

- Integration via HTTP API and webhooks.
- Integrations with favored vendors.
- Edge device integration.

CHAPTER

ONE

WHAT'S NEW IN FINDFACE MULTI 1.2

New Features:

- **Video Recorder** (BETA): a brand-new functionality that records, stores, and plays back video data from cameras.

  See:

  - *Architecture*
  - *Deploy from Console Installer*
  - *Deploy Video Recorder Step-by-Step*
  - *Configure Video Recorder*
  - *Enable Recording for Camera*
  - *Video Player in Event Notification*

- **Card index**: a logical result of the dossier database development. The card index contains cards of two types. A person card aggregates data about a person, such as photos of their face and body. Vehicle-related data, such as photos and license plate numbers, are stored in car cards.

  See *Set Up Object Monitoring and Card Index*.

- **Relations**: enrich your card index and analytics capacity by drawing relations between cards of the same type or different types.

  See *Card Relations*.

- **Special vehicles**: a new AI-based feature that allows you to automatically recognize police, ambulance, rescue service, and taxi vehicles.

  See *Enable Car and Car Attribute Recognition*.

- **Counters**: a possibility of counting cars in addition to faces and bodies.

  See *Face, Body, Car Counters. Distance Measurement*.

- **Clusters**: a completely revised functionality of what was formerly known as Persons. Includes automatic clustering of objects of the same origin (face/body images belonging to the same person, images of the same car), end-to-end integration with the card index, and many other features.

  See *Face, Body, Car Clusters*.

- **Episodes**: a major enhancement that divides episodes into two types: people and cars.

  See *Organize Events with Episodes*.

- **Webhooks**: a possibility of setting webhooks for areas and new episode types.

  See *Webhooks*.

- **Reports**: a possibility of building reports on areas, area activations, and activation records.

  See *Reports*.

- **Reports**: new work time reports with a possibility of export to Excel. Allow you to regard the exact moments of staff entering and exiting an enterprise or a designated area and calculate the total time spent at it. Can be built on the *Events* and *Areas* tabs.

  See *Reports*.

Enhanced Algorithms, UI, UX:

- *Distance measurement between bodies*.
- *Interaction analysis*.
- *Events*.
- *Areas*.
- Expanded usage of progress bars throughout the web interface.
- *Webhooks*.

Technical Changes:

- *Backup and recovery functionality*.
- *Instance removal script*.
- To save disc space, the system now saves normalized images to JPEG with the 95% quality instead of PNG.
- *Video processing*: statistics is now partitioned by object type.
- *Cleanup utility*: new entities removal support.
- *Custom meta-data in Tarantool*.
- *Cluster migration* to a different neural network.

Renamed:

- `dossier` → `card`.
- *Relations* → *Interaction Analysis*.
- *Persons* → *Clusters*.

Fresh Neural Networks:

- Special vehicles recognition: a brand-new neural network `carattr.special_types.v0` to recognize police cars, ambulance, rescue service, and taxi.
- Liveness recognition: brand-new neural networks `liveness.pacs.v0` (embedded into `findface-video-worker`) and `liveness.colombo` (`findface-liveness-api`) with improved characteristics.
- Car license plate normalizer: `anaferon.v3` with improved characteristics.

- Car license plate recognition: a new version `license_plate.v4` that supports license plates of Uzbekistan, Brazil, and India in addition to the UAE, Russia, Kazakhstan, Georgia, South Africa, Vietnam, Belarus, Ukraine, Armenia, Kyrgyzstan.

Coming Soon:

- **Distributed card index**: a possibility of distributing a card index among several hosts with synchronization and replication.
- **Flexible structure of the feature vector database**: a possibility of creating different meta-fields in different Tarantool galleries.

Note: This functionality is already available in the FindFace Core. If you need this functionality now, contact our support team (support@ntechlab.com).

CHAPTER

TWO

SYSTEM ADMINISTRATOR'S GUIDE

This chapter is all about FindFace Multi deployment and further updates and maintenance during exploitation.

2.1 Architecture

Though you mostly interact with FindFace Multi through its web interface, be sure to take a minute to learn the FindFace Multi architecture. This knowledge is essential for the FindFace Multi deployment, integration, maintenance, and troubleshooting.

In this chapter:

2.1.1 Recognition Objects and Recognition Process

FindFace Multi can recognize the following objects and their features:

- human faces
- human bodies (silhouettes)
- cars

Note: The face recognition functionality is enabled by default. Make changes to configuration files to enable the *body* and *car* recognition.

FindFace Multi detects an object in the photo or video and prepares its image through normalization. The normalized image is then used for extracting the object's feature vector (an n-dimensional vector of numerical features that represent the object). Object feature vectors are stored in the database and further used for verification and identification purposes.

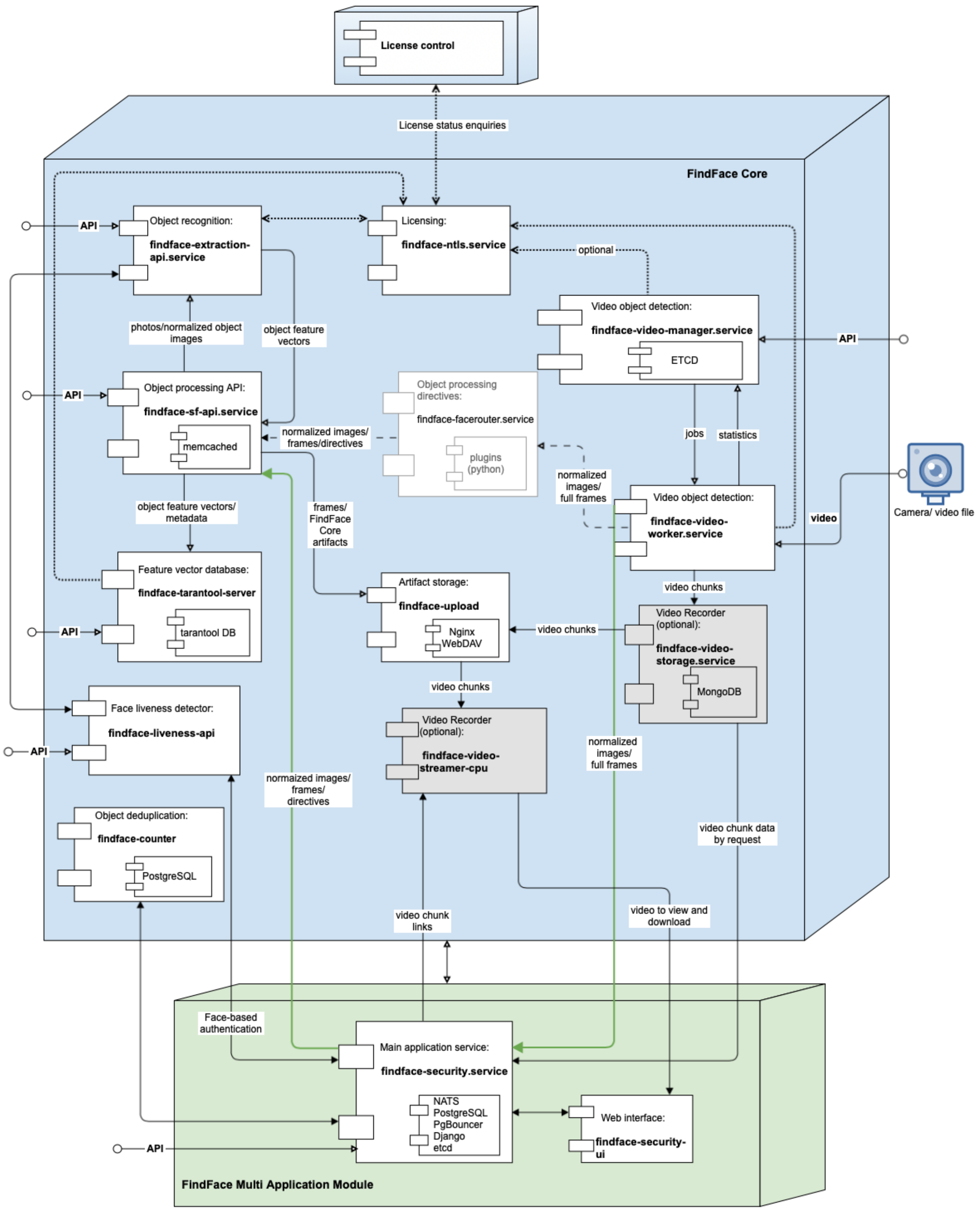
2.1.2 Architectural Elements

FindFace Multi consists of the following fundamental architectural elements:

- FindFace Core, a cutting-edge AI-based recognition technology that can be used as a separate product FindFace Enterprise Server.
- FindFace Multi, which is a turnkey application module for FindFace Enterprise Server.

The FindFace Core internal architecture allows for embedding Video Recorder, an additional functionality that records, stores, and plays back video data from cameras.

Architecture scheme


License control
License status enquiries
FindFace Core
API
Object recognition:
findface-extraction-api.service
Licensing:
findface-ntls.service
optional
Video object detection:
findface-video-manager.service
ETCD
API
photos/normalized object images
object feature vectors
API
Object processing API:
findface-sf-api.service
memcached
Object processing directives:
findface-facerouter.service
plugins (python)
normalized images/ frames/directives
jobs
statistics
normalized images/ full frames
Video object detection:
findface-video-worker.service
video
Camera/ video file
object feature vectors/ metadata
frames/ FindFace Core artifacts
Feature vector database:
findface-tarantool-server
tarantool DB
API
Artifact storage:
findface-upload
Nginx WebDAV
video chunks
video chunks
Video Recorder (optional):
findface-video-storage.service
MongoDB
video chunks
Face liveness detector:
findface-liveness-api
API
Video Recorder (optional):
findface-video-streamer-cpu
normalized images/ full frames
normaized images/ frames/ directives
Object deduplication:
findface-counter
PostgreSQL
video chunk data by request
video chunk links
video to view and download
Face-based authentication
Main application service:
findface-security.service
NATS PostgreSQL PgBouncer Django etcd
Web interface:
findface-security-ui
API
FindFace Multi Application Module

FindFace Core

The FindFace Core includes the following components:

Component	Ports in use	Description	Vendor
findface-extraction-api	18666	Service that uses neural networks to detect an object in an image and extract its feature vector. It also recognizes object attributes (for example, gender, age, emotions, beard, glasses, face mask - for face objects). CPU- or GPU-acceleration.	NtechLab own deployment
findface-sf-api	18411	Service that implements the internal HTTP API for object detection and recognition.	
findface-tarantool-server	32001, shard ports (default 330xx, 81xx)	Service that provides interaction between the `findface-sf-api` service and the feature vector database (the Tarantool-powered database that stores object feature vectors.	
findface-upload	3333	NginX-based web server used as a storage for original images, thumbnails, and normalized object images. If Video Recorder is installed, `findface-upload` also stores video data from cameras.	
findface-facerouter	18820	Service used to define processing directives for detected objects. In FindFace Multi, its functions are performed by `findface-security` (see *FindFace Multi Application Module*). If necessary, you can still deploy and enable this component for integration purposes (see *findface-facerouter and Custom Plugins*).	
findface-video-manager	18810, 18811	Service, part of the video object detection module, that is used for managing the video object detection functionality, configuring the video object detector settings and specifying the list of to-be-processed video streams.	
findface-video-worker	18999	Service, part of the video object detection module, that recognizes an object in the video and posts its normalized image, full frame and metadata (such as detection time) to the `findface-facerouter` service for further processing according to given directives. If *Video Recorder* is enabled, `findface-video-worker` sends video over to `findface-video-storage`. Provides *face liveness detection* if enabled. CPU- or GPU-acceleration.	
findface-ntls	443 (TCP), 3133, 3185	License server that interfaces with the NtechLab Global License Server, a USB dongle, or hardware fingerprint to verify the *license* of your FindFace Multi instance.	
findface-counter	18300	Service used for event deduplication.	
findface-liveness-api	18301	Besides the embedded functionality provided by `findface-video-worker`, face liveness detection can also be harnessed as a standalone service `findface-liveness-api`. The service takes a specific number of frames from a video chunk and returns the best quality face, and decimal liveness result averaged across the taken frames (see *Liveness Detection as Standalone Service*). The service is also involved in the course of user *authentication* by face.	
Tarantool	Shard ports (default 330xx, 81xx)	Third-party software that implements the feature vector database that stores extracted object feature vectors and identification events. The system data, cards, user accounts, and camera settings are stored in PostgreSQL (part of the FindFace Multi application module).	Tarantool
etcd	2379	Third-party software that implements a distributed key-value store for `findface-video-manager`. Used as a coordination service in the distributed system, providing the video object detector with fault tolerance.	etcd
NginX	80; SSL: 8002, 8003, 443, 80	Third-party software that implements the system web interfaces.	nginx
memcached	11211	Third-party software that implements a distributed memory caching system. Used by `findface-sf-api` as a temporary storage for extracted object feature vectors before they are written to the feature vector database powered by Tarantool.	memcached

FindFace Multi Application Module

The FindFace Multi application module includes the following components:

Component	Ports in use	Description	Vendor
findface-security	Configurable	Component that serves as a gateway to the FindFace Core. Provides interaction between the FindFace Core and the web interface, the system functioning as a whole, HTTP and web socket, object monitoring, event notifications, episodes, webhooks, object clusterization, and counters. Includes the following internal services: NTLS checker, Counter manager, Webhooks manager, Clusterizator, Event episodes manager, and Video archive queue manager. The last four can be enabled and disabled via the `/etc/findface-security/config.py` configuration file.	NtechLab own deployment
findface-security-ui	Configurable	Main web interface used to interact with FindFace Multi. Based on the Django framework. Allows you to work with object recognition events, search for objects, manage cameras, users, cards, watch lists, collect real-time statistics, and many more.	
NATS	4222	Third-party software that implements a message broker inside `findface-security`.	NATS
etcd	2379	Third-party software that implements locks in the `findface-security` service, such as locks in NTLS checker, reports, video processing, object clusterization, etc.	etcd
Pgbouncer	5439	Third-party software, a lightweight connection pooler for PostgreSQL. Optional, used to increase the database performance under high load.	PgBouncer
PostgreSQL	5432	Third-party software that implements the main system database. This database stores cards of persons and cars and data for internal use, including user accounts and camera settings. The object feature vectors and object identification events are stored in Tarantool (part of the FindFace Core).	PostgreSQL

Video Recorder

Video Recorder is an optional part of the FindFace Core. It includes the following components:

Component	Ports in use	Description	Vendor
findface-video-storage	18611	Service that implements video chunk management. It takes video chunks from the `findface-video-worker` component, puts them into the storage (`findface-upload`), and writes their meta-information and whereabouts to the Video Recorder database (MongoDB). By request from `findface-security`, it issues info about existing video chunks in the form of Websocket-links to the corresponding streams. These links are further used by `findface-video-streamer-cpu` to deliver the video to a user for viewing and downloading.	NtechLab own deployment
findface-video-streamer-cpu	9000	After receiving a `findface-security-ui` request, this service uses Websocket to extract requested video chunks from `findface-video-storage` and `findface-video-worker` (only the last chunk if it's not yet recorded to the storage). Then it merges the video chunks into a one-piece video and delivers it to a user for viewing and downloading.	
MongoDB	27017	Third-party software that implements the Video Recorder database. The database stores meta-information of the video chunks, including their location. The video chunks themselves are stored in the `findface-upload` component.	MongoDB

See also:

2.1.3 Single- and Multi-Host Deployment

You can deploy FindFace Multi on a single host or in a multi-host environment. If you opt for the latter, we offer you one of the following deployment schemes:

- Deploy FindFace Multi standalone and distribute additional `findface-video-worker` components across multiple hosts.

  See *Additional findface-video-worker Deployment on Remote Hosts*.

- Distribute the FindFace Multi components across multiple hosts. If necessary, set up load balancing.

  See *Guide to Typical Multi-Host Deployment*.

2.1.4 CPU- and GPU-acceleration

The `findface-extraction-api` and `findface-video-worker` services can be either CPU- or GPU-based. During installation from the developer-friendly *installer*, you will have an opportunity to choose the acceleration type you need.

If you opt to install FindFace Multi from the *repository package*, deploy the `findface-extraction-api` and `findface-video-worker-cpu` packages on a CPU-based server, and the `findface-extraction-api-gpu` and/or `findface-video-worker-gpu` packages on a GPU-based server.

Important: Refer to *Requirements* when choosing hardware configuration.

Important: If the resolution of a camera(s) in use is more than 1280x720px, it is strongly recommended to use the GPU-accelerated package `findface-video-worker-gpu`.

Note: The *liveness detector* is much slower on CPU than on GPU.

2.2 Requirements

In this chapter:

2.2.1 System Requirements for Basic Configuration

To calculate the FindFace Multi host(s) characteristics, use the requirements provided below.

Tip: Be sure to learn about the FindFace Multi *architecture* first.

Important: If the resolution of a camera(s) in use is more than 1280x720px, it is strongly recommended to use the GPU-accelerated package `findface-video-worker-gpu`.

Important: On AMD CPU servers, the full functionality of the CPU-accelerated `findface-extraction-api` service is not guaranteed. Use the GPU-accelerated service `findface-extraction-api-gpu` along with the GPU-version of neural networks instead.

Note: In the case of a high-load system (~> 15 events per second), we recommend using an SSD.

	Minimum	Recommended
CPU	Intel Core i5 CPU with 4+ physical cores 3+ GHz. AVX2 support	Intel Xeon Silver/Gold with 6+ physical cores
	The own needs of FindFace Multi require 2 cores HT > 2.5 GHz. The characteristics also depend on the number of cameras in use. A single camera 720p@25FPS requires 2 cores >2.5 GHz. AVX2 support	
GPU (optional)	NVIDIA GeForce® GTX 1060 6 GB	NVIDIA GeForce® GTX 1080Ti+ with 11+ GB RAM
	Supported series: GeForce (Maxwell, Pascal, Turing, and above), Tesla (Maxwell, Pascal, Volta v100, Turing, and above) *Note: NVIDIA GeForce RTX 40 Series graphics cards are currently not supported*	
RAM	10 Gb	16+ Gb
	The own needs of FindFace Multi require 8 Gb. The RAM consumption also depends on the number of cameras in use. A single camera 720p@25FPS requires 2 GB RAM	
HDD (SSD for best performance)	16 Gb	16+ Gb
	The own needs of the operating system and FindFace Multi require 15 GB. The total volume is subject to the required depth of the event archive in the database and in the log, at the rate of 1.5 Mb per 1 event	
Operating system	Ubuntu 18.04, x64 only	

Note: You can also use an Intel-based VM if there is AVX2 support, and eight physical cores are allocated exclusively to the VM.

Tip: For more accurate hardware selection, contact our support team by support@ntechlab.com.

2.2.2 Required Administrator Skills

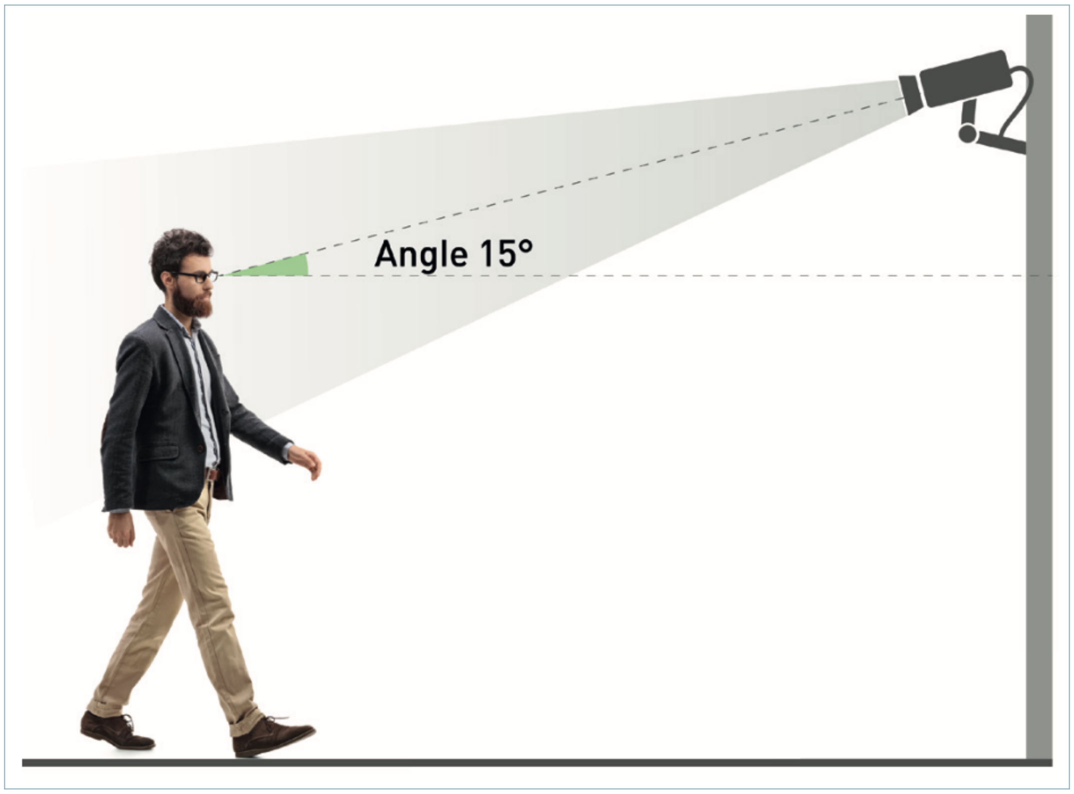
A FindFace Multi administrator must know and understand OS Ubuntu at the level of an advanced user.

2.2.3 Requirements for CCTV Cameras

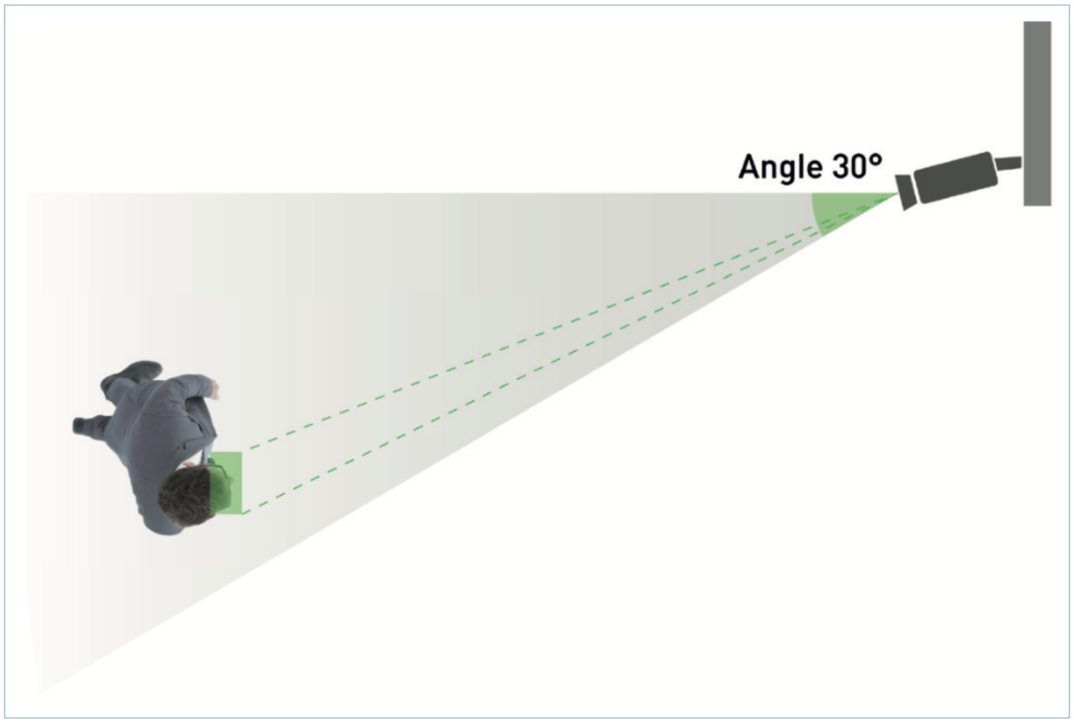
Face Recognition

The primary requirements for installation and characteristics of CCTV cameras in your FindFace Multi-based face recognition system are the following:

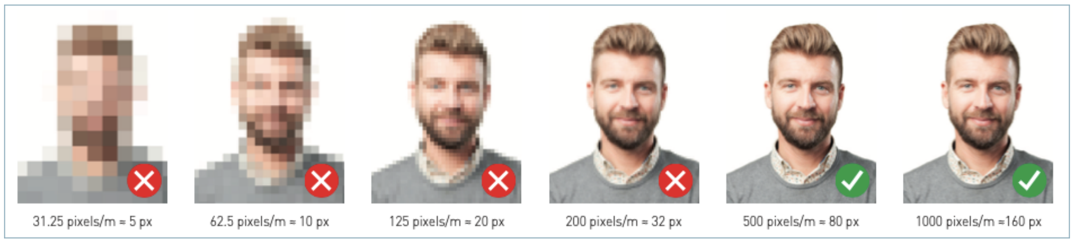
1. For correct face detection in a video stream, mount the camera so that the face of each individual entering the monitored area surely appears in the camera field of view.
2. The vertical tilt angle of the camera should not exceed 15°. The vertical tilt is a deviation of the camera's optical axis from the horizontal plane, positioned at the face center's level for an average height person (160 cm).



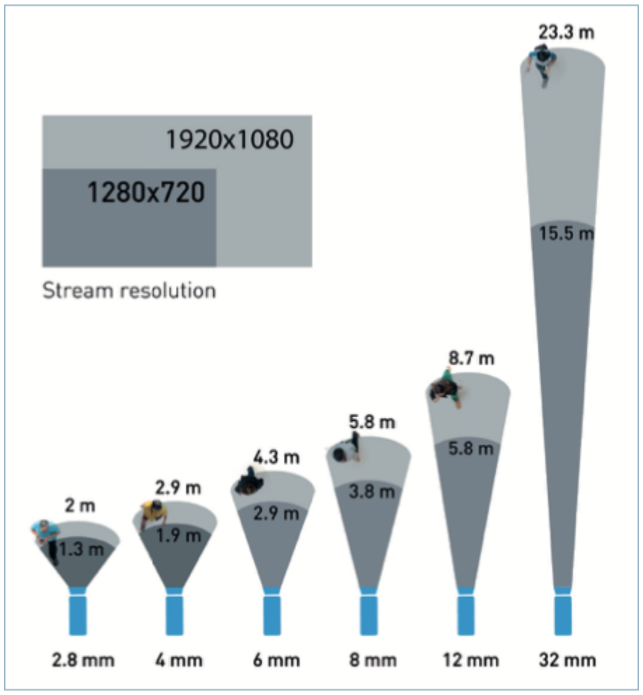
3. The horizontal deflection angle should not exceed 30°. The horizontal deflection is a deviation of the camera's optical axis from the motion vector of the main flow of objects subject to recognition.



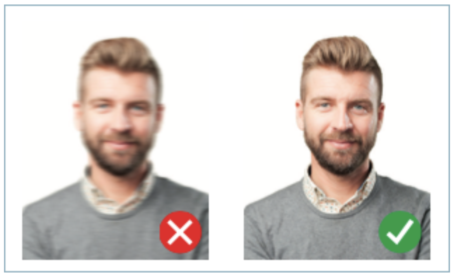
4. The minimum pixel density required for identification is 500 pixels/m (roughly corresponds to a face width of 80 pixels).



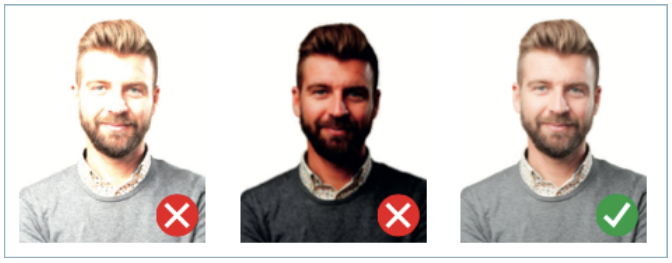
5. Select such a focal length of the camera's lenses that provides the required pixel density at a predetermined distance to the recognition objects. The picture below demonstrates how to calculate the focal length subject to the distance between the camera and recognition objects. Estimating the focal length for a particular camera requires either calculators or a methodology provided by the camera manufacturer.



6. The exposure must be adjusted so that the face images are sharp ("in focus"), non-blurred, and evenly lit (not overlit or too dark).



7. For imperfect lighting conditions such as flare, too bright or too dim illumination, choose cameras with WDR hardware (Wide Dynamic Range) or other technologies that provide compensation for backlight and low illumination. Consider BLC, HLC, DNR, high optical sensitivity, Smart infrared backlight, AGC, and such.



8. Video compression: most video formats and codecs that FFmpeg can decode.
9. Video stream delivery protocols: RTSP, HTTP.

Tip: To calculate the precise hardware configuration tailored to your purposes, contact our experts by support@ntechlab.com.

Body and Car Recognition

Since the body and car recognition are relatively new features, we still need a great deal of testing in the field to formulate universal requirements for CCTV cameras applicable to the operational phase. However, we are always happy to individually assist you with hardware selection and deployment tailored to your business needs. Please do not hesitate to contact our experts (support@ntechlab.com).

2.3 Licensing Info

In this chapter:

2.3.1 Licensing Principles

The FindFace Multi licensing is granted using the following criteria:

1. The overall number of extracted feature vectors, regardless of the object type (face, body, car).

   Note: The feature vectors are extracted from objects detected in the video, from card photos and user photos, and when building so-called *cluster* centroids.

   The licensing scheme is the following:

   - Events: 1 event of video object detection = 1 object in a license.
   - Card: 1 photo in a card = 1 object in a license.
   - Clusters: 1 person = 1 object in a license; 1 car = 1 object in a license.
   - Users: 1 photo of a user = 1 object in a license.

2. The number of video sources currently in use (i.e., active video processing jobs for cameras and video files).
3. The number of model instances in use in the `findface-extraction-api` component.
4. Face attribute recognition: gender/age/emotions/glasses/beard/face mask.
5. Body attribute recognition: clothing color/type.
6. Car attribute recognition: make/model/color/body style.
7. License plate recognition.
8. Face liveness detection.

9. Integration with partners.

You can choose between the following licensing methods:

- The online licensing is provided by interaction with the NtechLab Global License Manager `license.ntechlab.com` and requires a stable internet connection, DNS, and open port 443 TCP. Upon being disconnected from the internet, the system will continue working off-grid for 4 hours.

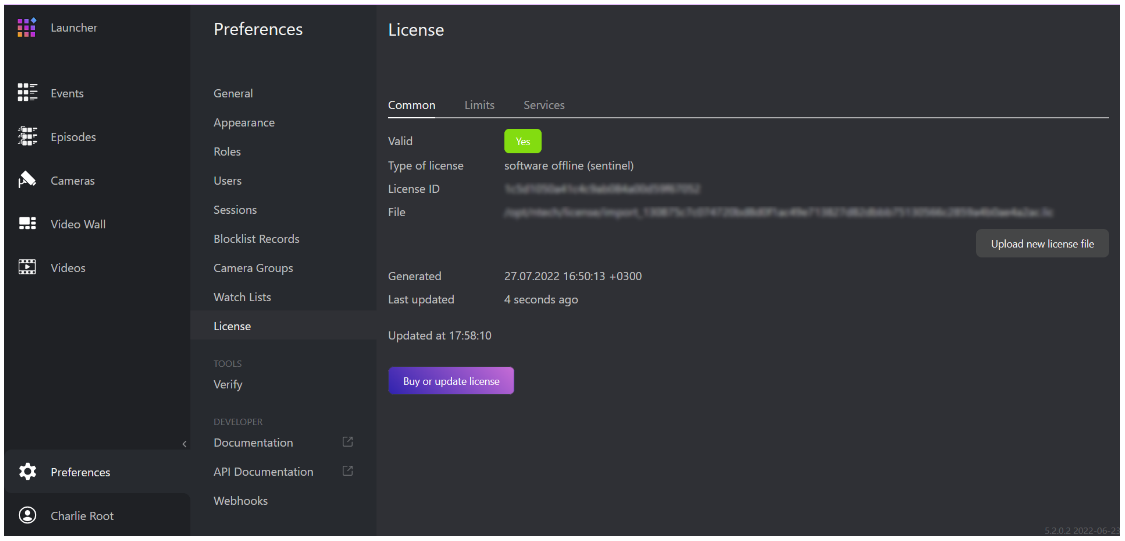
Note: It is possible to prolongate the off-grid period for up to 2 days. Inform your manager if you need that.

- The offline licensing via a USB dongle requires a USB port on the physical server with the `findface-ntls` component (license server in the *FindFace core*).
- The offline licensing via hardware fingerprint requires Sentinel drivers installed on the physical server with the `findface-ntls` component.

Important: For the system to function, a single instance of `findface-ntls` should be enough. If your system requires more license servers, contact your NtechLab manager beforehand to prevent your system from being blocked.

2.3.2 View and Update License

After installing FindFace Multi, upload the license file you obtained from the manager into the system. To do so, navigate to *Preferences -> License*.



Valid	Yes
Type of license	software offline (sentinel)
License ID	[redacted]
File	[redacted]
Generated	27.07.2022 16:50:13 +0300
Last updated	4 seconds ago

Updated at 17:58:10

Use the same tab to consult current licensing information and upgrade your license.

2.3.3 Offline Licensing via Hardware Fingerprint

Note: Sentinel is a type of offline licenses that, unlike guardant licenses, do not require any physical media for its work.

Glossary:

- Sentinel is a software protection and licensing system by Thales. It allows you to implement offline licensing without access to a global server.
- The C2V file is a file, containing data about a hardware fingerprint of the client's machine, for binding the license only to this machine. This file is generated by the sentinel library. The C2V file is generated on the client's machine where the license key will be installed later.

To implement the fingerprint licensing to your system, do the following:

1. Inform your manager that you intend to apply this licensing method and request your unique license id.
2. Install the Sentinel drivers on the physical server with the `findface-ntls` component.

   Do the following:

   1. Download Sentinel drivers from the official website.
   2. Unzip the downloaded archive and browse to it.

      ```
      tar -xvzf Sentinel_LDK_Linux_Runtime_Installer_script.tar.gz
      cd Sentinel_LDK_Linux_Runtime_Installer_script/
      ```

   3. There is another archive `aksusbd-8.31.1.tar.gz` inside the archive. Unzip it and browse to the resulting directory.

      ```
      tar -xvzf aksusbd-8.31.1.tar.gz
      cd aksusbd-8.31.1/
      ```

   4. Run the installation command.

      ```
      sudo ./dinst
      ```

   5. Run and check the statuses of the Sentinel services.

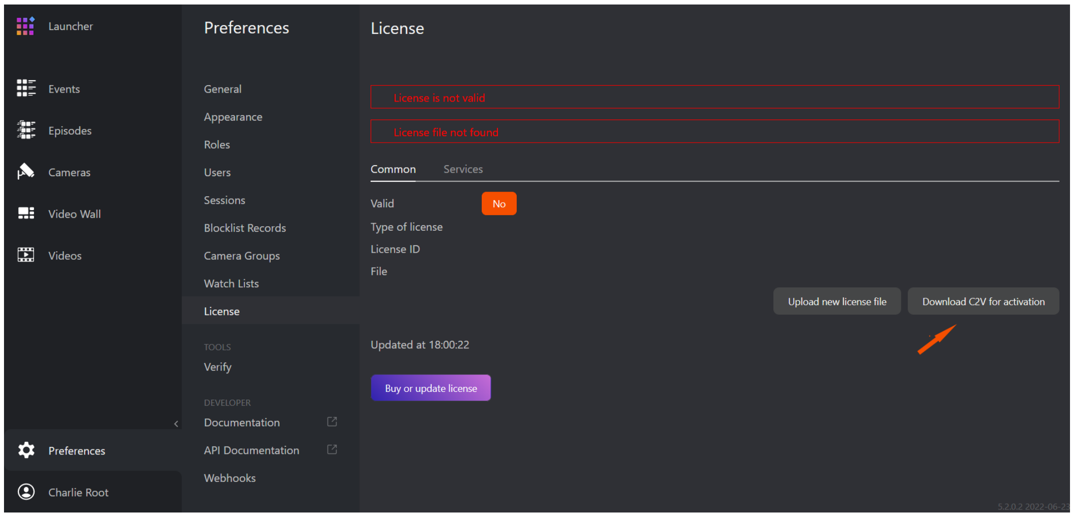
      ```
      sudo systemctl start aksusbd.service hasplmd.service
      sudo systemctl status aksusbd.service hasplmd.service
      ```

3. Put the `findface-sentinel-lib_*.deb` package received from your manager into some directory on the same host. Install the package.

   ```
   sudo dpkg -i /path/to/findface-sentinel-lib_*.deb
   ```

4. Get C2V file from the FindFace Multi.

   In the FindFace Multi web interface, navigate to *Preferences -> License*. Take a hardware fingerprint (C2V file) by clicking the *Download C2V for activation* button.



License is not valid

License file not found

Valid No

Type of license

License ID

File

Updated at 18:00:22

Tip:

If you prefer working with the console, you can send the following API request to `findface-ntls` instead:

```
curl 'http://<findface-ntls-server-ip>/ntls/c2v' >my_pc.c2v
```

5. Send the License ID and the C2V file to your manager and receive your license file in return.
6. Upload the license file on the *License* tab.

2.4 Deploy FindFace Multi

FindFace Multi provides the following deployment options:

- from a console installer
- step-by-step from an APT repository

Important: Starting the GPU-accelerated services `findface-extraction-api` and `findface-video-worker-gpu` for the first time after deployment may take up a considerable amount of time due to the caching process (up to 45 minutes).

Important: Although FindFace Multi provides *tools* to ensure its protection from unauthorized access, they are not replacing a properly configured firewall. Be sure to use a firewall to heighten the FindFace Multi network protection.

2.4.1 Deploy from Console Installer

To deploy FindFace Multi, use a developer-friendly console installer.

Tip: Before deployment, be sure to consult the *system requirements*.

Important: If you intend to use the additional functionality of the Video Recorder and you are located in Russia or Belarus, before you start deploying, you need to contact support@ntechlab.com to get the MongoDB distribution package. Then follow the installation instructions in the section *Troubleshoot MongoDB distribution*.

Important: The FindFace Multi host must have a static IP address in order to be running successfully. To make the IP address static, open the `/etc/network/interfaces` file and modify the current primary network interface entry as shown in the case study below. Be sure to substitute the suggested addresses with the actual ones, subject to your network specification.

```
sudo vi /etc/network/interfaces

iface eth0 inet static
address 192.168.112.144
netmask 255.255.255.0
gateway 192.168.112.254
dns-nameservers 192.168.112.254
```

Restart networking.

```
sudo service networking restart
```

Be sure to edit the `etc/network/interfaces` file with extreme care. Please refer to the Ubuntu guide on networking before proceeding.

To deploy FindFace Multi from the console installer, do the following:

1. Download the installer file `findface-multi-1.2-and-server-5.2.run`.
2. Put the `.run` file into some directory on the designated host (for example, `/home/username`).
3. From this directory, make the `.run` file executable.

   ```
   chmod +x findface-multi-1.2-and-server-5.2.run
   ```

4. Execute the `.run` file.

   ```
   sudo ./findface-multi-1.2-and-server-5.2.run
   ```

   The installer will ask you a few questions and perform several automated checks to ensure that the host meets the system requirements. Fill out the prompts appropriately once requested. The questions and answers are the following:

   1. Product to install: FindFace Multi.
   2. Installation type:
      - 1: install FindFace Multi standalone.

- `2`: install FindFace Multi and configure it to interact with additional remote `findface-video-worker` instances.

  Tip: To install only `findface-video-worker` on a host, refer to *Additional findface-video-worker Deployment on Remote Hosts*.

- `3`: install the apt repository for the *step-by-step deployment*.
- `4`: *fully customized installation*.

Note: If you select installation type #3 or #4, keep in mind to install necessary neural network models along with the `findface-extraction-api` component.

3. Type of `findface-video-worker` package: CPU or GPU.
4. Type of `findface-extraction-api` package: CPU or GPU.
5. Do you want to install NtechLab VMS?: yes or no to install Video Recorder.

Should you choose to install FindFace Multi standalone, its components will be automatically installed, configured and/or started in the following configuration:

Important: In the case of a clean install, the installer will automatically configure `findface-extraction-api` to use the `kiwi_320` neural network. Otherwise, you will be able to choose between `kiwi_320` and the previous model. It is strictly not recommended to use the installer to update the system. See *Update to FindFace Multi 1.2* for the instructions.

Service	Configuration
postgresql-10	Installed and started.
nats-server	Installed and started.
etcd	Installed and started.
pg-bouncer	Installed and started.
mem-cached	Installed and started.
nginx	Installed and started.
django	Installed and started as a web framework for the FindFace Multi web interface.
findface-ntls	Installed and started.
findface-tarantool-server	Installed and started. The number of instances (shards) is calculated using the formula: `N = min(max(min(mem_mb // 2000, cpu_cores), 1), 16 * cpu_cores)`. I.e., it is equal to the RAM size in MB divided by 2000, or the number of CPU physical cores (but at least one shard), or the number of CPU physical cores multiplied by 16, if the first obtained value is greater.
findface-extraction-api	Installed and started (CPU/GPU-acceleration).
findface-sf-api	Installed and started.
findface-upload	Installed.
findface-video-manager	Installed and started.
findface-video-worker-*	Installed and started (CPU/GPU-acceleration).
findface-data-*	Neural network models for object and object attribute recognition. Installed.
findface-security	Installed and started.
findface-counter	Installed and started.
findface-liveness-api	Installed and started.
jq	Installed. Used to pretty-print API responses from FindFace Multi.
python3-ntech.*	Internal and auxiliary services. Installed and started.
findface-video-storage	Installed and started (only with Video Recorder).
findface-video-streamer-cpu	Installed and started (only with Video Recorder).
mon-god	Installed and started (only with Video Recorder).

After the installation is complete, the following output is shown on the console:

Tip: Be sure to save this data: you will need it later.

```
#############################################################################
#                       Installation is complete                            #
#############################################################################
- upload your license to http://172.20.77.17/#/license/
- user interface: http://172.20.77.17/
  superuser:      admin
  password:       admin
  documentation:  http://172.20.77.17/doc/
```

5. Specify your time zone in the `/etc/findface-security/config.py` configuration file, either in the `Region/Country/City` or `Etc/GMT+H` format. The time zone determines the time in reports, logs, and names of such FindFace Multi artifacts as event full frames and thumbnails, counter screenshots, etc.

   Tip: The best way to do so is to copy/paste your time zone from this table on Wikipedia.

   ```
   sudo vi /etc/findface-security/config.py

   # time zone
   TIME_ZONE = 'America/Argentina/Buenos_Aires'
   ```

6. (Optional) In the same configuration file, you can modify the default web interface language.

   ```
   # language code
   LANGUAGE_CODE = 'es-ar'
   ```

   See also:

   Add Custom Language

7. Restart the `findface-security` service.

   ```
   sudo systemctl restart findface-security.service
   ```

8. Upload the FindFace Multi license file via the main web interface `http://<Host_IP_address>/#/license`. To access the web interface, use the provided `superuser` credentials.

   Note: The host IP address is shown in the links to FindFace web services in the following way: as an external IP address if the host belongs to a network, or `127.0.0.1` otherwise.

   Important: Do not disclose the `superuser` (Super Administrator) credentials to others. To administer the system, create a new user with administrator privileges. Whatever the role, the Super Administrator cannot be deprived of its rights.

9. The answers to the installer questions were saved to a file `/tmp/<findface-installer-*>.json`. You can edit this file and use it to install FindFace Multi on other hosts without having to answer the questions again.

   To do so, execute:

```
sudo ./findface-multi-1.2-and-server-5.2.run -f /tmp/<findface-installer-*>.json
```

Tip: You can find an example of the installation file in *Installation File*.

Important: To preserve the FindFace Multi compatibility with the installation environment, we highly recommend you to disable the Ubuntu automatic update. In this case, you will be able to update your OS manually, fully controlling which packages to update.

To disable the Ubuntu automatic update, execute the following commands:

```
sudo apt-get remove unattended-upgrades
sudo systemctl stop apt-daily.timer
sudo systemctl disable apt-daily.timer
sudo systemctl disable apt-daily.service
sudo systemctl daemon-reload
```

Important: The FindFace Multi services log a large amount of data, which can eventually lead to disc overload. To prevent this from happening, we advise you to disable `rsyslog` due to its suboptimal log rotation scheme and use the appropriately configured `systemd-journal` service instead. See *Service Logs* for the step-by-step instructions.

Note: To configure Video Recorder after the deployment, follow *these instructions*.

2.4.2 Basic Step-by-Step Deployment from Repository

This section will guide you through the FindFace Multi basic step-by-step deployment process. Follow the instructions below minding the sequence.

Tip: Be sure to learn the FindFace Multi *architecture* first.

Important: This section doesn't cover the Video Recorder deployment. You can find the step-by-step instruction on this subject *here*.

Important: If you are located in Russia or Belarus and intend to use Video Recorder, before you start deploying, you need to contact support@ntechlab.com to get the MongoDB distribution package. Then follow the installation instructions in the section *Troubleshoot MongoDB distribution*.

In this section:

Install APT Repository

First of all, install the FindFace apt repository as follows:

1. Download the installer file `findface-multi-1.2-and-server-5.2.run`.
2. Put the `.run` file into some directory on the designated host (for example, `/home/username`).
3. From this directory, make the `.run` file executable.

   ```
   chmod +x findface-multi-1.2-and-server-5.2.run
   ```

4. Execute the `.run` file.

   ```
   sudo ./findface-multi-1.2-and-server-5.2.run
   ```

   The installer will ask you a few questions and perform several automated checks to ensure that the host meets the system requirements. Fill out the prompts appropriately once requested. The questions and answers are the following:

   1. Product to install: `FindFace Multi`.
   2. Installation type: `repo:  Don't install anything, just set up the APT repository`.
   3. Neural network models to install if necessary. To select a model(s), deselect all those on the list by entering `-*` in the command line, then select the required models by entering their sequence numbers (keyword): for example, `1 3 4`. Enter done to save your selection and proceed to another step.

      Important: You must install a detector model for at least one object type (face, body, or car).

   After that, the FindFace apt repository will be automatically installed.

Prerequisites

FindFace Multi requires such third-party software as PostgreSQL, Pgbouncer, NATS, etcd, and memcached. Do the following:

1. Install the prerequisite packages as such:

```
sudo apt update
sudo apt install -y postgresql-10 nats-server etcd memcached pgbouncer
```

2. Open the `/etc/memcached.conf` configuration file. Set the maximum memory in megabytes to use for `memcached` items: `-m 1024`. Set the maximum item size: `-I 16m`. If one or both of these parameters are absent, add them to the file.

```
sudo vi /etc/memcached.conf

-m 1024
-I 16m
```

3. Give a strong password to the `ntech` user (`9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3` in the example below). Output the credentials to the `pgbouncer` user list.

```
echo '"ntech" "9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3"' | sudo tee -a /etc/pgbouncer/
↪userlist.txt
```

4. Configure `pgbouncer`. In `/etc/pgbouncer/pgbouncer.ini`, add the `ffsecurity` database to the `databases` section. Configure named parameters, as shown in the example below. Parameters other than those must be commented out.

```
sudo vi /etc/pgbouncer/pgbouncer.ini

[databases]
ffsecurity = dbname=ffsecurity host=localhost port=5432 user=ntech
[pgbouncer]
pidfile = /var/run/postgresql/pgbouncer.pid
listen_addr = 127.0.0.1
listen_port = 5439
unix_socket_dir = /var/run/postgresql
auth_type = plain
auth_file = /etc/pgbouncer/userlist.txt
pool_mode = transaction
server_reset_query = DISCARD ALL
max_client_conn = 16384
default_pool_size = 20
syslog = 1
```

5. Enable the prerequisite services autostart on boot and re-launch the services:

```
sudo systemctl enable postgresql@10-main.service nats-server etcd.service memcached.
↪service pgbouncer.service
sudo systemctl restart postgresql@10-main.service nats-server etcd.service␣
↪memcached.service pgbouncer.service
```

Provide Licensing

Important: See *Licensing Info* to learn about the NtechLab licensing policy.

To provide the FindFace Multi licensing, deploy `findface-ntls`, license server in the FindFace core.

Important: There must be only one `findface-ntls` instance in each `FindFace Multi` installation.

```
sudo apt update
sudo apt install -y findface-ntls
sudo systemctl enable findface-ntls.service && sudo systemctl start findface-ntls.service
```

Deploy Main Database

In FindFace Multi, the main system database is based on PostgreSQL. To deploy the main database, do the following:

1. Open the `pgbouncer` list of users `/etc/pgbouncer/userlist.txt`. Copy the `ntech` user's password (`9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3` in the example below).

   ```
   sudo cat /etc/pgbouncer/userlist.txt

   "ntech" "9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3"
   ```

2. Using the **`PostgreSQL`** console, create a new user `ntech` with the copied password, and databases `ffsecurity` and `ffcounter` in PostgreSQL.

   ```
   sudo -u postgres psql

   postgres=# CREATE ROLE ntech WITH LOGIN PASSWORD '9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3';

   postgres=# CREATE DATABASE ffsecurity WITH OWNER ntech ENCODING 'UTF-8' LC_COLLATE=
   ↪'en_US.UTF-8' LC_CTYPE='en_US.UTF-8' TEMPLATE template0;

   postgres=# CREATE DATABASE ffcounter WITH OWNER ntech ENCODING 'UTF-8' LC_COLLATE='C.
   ↪UTF-8' LC_CTYPE='C.UTF-8' TEMPLATE template0;
   ```

   Tip: To quit from the **`PostgreSQL`** console, type `\q` and press `Enter`.

3. Allow authentication by UID of a socket client in **`PostgreSQL`**. Restart **`PostgreSQL`**.

   ```
   echo 'local all ntech peer' | sudo tee -a /etc/postgresql/10/main/pg_hba.conf

   sudo systemctl restart postgresql@10-main.service
   ```

Deploy FindFace Core

To deploy the FindFace core, do the following:

Tip: You can find the description of the FindFace core components and their configuration parameters in *Architecture* and *Components in Depth*.

1. For FindFace Multi on GPU, *install NVIDIA drivers*.

   Important: Be sure the restart the server after the NVIDIA drivers installation is complete. Otherwise, the subsequent installation of the GPU-based components experiences a failure.

2. Install the FindFace core components:

   #### On CPU:

   ```
   sudo apt update
   sudo apt install -y findface-tarantool-server findface-extraction-api findface-sf-
   ↪api findface-upload findface-video-manager findface-video-worker-cpu findface-
   ↪liveness-api
   ```

   #### On GPU:

   ```
   sudo apt update
   sudo apt install -y findface-tarantool-server findface-extraction-api-gpu findface-
   ↪sf-api findface-upload findface-video-manager findface-video-worker-gpu findface-
   ↪liveness-api
   ```

   Note: If you have several video cards on your server, see *Multiple Video Cards Usage*.

   Important: Be sure to *manually install* neural network models on the host(s) with `findface-extraction-api`.

3. In the `/etc/findface-sf-api.ini` configuration file, enable the `allow-return-facen` parameter.

   ```
   sudo vi /etc/findface-sf-api.ini

   ...
   limits:
     ...
     allow-return-facen: true
   ...
   ```

4. Open the `/etc/findface-video-worker-cpu.ini` (`/etc/findface-video-worker-gpu.ini`) configuration file. Specify the following parameters:

- In the `mgr-static` parameter, specify the `findface-video-manager` host IP address, which provides `findface-video-worker` with settings and the video stream list.
- In the `capacity` parameter, specify the maximum number of video streams to be processed by `findface-video-worker`.
- In the `streamer` section, specify the IP address and port to access the *Video Wall*. The streamer `port` must be set to 18999. Set `tracks = true` to improve how the object bboxes are displayed on the Video Wall.

```
sudo vi /etc/findface-video-worker-cpu.ini
sudo vi /etc/findface-video-worker-gpu.ini

mgr-static=127.0.0.1:18811

capacity=10

[streamer]
#------------------------------
## streamer/shots webserver port, 0=disabled
## type:number env:CFG_STREAMER_PORT longopt:--streamer-port
port = 18999

## streamer url - how to access this worker on streamer_port
## type:string env:CFG_STREAMER_URL longopt:--streamer-url
url = 127.0.0.1:18999

## use tracks instead detects for streamer
## type:bool env:CFG_STREAMER_TRACKS longopt:--streamer-tracks
tracks = true
```

5. Enable the FindFace core services autostart and launch the services.

On CPU:

```
sudo systemctl enable findface-extraction-api findface-sf-api findface-video-
↪manager findface-video-worker-cpu findface-liveness-api
sudo systemctl start findface-extraction-api findface-sf-api findface-video-manager␣
↪findface-video-worker-cpu findface-liveness-api
```

On GPU:

```
sudo systemctl enable findface-extraction-api findface-sf-api findface-video-
↪manager findface-video-worker-gpu findface-liveness-api
sudo systemctl start findface-extraction-api findface-sf-api findface-video-manager␣
↪findface-video-worker-gpu findface-liveness-api
```

Deploy FindFace Multi Application Module and Feature Vector Database

To deploy the FindFace Multi application module, do the following:

1. Install the `findface-security`, `findface-security-ui`, and `findface-counter` components. Enable the `findface-counter` autostart and launch the service.

```
sudo apt update
sudo apt install -y findface-security findface-security-ui findface-counter
sudo systemctl enable findface-counter && sudo systemctl start findface-counter
```

2. Migrate the database architecture from FindFace Multi to **PostgreSQL**, create *predefined* user roles and the first administrator (a.k.a. Super Administrator).

Important: The Super Administrator cannot be deprived of its rights, whatever the role.

```
sudo findface-security migrate
sudo findface-security create_groups
sudo findface-security create_default_user
```

3. Create a structure of the Tarantool-based feature vector database by executing the command below.

```
sudo findface-security make_tnt_schema | sudo tee /etc/findface-security/tnt_schema.
↪lua
```

4. Open the `/etc/tarantool/instances.available/FindFace.lua` configuration file. Check whether it contains the `dofile` command, `meta_indexes` and `meta_scheme` definitions, as in the example below.

```
sudo vi /etc/tarantool/instances.available/FindFace.lua

dofile("/etc/findface-security/tnt_schema.lua")
-- host:port to bind, HTTP API
FindFace = require("FindFace")
FindFace.start("127.0.0.1", 8101, {
    license_ntls_server="127.0.0.1:3133",
    meta_indexes=meta_indexes,
    meta_scheme=meta_scheme
})
```

Important: The IP address and port number specified in the `shards` section of the `/etc/findface-sf-api.ini` configuration file must be identical to those in the `FindFace.start` section.

```
sudo vi /etc/tarantool/instances.available/FindFace.lua


...

FindFace.start("127.0.0.1", 8101...)
```

```
sudo vi /etc/findface-sf-api.ini

storage-api:
  ...
```

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```
  shards:
  - master: http://127.0.0.1:8101/v2/
  ...
```

Important: If you change the /etc/findface-sf-api.ini configuration file, be sure to restart the findface-sf-api service:

```
sudo systemctl restart findface-sf-api.service
```

5. Enable the findface-tarantool-server service autostart and launch the service.

```
sudo systemctl enable tarantool@FindFace.service && sudo systemctl start␣
↪tarantool@FindFace.service
```

6. Open the /etc/findface-security/config.py configuration file. Specify the following parameters:

Tip: You can find the /etc/findface-security/config.py default version here.

- SERVICE_EXTERNAL_ADDRESS: FindFace Multi IP address or URL prioritized for the Genetec integration and webhooks. If this parameter is not specified, the system will be using EXTERNAL_ADDRESS for these purposes.

  Important: To use Genetec and webhooks, be sure to specify at least one of these parameters: SERVICE_EXTERNAL_ADDRESS/EXTERNAL_ADDRESS.

- EXTERNAL_ADDRESS: (Optional) IP address or URL used to access the FindFace Multi web interface. If this parameter is not manually set, the system auto-detects it as the external IP address of the host.

  Note: To access FindFace Multi, you can use both the auto-detected and manually set IP addresses.

- VIDEO_DETECTOR_TOKEN: to authorize the video object detection module, come up with a token and specify it here.

  Tip: It's a good idea to generate a token by executing:

  ```
  pwgen -sncy 50 1|tr "'" "."
  ```

- VIDEO_MANAGER_ADDRESS: IP address of the findface-video-manager host.
- NTLS_HTTP_URL: IP address of the findface-ntls host.
- ROUTER_URL: IP address of the findface-security host that will receive detected objects from the findface-video-worker instance(s). Specify either external or internal IP address, subject to the network through which findface-video-worker interacts with findface-security. Change the default port, subject to the *redirect settings* from HTTP to HTTPS, or omit it leaving only the IP address.
- SF_API_ADDRESS: IP address of the findface-sf-api host.

- DATABASES (section): fill it in as such: 'PORT': 5439, 'USER': 'ntech', 'PASSWORD': '<password from /etc/pgbouncer/userlist.txt>' (see *Prerequisites*).

Tip: If necessary, ensure data security by enabling *SSL*.

Tip: If necessary, set 'IGNORE_UNMATCHED': True to disable logging events for the objects that have no match with the cards. Enable this option if the system has to process a large number of objects.

7. Generate a signature key for the session encryption (used by Django) by executing the command below. Specify this key as SECRET_KEY.

```
pwgen -sncy 50 1|tr "'" "."
```

8. Start the services.

```
sudo systemctl enable findface-security
sudo systemctl start findface-security
```

9. Disable the default nginx server and add the findface-security server to the list of enabled servers. Restart nginx.

```
sudo rm /etc/nginx/sites-enabled/default

sudo ln -s /etc/nginx/sites-available/ffsecurity-nginx.conf /etc/nginx/sites-
↪enabled/

sudo nginx -s reload
```

10. Provide licensing:

    - Use the FindFace Multi main web interface to *upload the license file* you have prior received from your manager (*Preferences* -> *License*).
    - For the on-premise licensing via a USB dongle, insert it into a USB port.
    - For the on-premise licensing via hardware fingerprint, refer to *Offline Licensing via Hardware Fingerprint*.

Important: To log in for the first time, use the default Super Administrator account admin:admin.

Note: To create more users or change the Super Administrator password, refer to *User Management*.

Important: To preserve the FindFace Multi compatibility with the installation environment, we highly recommend you to disable the Ubuntu automatic update. In this case, you will be able to update your OS manually, fully controlling which packages to update.

To disable the Ubuntu automatic update, execute the following commands:

```
sudo apt-get remove unattended-upgrades
sudo systemctl stop apt-daily.timer
sudo systemctl disable apt-daily.timer
```

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```
sudo systemctl disable apt-daily.service
sudo systemctl daemon-reload
```

Important: The FindFace Multi services log a large amount of data, which can eventually lead to disc overload. To prevent this from happening, we advise you to disable `rsyslog` due to its suboptimal log rotation scheme and use the appropriately configured `systemd-journal` service instead. See *Service Logs* for the step-by-step instructions.

2.4.3 Additional `findface-video-worker` Deployment on Remote Hosts

Important: Before deploying `findface-video-worker` instances on remote hosts, do the following:

1. Allow accessing the `findface-ntls` license server from any IP address. To do so, open the `/etc/findface-ntls.cfg` configuration file on the server with `findface-ntls` and set `listen = 0.0.0.0:3133`. Restart the `findface-ntls` service.

   ```
   sudo vi /etc/findface-ntls.cfg

   ## Address to accept incoming client connections (IP:PORT)
   ## type:string env:CFG_LISTEN longopt:--listen
   listen = 0.0.0.0:3133
   ```

   ```
   sudo systemctl restart findface-ntls.service
   ```

2. Allow accessing the `findface-video-manager` service from any IP address. To do so, open the `/etc/findface-video-manager.conf` configuration file on the server with `findface-video-manager` and set `listen: 0.0.0.0:18810` and `rpc:listen: 0.0.0.0:18811`. Restart the `findface-video-manager` service.

   ```
   sudo vi /etc/findface-video-manager.conf

   listen: 0.0.0.0:18810
   ...
   rpc:
     listen: 0.0.0.0:18811
   ```

   ```
   sudo systemctl restart findface-video-manager.service
   ```

3. On the FindFace Multi server, open the `/etc/findface-security/config.py` configuration file and make sure that the `ROUTER_URL` parameter contains the external IP address of the FindFace Multi server and not the localhost. The `findface-video-worker` instances on the remote hosts will be using this address for posting objects.

   ```
   sudo vi /etc/findface-security/config.py

   ...

   'ROUTER_URL': 'http://192.168.0.12',
   ```

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```
...
```

To install only a `findface-video-worker` service, do the following:

Tip: Before deployment, be sure to consult the *system requirements*.

Tip: If you have several video cards on your server, see *Multiple Video Cards Usage* before deploying `findface-video-worker-gpu`.

1. Download the installer file `findface-multi-1.2-and-server-5.2.run`.
2. Put the `.run` file into some directory on the designated host (for example, `/home/username`).
3. From this directory, make the `.run` file executable.

   ```
   chmod +x findface-multi-1.2-and-server-5.2.run
   ```

4. Execute the `.run` file.

   ```
   sudo ./findface-multi-1.2-and-server-5.2.run
   ```

   The installer will ask you a few questions and perform several automated checks to ensure that the host meets the system requirements. Fill out the prompts appropriately once requested. The questions and answers are the following:

   1. Product to install: FindFace Video Worker.
   2. Type of `findface-video-worker` package: CPU or GPU.
   3. IP address of the `findface-security` host.

   After that, the installation process will automatically begin.

Note: If you chose to install `findface-ntls` and/or `findface-video-manager` on different hosts than that with `findface-security`, specify their IP addresses in the `/etc/findface-video-worker-cpu.ini` (`/etc/findface-video-worker-gpu.ini`) configuration file after the installation.

```
sudo vi /etc/findface-video-worker-cpu.ini
sudo vi /etc/findface-video-worker-gpu.ini
```

In the `ntls-addr` parameter, specify the `findface-ntls` host IP address.

```
ntls-addr=127.0.0.1:3133
```

In the `mgr-static` parameter, specify the `findface-video-manager` host IP address, which provides `findface-video-worker` with settings and the video stream list.

```
mgr-static=127.0.0.1:18811
```

Tip: To automatically install `findface-video-worker` on another host without answering the installation questions, use the `/tmp/<findface-installer-*>.json` file. Execute:

```
sudo ./findface-multi-1.2-and-server-5.2.run -f /tmp/<findface-installer-*>.json
```

You can find an example of the installation file in *Installation File*.

Important: To preserve the FindFace Multi compatibility with the installation environment, we highly recommend you to disable the Ubuntu automatic update. In this case, you will be able to update your OS manually, fully controlling which packages to update.

To disable the Ubuntu automatic update, execute the following commands:

```
sudo apt-get remove unattended-upgrades
sudo systemctl stop apt-daily.timer
sudo systemctl disable apt-daily.timer
sudo systemctl disable apt-daily.service
sudo systemctl daemon-reload
```

Important: The FindFace Multi services log a large amount of data, which can eventually lead to disc overload. To prevent this from happening, we advise you to disable `rsyslog` due to its suboptimal log rotation scheme and use the appropriately configured `systemd-journal` service instead. See *Service Logs* for the step-by-step instructions.

2.4.4 Installation of Neural Network Models

To detect and recognize objects and object attributes, `findface-extraction-api` uses neural networks.

If you want to manually initiate the installation of neural network models, use the console installer as follows:

1. Execute the prepared `findface-multi-1.2-and-server-5.2.run` file.

   ```
   sudo ./findface-multi-1.2-and-server-5.2.run
   ```

2. Select the installation type: `Fully customized installation`.
3. Select a FindFace Multi component to install: `findface-data`. To do so, first, deselect all the listed components by entering `-*` in the command line, then select the required component by entering its sequence number (keyword). Enter `done` to save your selection and proceed to another step.
4. In the same manner, select models to install. After that, the installation process will automatically begin.

You can find installed models for the object and object attribute recognition at `/usr/share/findface-data/models/`. See *Neural Network Models*.

2.4.5 Fully Customized Installation

The FindFace Multi developer-friendly *installer* provides you with quite a few installation options, including the fully customized installation. This option is mostly used when deploying FindFace Multi in a highly distributed environment.

To initiate the fully customized installation, answer the installer questions as follows:

- Product to install: `FindFace Multi`.
- Installation type: `Fully customized installation`.
- FindFace Multi components to install: whenever you have to make a selection, first, deselect all the listed components by entering `-*` in the command line, then select required components by entering their sequence number (keyword), for example: `1 7 13`, etc. Enter `done` to save your selection and proceed to another step.
- Related questions such as about the acceleration type: CPU or GPU.

2.4.6 Guide to Typical Multi-Host Deployment

This section is all about deploying FindFace Multi in a multi-host environment.

Tip: If after having read this section, you still have questions, do not hesitate to contact our experts by support@ntechlab.com.

Important: This section doesn't cover the Video Recorder deployment. You can find the step-by-step instruction on this subject *here*.

The reasons for deploying FindFace Multi in a multi-host environment are the following:

- The necessity to distribute the video processing high load.
- The necessity to process video streams from a group of cameras in the place of their physical location.

  Note: The most common use cases where such need comes to the fore are hotel chains, chain stores, several security checkpoints in the same building, etc.

  See also:

  Allocate findface-video-worker to Camera Group

- The necessity to distribute the feature vector extraction high load.
- Large number of objects to search through, that requires implementation of a distributed object database.

Before you start the deployment, outline your system architecture, depending on its load and allotted resources (see *Requirements*). The most common distributed scheme is as follows:

- One principal server with the following components: `findface-ntls`, `findface-security`, `findface-sf-api`, `findface-video-manager`, `findface-upload`, `findface-video-worker`, `findface-extraction-api`, `findface-tarantool-server`, and third-parties.
- Several additional video processing servers with installed `findface-video-worker`.
- (If needed) Several additional extraction servers with installed `findface-extraction-api`.
- (If needed) Additional database servers with multiple Tarantool shards.

This section describes the most common distributed deployment. In high load systems, it may also be necessary to distribute the API processing (`findface-sf-api` and `findface-video-manager`) across several additional servers. This procedure requires a high level of expertise and some extra coding. Please do not hesitate to contact our experts for help (support@ntechlab.com).

To deploy FindFace Multi in a multi-host environment, follow the steps below:

Deploy Principal Server

To deploy the principal server as part of a distributed architecture, do the following:

1. On the designated physical server, *install* FindFace Multi from installer as follows:

   - Product to install: `FindFace Multi`.
   - Installation type: `Single server, multiple video workers`. In this case, FindFace Multi will be installed and configured to interact with additional remote `findface-video-worker` instances.
   - Type of the `findface-video-worker` acceleration (on the principal server): CPU or GPU, subject to your hardware configuration.
   - Type of the `findface-extraction-api` acceleration (on the principal server): CPU or GPU, subject to your hardware configuration.

   After the installation is complete, the following output will be shown on the console:

```
#############################################################################
#                        Installation is complete                           #
#############################################################################
- upload your license to http://172.20.77.17/#/license/
- user interface: http://172.20.77.17/
  superuser:      admin
  password:       admin
  documentation:  http://172.20.77.17/doc/
```

2. Upload the FindFace Multi license file via the main web interface `http://<Host_IP_address>/#/license`. To access the web interface, use the provided `superuser` credentials.

   Note: The host IP address is shown in the links to FindFace web services in the following way: as an external IP address if the host belongs to a network, or `127.0.0.1` otherwise.

   Important: Do not disclose the `superuser` (Super Administrator) credentials to others. To administer the system, create a new user with the administrator privileges. Whatever the role, Super Administrator cannot be deprived of its rights.

3. Allow the licensable services to access the `findface-ntls` license server from any IP address, To do so, open the `/etc/findface-ntls.cfg` configuration file and set `listen = 0.0.0.0:3133`. Restart `findface-ntls.service`.

```
sudo vi /etc/findface-ntls.cfg

## Address to accept incoming client connections (IP:PORT)
## type:string env:CFG_LISTEN longopt:--listen
listen = 0.0.0.0:3133
```

```
sudo systemctl restart findface-ntls.service
```

4. Allow accessing the `findface-video-manager` service from any IP address. To do so, open the `/etc/findface-video-manager.conf` configuration file and set `listen:  0.0.0.0:18810` and `rpc:listen: 0.0.0.0:18811`. Restart the `findface-video-manager` service.

```
sudo vi /etc/findface-video-manager.conf

listen: 0.0.0.0:18810
...
rpc:
  listen: 0.0.0.0:18811
```

```
sudo systemctl restart findface-video-manager.service
```

Deploy Video Processing Servers

On an additional video processing server, install only a `findface-video-worker` instance following the *step-by-step instructions*. Answer the installer questions as follows:

- Product to install: FindFace Video Worker.
- Type of the `findface-video-worker` acceleration: CPU or GPU, subject to your hardware configuration.
- FindFace Multi IP address: IP address of the principal server.

After that, the installation process will automatically begin. The answers will be saved to a file `/tmp/<findface-installer-*>.json`. Use this file to install `FindFace Video Worker` on other hosts without having to answer the questions again, by executing:

```
sudo ./findface-multi-1.2-and-server-5.2.run -f /tmp/<findface-installer-*>.
↪json
```

Note: If `findface-ntls` and/or `findface-video-manager` are installed on a different host than that with `findface-security`, specify their IP addresses in the `/etc/findface-video-worker-gpu.ini` (`/etc/findface-video-worker-cpu.ini`) configuration file after the installation.

```
sudo vi /etc/findface-video-worker-cpu.ini
sudo vi /etc/findface-video-worker-gpu.ini
```

In the `ntls-addr` parameter, specify the `findface-ntls` host IP address.

```
ntls-addr=127.0.0.1:3133
```

In the `mgr-static` parameter, specify the `findface-video-manager` host IP address, which provides `findface-video-worker` with settings and the video stream list.

```
mgr-static=127.0.0.1:18811
```

Deploy Extraction Servers

On an additional extraction server, install only a `findface-extraction-api` instance from the console installer. Answer the installer questions as follows:

- Product to install: `FindFace Multi`.
- Installation type: `Fully customized installation`.
- FindFace Multi components to install: `findface-extraction-api` and `findface-data`. To make a selection, first, deselect all the listed components by entering `-*` in the command line, then select `findface-extraction-api` and `findface-data` by entering their sequence number (keyword). Enter `done` to save your selection and proceed to another step.
- Type of `findface-extraction-api` acceleration: CPU or GPU.
- Modification of the `/etc/findface-extraction-api.ini` configuration file: specify the IP address of the `findface-ntls` server.
- Neural network models to install: CPU or GPU model for face biometrics (mandatory), and (optional) CPU/GPU models to recognize face attributes, car and car attributes, and body and body attributes. Be sure to choose the right acceleration type for each model, matching the acceleration type of `findface-extraction-api`: CPU or GPU. Be aware that `findface-extraction-api` on CPU can work only with CPU-models, while `findface-extraction-api` on GPU supports both CPU- and GPU-models.

Tip: See *Neural Network Models*, *Enable Face Attribute Recognition*, *Enable Car and Car Attribute Recognition*, *Enable Body and Body Attribute Recognition* for details.

After that, the installation process will automatically begin. The answers will be saved to a file `/tmp/<findface-installer-*>.json`. Use this file to install `findface-extraction-api` on other hosts without having to answer the questions again.

```
sudo ./findface-multi-1.2-and-server-5.2.run -f /tmp/<findface-installer-*>.
↪json
```

After all the extraction servers are deployed, distribute load across them by using a *load balancer*.

Distribute Load across Extraction Servers

To distribute load across several extraction servers, you need to set up load balancing. The following step-by-step instructions demonstrate how to set up `nginx` load balancing in a round-robin fashion for 3 `findface-extraction-api` instances located on different physical hosts: one on the FindFace Multi principal server (`172.168.1.9`), and 2 on additional remote servers (`172.168.1.10`, `172.168.1.11`). Should you have more extraction servers in your system, load-balance them by analogy.

Tip: You can use any load balancer according to your preference. Please refer to the relevant official documentation for guidance.

To set up load balancing, do the following:

1. Designate the FindFace Multi principal server (recommended) or any other server with nginx as a gateway to all the extraction servers.

   Important: You will have to specify the gateway server IP address when configuring the FindFace Multi *network*.

   Tip: You can install nginx as such:

   ```
   sudo apt update
   sudo apt install nginx
   ```

2. On the gateway server, create a new nginx configuration file.

   ```
   sudo vi /etc/nginx/sites-available/extapi
   ```

3. Insert the following entry into the just created configuration file. In the `upstream` directive (`upstream extapibackends`), substitute the exemplary IP addresses with the actual IP addresses of the extraction servers. In the `server` directive, specify the gateway server listening port as `listen`. You will have to enter this port when configuring the FindFace Multi *network*.

   ```
   upstream extapibackends {
           server 172.168.1.9:18666; ## ``findface-extraction-api`` on principal server
           server 172.168.1.10:18666; ## 1st additional extraction server
           server 127.168.1.11:18666; ## 2nd additional extraction server
   }
   server {
           listen 18667;
           server_name extapi;
           client_max_body_size 64m;
           location / {
                   proxy_pass http://extapibackends;
                   proxy_next_upstream error;
           }
           access_log /var/log/nginx/extapi.access_log;
           error_log /var/log/nginx/extapi.error_log;
   }
   ```

4. Enable the load balancer in nginx.

```
sudo ln -s /etc/nginx/sites-available/extapi /etc/nginx/sites-enabled/
```

5. Restart nginx.

```
sudo service nginx restart
```

6. On the principal server and each additional extraction server, open the `/etc/findface-extraction-api.ini` configuration file. Substitute localhost in the `listen` parameter with the relevant server address that you have specified in `upstream extapibackends` (`/etc/nginx/sites-available/extapi`) before. In our example, the address of the 1st additional extraction server has to be substituted as such:

```
sudo vi /etc/findface-extraction-api.ini

listen: 172.168.1.10:18666
```

7. Restart the `findface-extraction-api` on the principal server and each additional extraction server.

```
sudo systemctl restart findface-extraction-api.service
```

The load balancing is now successfully set up. Be sure to specify the actual gateway server IP address and listening port, when configuring the FindFace Multi *network*.

Deploy Additional Database Servers

The `findface-tarantool-server` component connects the Tarantool-based feature vector database and the `findface-sf-api` component, transferring search results from the database to `findface-sf-api` for further processing.

To increase search speed, you can allocate several additional servers to the feature vector database and create multiple `findface-tarantool-server` shards on each additional server. The concurrent functioning of multiple shards will lead to a remarkable increase in performance, as each shard can handle up to approximately 10,000,000 feature vectors.

To deploy additional database servers, do the following:

1. Install the `findface-tarantool-server` component on the first designated server. Answer the installer questions as follows:

   - Product to install: `FindFace Multi`.
   - Installation type: `Fully customized installation`.
   - FindFace Multi components to install: `findface-tarantool-server`. To make a selection, first, deselect all the listed components by entering `-*` in the command line, then select `findface-tarantool-server` by entering its sequence number (keyword). Enter `done` to save your selection and proceed to another step.

   After that, the installation process will automatically begin.

   As a result of the installation, the `findface-tarantool-server` shards will be automatically installed in the amount of `N = min(max(min(mem_mb // 2000, cpu_cores), 1), 16 * cpu_cores)`. I.e., it is equal to the RAM size in MB divided by 2000, or the number of CPU physical cores (but at least one shard), or the number of CPU physical cores multiplied by 16 if the first obtained value is greater.

2. Use the created `/tmp/<findface-installer-*>.json` file to install `findface-tarantool-server` on other servers without answering the questions again. To do so, execute:

```
sudo ./findface-multi-1.2-and-server-5.2.run -f /tmp/<findface-installer-*>.json
```

3. Be sure to specify the IP addresses and ports of the shards later on when configuring the FindFace Multi *network*. To learn the port numbers, execute on each database server:

   ```
   sudo cat /etc/tarantool/instances.enabled/*shard* | grep -E ".start|(listen =)"`
   ```

   You will get the following result:

   ```
       listen = '127.0.0.1:33001',
   FindFace.start("127.0.0.1", 8101, {
       listen = '127.0.0.1:33002',
   FindFace.start("127.0.0.1", 8102, {
   ```

   You can find the port number in the `FindFace.start` section, for example, `8101`, `8102`, etc.

Configure Network

After all the FindFace Multi components are deployed, configure their interaction over the network. Do the following:

1. Open the `/etc/findface-sf-api.ini` configuration file:

   ```
   sudo vi /etc/findface-sf-api.ini
   ```

   Specify the following parameters:

Parameter	Description
`extraction-api -> extraction-api`	IP address and listening port of the *gateway extraction server* with set up load balancing.
`storage-api -> shards -> master`	IP address and port of the `findface-tarantool-server` master shard. Specify each shard by analogy.
`upload_url`	WebDAV NginX path to send original images, thumbnails and normalized object images to the `findface-upload` service.

   ```
   ...
   extraction-api:
     extraction-api: http://172.168.1.9:18667

   ...
   webdav:
     upload-url: http://127.0.0.1:3333/uploads/

   ...
   storage-api:
     ...
     shards:
     - master: http://172.168.1.9:8101/v2/
       slave: ''
     - master: http://172.168.1.9:8102/v2/
       slave: ''
     - master: http://172.168.1.12:8101/v2/
       slave: ''
     - master: http://172.168.1.12:8102/v2/
       slave: ''
     - master: http://172.168.1.13:8102/v2/
   ```

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```
    slave: ''
  - master: http://172.168.1.13:8102/v2/
    slave: ''
```

2. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

Specify the following parameters:

Parameter	Description
SERVICE_EXTERNAL_ADDRESS	(Optional) IP address or URL prioritized for the Genetec integration and webhooks. Once this parameter not specified, the system uses EXTERNAL_ADDRESS for these purposes. To use Genetec and webhooks, be sure to specify at least one of those parameters: SERVICE_EXTERNAL_ADDRESS, EXTERNAL_ADDRESS.
EXTERNAL_ADDRESS	(Optional) IP address or URL that can be used to access the FindFace Multi web interface. Once this parameter not specified, the system auto-detects it as the external IP address. To access FindFace Multi, you can use both the auto-detected and specified IP addresses.
VIDEO_DETECTOR_TOKEN	To authorize the video object detection module, come up with a token and specify it here.
VIDEO_MANAGER_ADDRESS	IP address of the `findface-video-manager` host.
NTLS_HTTP_URL	IP address of the `findface-ntls` host.
ROUTER_URL	External IP address of the `findface-security` host that will receive detected objects from the `findface-video-worker` instance(s).
SF_API_ADDRESS	IP address of the `findface-sf-api` host.

```
sudo vi /etc/findface-security/config.py

...
# SERVICE_EXTERNAL_ADDRESS prioritized for webhooks and genetec
SERVICE_EXTERNAL_ADDRESS = 'http://localhost'
EXTERNAL_ADDRESS = 'http://127.0.0.1'



...
FFSECURITY = {
    'VIDEO_DETECTOR_TOKEN': '7ce2679adfc4d74edcf508bea4d67208',
    ...
    'VIDEO_MANAGER_ADDRESS': 'http://127.0.0.1:18810',
    ...
    'NTLS_HTTP_URL': 'http://127.0.0.1:3185',
    'ROUTER_URL': 'http://172.168.1.9',
    ...
    'SF_API_ADDRESS': 'http://127.0.0.1:18411',
    ...
}
```

The FindFace Multi components interaction is now set up.

Important: To preserve the FindFace Multi compatibility with the installation environment, we highly recommend you to disable the Ubuntu automatic update. In this case, you will be able to update your OS manually, fully controlling which packages to update.

To disable the Ubuntu automatic update, execute the following commands:

```
sudo apt-get remove unattended-upgrades
sudo systemctl stop apt-daily.timer
sudo systemctl disable apt-daily.timer
sudo systemctl disable apt-daily.service
sudo systemctl daemon-reload
```

Important: The FindFace Multi services log a large amount of data, which can eventually lead to disc overload. To prevent this from happening, we advise you to disable `rsyslog` due to its suboptimal log rotation scheme and use the appropriately configured `systemd-journal` service instead. See *Service Logs* for the step-by-step instructions.

2.4.7 Deploy Video Recorder Step-by-Step

The FindFace Core internal *architecture* allows for embedding Video Recorder, an additional functionality that records, stores, and plays back video data from cameras.

There are the following ways to deploy Video Recorder:

- Automatically during the FindFace Multi deployment from a console installer. See *Deploy from Console Installer* for details.
- Step-by-step. Recommended in a multi-host environment.

This section will guide you through the Video Recorder step-by-step deployment.

Important: If you are located in Russia or Belarus and intend to use Video Recorder, before you start deploying, you need to contact support@ntechlab.com to get the MongoDB distribution package. Then follow the installation instructions in the section *Troubleshoot MongoDB distribution*. After you've done that, follow the instructions below.

Tip: Be sure to learn the FindFace Multi *architecture* first.

In this section:

Install APT Repository

First of all, install the FindFace apt repository as follows:

1. Download the installer file `findface-multi-1.2-and-server-5.2.run`.
2. Put the `.run` file into some directory on the designated host (for example, `/home/username`).
3. From this directory, make the `.run` file executable.

   ```
   chmod +x findface-multi-1.2-and-server-5.2.run
   ```

4. Execute the `.run` file.

   ```
   sudo ./findface-multi-1.2-and-server-5.2.run
   ```

   The installer will ask you a few questions and perform several automated checks to ensure that the host meets the system requirements. Fill out the prompts appropriately once requested. The questions and answers are the following:

   1. Product to install: `FindFace Multi`.
   2. Installation type: `repo:  Don't install anything, just set up the APT repository`.
   3. `APT repository doesn't include recognition models. Do you want to install them now?`: no.

   After that, the FindFace apt repository will be automatically installed.

Install Prerequisite, MongoDB

The Video Recorder operation requires a third-party software, MongoDB. Install it as follows:

```
sudo apt update
sudo apt install -y mongodb
```

After the installation, the `mongodb` service will be launched and enabled to auto-start on boot. You can check its status by executing the command bellow:

```
sudo systemctl status mongodb

 mongodb.service - An object/document-oriented database
   Loaded: loaded (/lib/systemd/system/mongodb.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2022-05-16 10:23:04 UTC; 46s ago
...
```

Install Main Components

To install the Video Recorder components, do the following:

1. Install the `findface-video-storage` and `findface-video-streamer-cpu` services from the previously installed APT repository.

   ```
   sudo apt install -y findface-video-storage findface-video-streamer-cpu
   ```

   After the installation, `findface-video-storage` will be launched and enabled to auto-start on boot, while the `findface-video-streamer-cpu` service will remain disabled and inactive.

2. Open the `/etc/findface-video-storage.conf` configuration file. Set `webdav` for the `chunk-storage -> type` parameter.

```
sudo vi /etc/findface-video-storage.conf

...
chunk-storage:
  type: webdav
```

3. Restart the `findface-video-storage` service after saving the changes.

```
sudo systemctl restart findface-video-storage
```

4. Launch the `findface-video-streamer-cpu` service and enable it to auto-start on boot.

```
sudo systemctl enable findface-video-streamer-cpu && sudo systemctl start findface-
↪video-streamer-cpu
```

Video Recorder is now successfully deployed. To configure Video Recorder after the deployment, follow *these instructions*.

2.4.8 Add NVIDIA Repository and Install Drivers (GPU only)

FindFace Multi on GPU requires the prior installation of NVIDIA drivers.

To add the NVIDIA repository and install the drivers, do the following:

Important: You will need a stable Internet connection, as the driver packages will be downloaded from the NVIDIA web resource.

1. Download the installer file `findface-multi-1.1-and-server-5.1.run`.
2. Put the `.run` file into some directory on the designated host (for example, `/home/username`).
3. From this directory, make the `.run` file executable.

```
chmod +x findface-multi-1.1-and-server-5.1.run
```

4. Execute the `.run` file.

```
sudo ./findface-multi-1.1-and-server-5.1.run
```

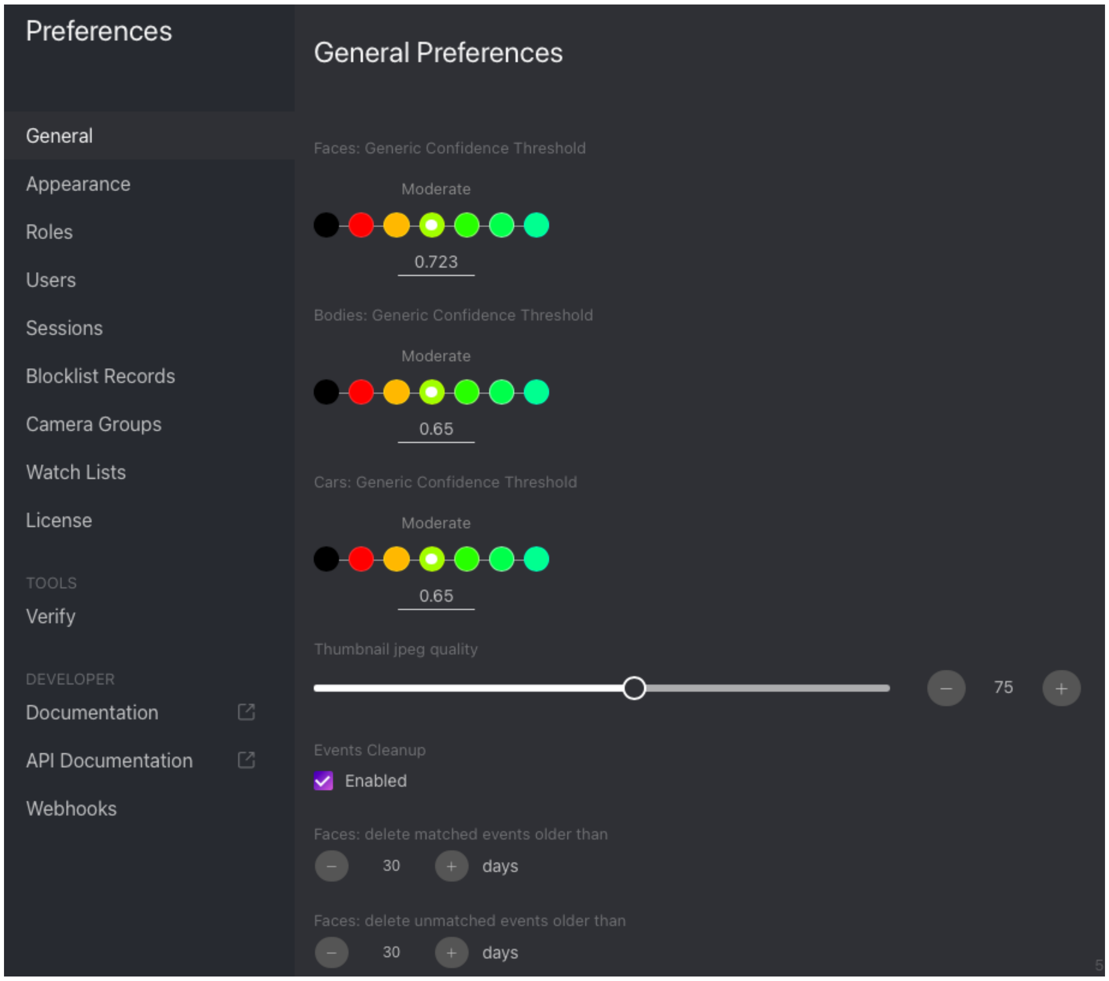
5. Choose the product to install: `NVIDIA CUDA drivers`.
6. After the NVIDIA drivers installation is complete, restart the server.

2.5 General Preferences

The FindFace Multi general preferences determine your system functioning and resource consumption. Here they are:

- generic confidence thresholds for face, body, car recognition (subject to the enabled objects)
- thumbnail JPEG quality
- schedule for automatic events/episodes cleanup

To configure the general preferences, navigate to the *Preferences* tab and click *General*. After you are finished with adjustments, click *Update*. Find the detailed explanation of each setting below.



Faces: Generic Confidence Threshold
Moderate
0.723

Bodies: Generic Confidence Threshold
Moderate
0.65

Cars: Generic Confidence Threshold
Moderate
0.65

Thumbnail jpeg quality
75

Events Cleanup
✓ Enabled

Faces: delete matched events older than
30 days

Faces: delete unmatched events older than
30 days

In this section:

2.5.1 Generic Confidence Threshold

FindFace Multi verifies that a detected face and some face from the card index belong to the same person (i.e., the faces match), based on the pre-defined similarity threshold. The default threshold is set to the optimum value. If necessary, you can change it.

Note: The higher is the threshold, the less are chances that a wrong person will be positively verified, however, some valid photos may also fail verification.

The same principle applies to the body and car recognition, should you have enabled these objects. Based on the pre-defined threshold, FindFace Multi verifies that a detected body and a body from the card index belong to the same person. Likewise, a detected car matches a car from the card index.

Tip: You can configure the confidence thresholds individually for each *camera group* and *watch list*.

Important: The default generic confidence threshold is optimal for the majority of recognition cases. We do not recommend changing it on your own. Be sure to consult with our technical experts prior (support@ntechlab.com).

2.5.2 Thumbnail JPEG Quality

Subject to JPEG quality, thumbnails may take up a significant amount of disc volume. Use the *General* tab to configure the parameter.

2.5.3 Automatic Event And Episode Cleanup

Use the same tab to schedule automatically purging old events and related episodes from the database. For example, you can purge matched and unmatched events/episodes on different schedules and purge only full frames. You can also separately purge events with faces, cars, and bodies.

2.6 User Management and System Security

Important: Although FindFace Multi provides tools to ensure its protection from unauthorized access, they are not replacing a properly configured firewall. Be sure to use a firewall to heighten the FindFace Multi network protection.

2.6.1 User Management

In this chapter:

Predefined Roles

FindFace Multi provides the following predefined roles:

- Administrator is granted full access to the FindFace Multi functionality, integrative and administrative tools.

  Important: Whatever the role, the first administrator (Super Administrator) cannot be deprived of its rights.

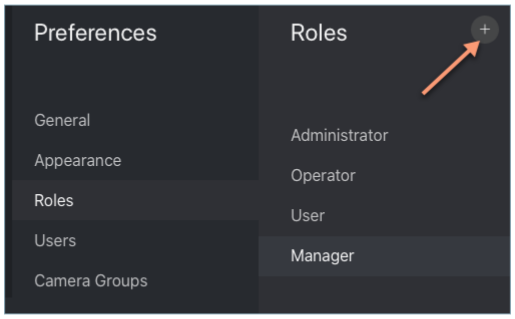
- Operator is granted full access to the FindFace Multi functionality.
- User is granted rights to receive and acknowledge events and episodes, search for objects on the event list, modify their profile data. The other functions are available read-only.

You can change the predefined roles privileges, as well as create various custom roles.

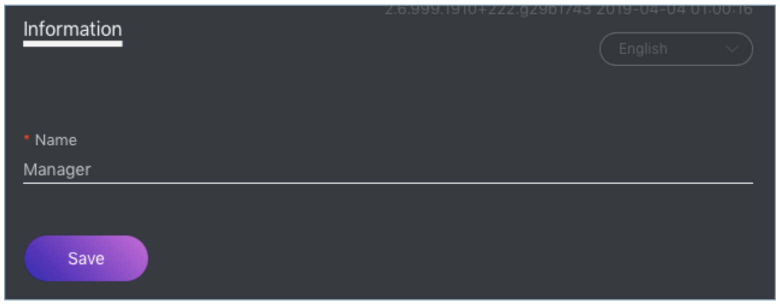
Create Custom Role

To create a custom role, do the following:

1. Navigate to the *Preferences* tab. Click *Roles*.
2. Click +.



3. On the *Information* tab, specify the role name.



* Name
Manager

4. Click *Save*. You will see additional tabs appear next to the *Information* tab. You can use these tabs to assign the role privileges for specific watch lists (the *Watch Lists* tab) and camera groups (*Camera Groups*), as well as for entire system functions and entities (*Permissions*).

   Note: For example, if you set `None` for a certain camera group on the *Camera Groups* tab, users with this role won't be able to work with **this** very group of cameras. Setting `None` for `cameragroup` on the *Permissions* tab will prevent users from viewing and working with **all** camera groups.

   Note: The right for an event consists of the rights for a corresponding camera and watch list. To see unmatched events, you only need the rights for a camera.

   The full list of the FindFace Multi entities is as follows:

   - `area`: *area*
   - `faceevent`: face recognition *event*
   - `faceobject`: face photo in a *card*
   - `carevent`: car recognition event
   - `carobject`: car photo in a card
   - `bodyevent`: body recognition event
   - `bodyobject`: full-length photo in a card
   - `deviceblacklistrecord`: *blocklist*
   - `watchlist`: *watch list*
   - `cameragroup`: *camera group*
   - `camera`: *camera*
   - `uploadlist`: list of photos in *batch upload*
   - `upload`: item (photo) in batch photo upload
   - `user`: *user*
   - `webhook`: *webhook*
   - `videoarchive`: *object identification in offline video*
   - `counter`: *counters picking statistics on faces and bodies*
   - `report`: *report*
   - `all_own_sessions`: all *sessions* of the current user on different devices

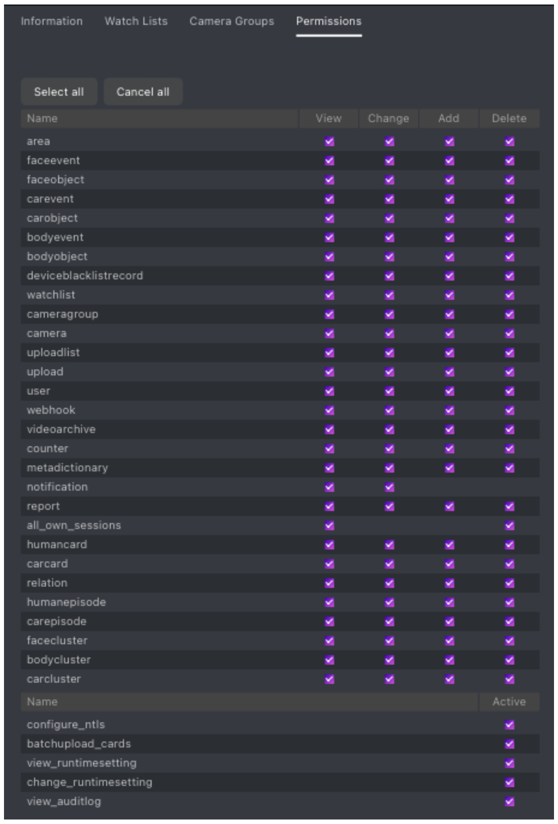
     Note: If relevant permissions for this entity are set, users will be able to view (`view`) and close (`delete`) all their sessions on different devices. Otherwise, users will be only allowed to view and close their session on the current device. Working with sessions takes place on the *Sessions* tab (*Preferences*).

   - `humancard`: *person card*
   - `carcard`: *car card*
   - `relation`: *card-to-card relation*

- humanepisode: *person-related episode*
- carepisode: *car-related episode*
- facecluster: *cluster of faces*
- bodycluster: *cluster of bodies*
- carcluster: *cluster of cars*

You can also enable and disable rights for the following functionality:

- configure_ntls: configuration of the findface-ntls *license server*
- batchupload_cards: *batch photo upload*
- view_runtimesetting: viewing the FindFace Multi *general preferences*
- change_runtimesetting: changing the FindFace Multi general preferences
- view_auditlog: viewing and working with the *audit logs*.



Name	View	Change	Add	Delete
area	✓	✓	✓	✓
faceevent	✓	✓	✓	✓
faceobject	✓	✓	✓	✓
carevent	✓	✓	✓	✓
carobject	✓	✓	✓	✓
bodyevent	✓	✓	✓	✓
bodyobject	✓	✓	✓	✓
deviceblacklistrecord	✓	✓	✓	✓
watchlist	✓	✓	✓	✓
cameragroup	✓	✓	✓	✓
camera	✓	✓	✓	✓
uploadlist	✓	✓	✓	✓
upload	✓	✓	✓	✓
user	✓	✓	✓	✓
webhook	✓	✓	✓	✓
videoarchive	✓	✓	✓	✓
counter	✓	✓	✓	✓
metadictionary	✓	✓	✓	✓
notification	✓	✓		
report	✓	✓	✓	✓
all_own_sessions	✓			✓
humancard	✓	✓	✓	✓
carcard	✓	✓	✓	✓
relation	✓	✓	✓	✓
humanepisode	✓	✓	✓	✓
carepisode	✓	✓	✓	✓
facecluster	✓	✓	✓	✓
bodycluster	✓	✓	✓	✓
carcluster	✓	✓	✓	✓

Name	Active
configure_ntls	✓
batchupload_cards	✓
view_runtimesetting	✓
change_runtimesetting	✓
view_auditlog	✓

Primary and Additional User Privileges

You assign privileges to a user by using roles:

- *Primary role*: main user role, mandatory for assignment. You can assign only one primary role to a user.
- *Role*: additional user role, optional for assignment. You can assign several roles to one user. The rights associated with the additional roles will be added to the primary privileges.

All users belonging to a particular primary role automatically get access to camera groups (and cameras within the group) and watch lists (and cards in the watchlist) created by a user with the same primary role, subject to the privileges defined by their additional role(s).

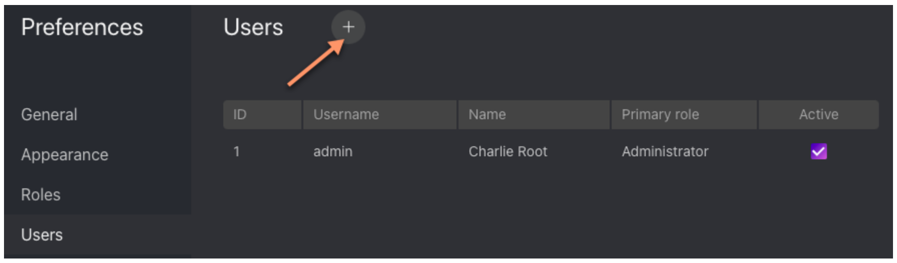
See also:

Create User

Create User

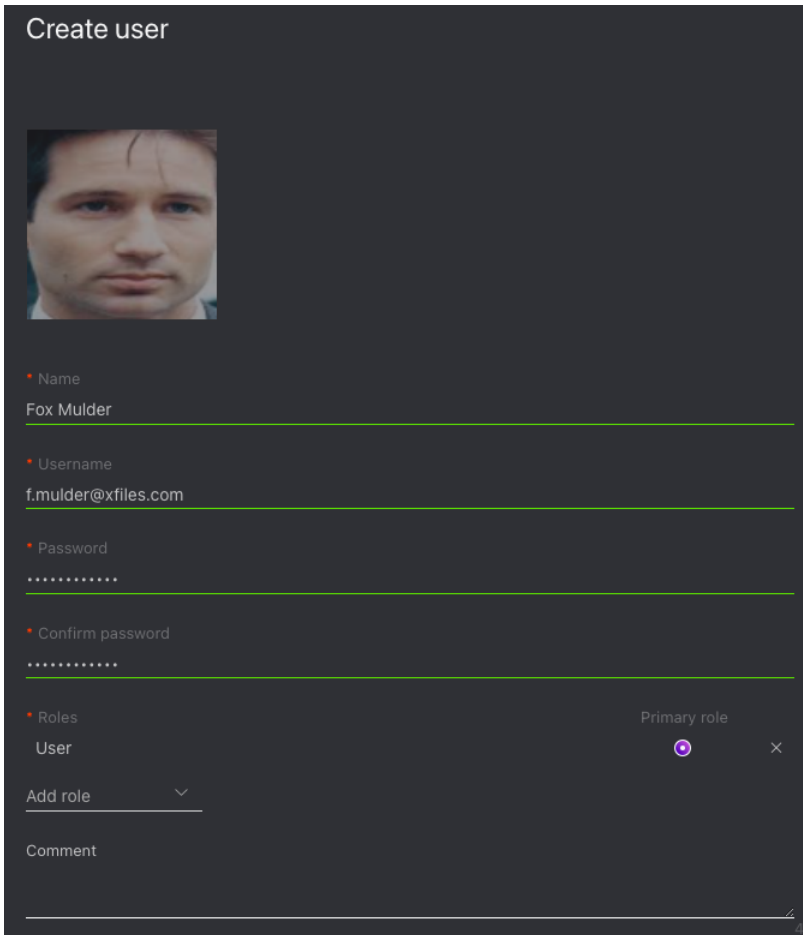
To create a user, do the following:

1. Navigate to the *Preferences* tab. Click *Users*.
2. Click +.



ID	Username	Name	Primary role	Active
1	admin	Charlie Root	Administrator	✓

3. Specify such user data as name, login and password. If necessary, add a comment. Attach the user's photo.


Create user

* Name
Fox Mulder

* Username
f.mulder@xfiles.com

* Password
••••••••••••

* Confirm password
••••••••••••

* Roles
User

Primary role ●

Important: A face in the photo must be of high quality, i.e. close to a frontal position. Distance between pupils: 60 px. Supported formats: WEBP, JPG, BMP, PNG. Photos that do not meet the requirements will be rejected with a detailed error description.

Tip: The photo can be used for *biometric authentication*.

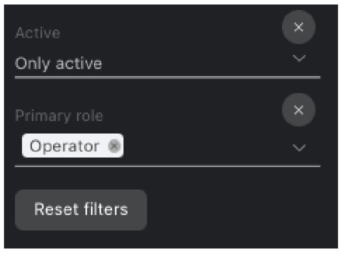
4. From the *Roles* drop-down menu, select one or several user roles. Set one of them as the *Primary role*.
5. Check *Active*.
6. Click *Create*.

Deactivate or Delete User

In order to deactivate a user, uncheck *Active* on the user list (*Preferences* -> *Users*).

To delete a user from FindFace Multi, click on the user login on the list. Click *Delete*.

To filter the user list, use the following parameters:



- *Active*: user status
- *Primary role*: one or several primary roles

Enable Administrator Privileges for System Plugins

The FindFace Multi package incorporates an extensive set of system plugins that provide the following functionality:

- *partner integrations*
- log-in through a crypto certificate (contact your manager for details)

Note: You have to manually enable the system plugins via the `/etc/findface-security/config.py` configuration file.

By default, the Administrator role is granted no privileges for any of the plugins. To assign relevant privileges to Administrator, do the following:

1. Enable a system plugin in the `/etc/findface-security/config.py` configuration file, following the step-by-step instructions provided by our team.
2. Re-migrate the main database architecture from FindFace Multi to **`PostgreSQL`**.

```
sudo findface-security migrate
```

3. Re-create user groups in the main database.

```
sudo findface-security create_groups
```

4. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

2.6.2 Authentication and Session Monitoring

In this section:

Authentication Types

FindFace Multi provides the following authentication types:

- `password`: standard login/password authentication. Enabled by default.
- `face`: authentication is possible only by the user's face.
- `face_or_password`: authentication is possible using either a face or login/password.
- `face_and_password`: two-factor authentication. After a face is successfully recognized, the user must enter their credentials.

Important: For all the authentication types based on face recognition, you need the following configuration:

- *standalone liveness service* (`findface-liveness-api`)
- *HTTPS*

Important: Before using face recognition for authentication, you need to *attach photos* to users' profiles and equip their workplaces with webcams.

Note: You can enable a work session monitoring for the authentication types `face` and `face_or_password`. In this case, the system will be periodically renewing the session after verifying that the face of a person at the workplace matches the user's face that has logged in (see *Configure Authentication and Session Renewal* for details).

Tip: FindFace Multi also provides a certificate-based authentication that is configured independently. Contact our support team for details (support@ntechlab.com).

Configure Authentication and Session Renewal

To configure authentication and session monitoring, do the following:

1. Open the /etc/findface-security/config.py configuration file. Find the FFSECURITY and FFSECURITY_AUTH_CONFIG sections.

```
sudo vi /etc/findface-security/config.py

FFSECURITY = {
    # auth config
    # available options: face, password, face_and_password, face_or_password
    'AUTH_TYPE': 'face_or_password',
    # 180 days by default
    'MAXIMUM_SESSION_LENGTH': 15552000,
    ...
    }

...
# - FindFace Security authorization configuration dictionary -

FFSECURITY_AUTH_CONFIG = {
    'FACE_AUTH_CONFIDENCE': 0.740,  # FAR = 2.5E-09  # model: [kiwi_320]
    # 3 settings below are for front-end only
    # session renew works only with face or face_or_password authorization type
    'NEED_SESSION_RENEW': False,
    'RENEW_SESSION_INTERVAL': 0,
    'MAXIMUM_RENEW_ATTEMPTS': 2,
}
```

2. In the FFSECURITY section, set the following authentication parameters:
   - AUTH_TYPE: authentication type. Available options: face, password, face_and_password, face_or_password.
   - MAXIMUM_SESSION_LENGTH: the maximum session length, in seconds. After a session expires, the user will be automatically logged out unless the session is renewed.
3. In the FFSECURITY_AUTH_CONFIG section, set the following authentication and session monitoring parameters:
   - FACE_AUTH_CONFIDENCE: after a face in the webcam video is detected as alive, the system checks this face against the database of user photos with this confidence threshold.
   - NEED_SESSION_RENEW: if True, a session can be renewed and prolonged by the time equal to MAXIMUM_SESSION_LENGTH, after verifying that the face of a person at the workplace matches the user's face that has logged in.
   - RENEW_SESSION_INTERVAL: period in seconds before the expected time of the session expiry, during which the system will attempt to renew the session by enabling the webcam and verifying the user's face.
   - MAXIMUM_RENEW_ATTEMPTS: the number of user verification attempts. The attempts occur in a row during the renewal interval.

Note: A verification attempt takes about 3 seconds to complete.

Tip: We recommend you to set up the monitoring parameters so that MAXIMUM_RENEW_ATTEMPTS multiplied by the attempt duration is less than `RENEW_SESSION_INTERVAL`. Otherwise, the system will extend the renewal interval x2, x3, and so on, subject to the number of attempts.

4. Restart `findface-security`.

```
sudo systemctl restart findface-security.service
```

Log out All Users

To automatically log out all users, execute the following command on the FindFace Multi principal server console:

```
sudo findface-security logout_all_users
```

Tip: This command comes in handy when switching to a different authentication type.

2.6.3 Enable Data Encryption

To ensure data security, we recommend you enabling SSL encryption. Do the following:

1. Under the nginx configuration directory, create a directory that will be used to hold all of the SSL data:

```
sudo mkdir /etc/nginx/ssl
```

2. Create the SSL key and certificate files:

```
sudo openssl req -x509 -nodes -days 365 -newkey rsa:2048 -keyout /etc/nginx/ssl/my-
↪example-domain.com.key -out /etc/nginx/ssl/my-example-domain.com.crt
```

You will be asked a few questions about your server in order to embed the information correctly in the certificate. Fill out the prompts appropriately. The most important line is the one that requests the `Common Name`. You need to enter the domain name or public IP address that you want to be associated with your server. Both of the files you created (`my-example-domain.com.key` and `my-example-domain.com.crt`) will be placed in the `/etc/nginx/ssl` directory.

3. Configure nginx to use SSL. Open the nginx configuration file `/etc/nginx/sites-available/ffsecurity-nginx.conf`. Apply the following modifications to the file:

   1. Add the new `server {...}` section that contains the URL replacement rule:

```
server {
        listen 80;
        server_name my-example-domain.com www.my-example-domain.com;
        rewrite ^(.*) https://my-example-domain.com$1 permanent;
        access_log off;
}
```

   2. Comment out the following lines in the existing `server {...}` section:

```
# listen 80 default_server;
# listen [::]:80 default_server;
```

3. Add the following lines, including the paths to the certificate and the key, to the existing `server {...}` section:

```
listen 443 ssl;

ssl_certificate     /etc/nginx/ssl/my-example-domain.com.crt;
ssl_certificate_key /etc/nginx/ssl/my-example-domain.com.key;
```

4. In the generic nginx configuration file `/etc/nginx/nginx.conf`, find the `SSL Settings` section and append the following lines:

```
ssl_session_cache   shared:SSL:10m;
ssl_session_timeout 1h;
```

The example of the configuration file `/etc/nginx/sites-available/ffsecurity-nginx.conf` with correctly configured SSL settings is shown below:

```
upstream ffsecurity {
 server 127.0.0.1:8002;
}

upstream ffsecurity-ws {
  server 127.0.0.1:8003;
}

map $http_upgrade $ffsec_upstream {
  default "http://ffsecurity-ws";
  "" "http://ffsecurity";
}

server {
  listen 80;
  server_name my-example-domain.com www.my-example-domain.com;
  rewrite ^(.*) https://my-example-domain.com$1 permanent;
  access_log off;
}

server {
  # listen 80 default_server;
  # listen [::]:80 default_server;
  listen 443 ssl;
  ssl_certificate /etc/nginx/ssl/my-example-domain.com.crt;
  ssl_certificate_key /etc/nginx/ssl/my-example-domain.com.key;

  root /var/lib/findface-security;

  autoindex off;

  server_name _;

  location = / {

    alias /usr/share/findface-security-ui/;
    try_files /index.html =404;
```

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```
    }
  location /static/ {

  }
  location /uploads/ {
    add_header 'Access-Control-Allow-Origin' '*';
    add_header 'Access-Control-Allow-Methods' 'GET';
    add_header 'Access-Control-Allow-Headers' 'DNT,User-Agent,X-
↪Requested-With,If-Modified-Since,Cache-Control,Content-Type,Range,
↪Authorization';
    add_header 'Access-Control-Expose-Headers' 'Content-Length,
↪Content-Range';
    add_header 'Access-Control-Max-Age' 2592000;
  }
  location /ui-static/ {
    alias /usr/share/findface-security-ui/ui-static/;
  }
  location /doc/ {
    alias /opt/findface-security/doc/;
  }
  location ~ /videos/(?<video_id>[0-9]+)/upload/(.*)$ {
    if ($request_method = 'OPTIONS') {
      add_header 'Content-Type' 'text/plain; charset=utf-8';
      add_header 'Content-Length' 0;
      return 204;
    }
    set $auth_request_uri "http://ffsecurity/videos/$video_id/auth-
↪upload/";
    auth_request /video-upload-auth/;

    alias "/var/lib/findface-security/uploads/videos/$video_id.bin";
    client_max_body_size 15g;

    dav_access user:rw group:rw all:rw;
    dav_methods PUT;

    create_full_put_path on;
    autoindex off;
    autoindex_exact_size off;
    autoindex_localtime on;
    charset utf-8;

    add_header 'Access-Control-Allow-Origin' '*';
    add_header 'Access-Control-Allow-Methods' 'PUT, OPTIONS';
    add_header 'Access-Control-Allow-Headers' 'authorization';
  }
  location = /video-upload-auth/ {
    internal;
    client_max_body_size 15g;
    proxy_set_header Content-Length "";
    proxy_set_header Host $http_host;
    proxy_set_header X-Forwarded-For $remote_addr;
```

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```
    proxy_set_header X-Forwarded-Proto $scheme;
    proxy_pass_request_body off;
    proxy_pass $auth_request_uri;
  }

  location / {
    client_max_body_size 300m;
    proxy_set_header Host $http_host;
    proxy_set_header X-Forwarded-For $remote_addr;
    proxy_set_header X-Forwarded-Proto $scheme;
    proxy_http_version 1.1;
    proxy_set_header Upgrade $http_upgrade;
    proxy_set_header Connection "upgrade";
    proxy_pass $ffsec_upstream;
    proxy_read_timeout 5m;

    location ~ ^/(cameras|videos)/([0-9]+)/stream/?$ {
      proxy_set_header Host $http_host;
      proxy_set_header X-Forwarded-For $remote_addr;
      proxy_set_header X-Forwarded-Proto $scheme;
      proxy_pass http://ffsecurity;
    }

    location ~ ^/streams/(.*)$ {
      internal;
      proxy_pass $1;
    }
  }
}
```

4. Restart nginx.

```
sudo systemctl restart nginx.service
```

5. Edit the `/etc/findface-security/config.py` configuration file. In the `EXTERNAL_ADDRESS` and `ROUTER_URL` parameters, substitute the `http://` prefix with `https://`.

```
sudo vi /etc/findface-security/config.py

...
EXTERNAL_ADDRESS="https://my-example-domain.com"
...
ROUTER_URL="https://IP_address"
```

6. Restart `findface-security`.

```
sudo systemctl restart findface-security
```

7. If there are running `findface-video-worker` services in the system, you need to either recreate cameras in the web interface, or change the `router_url` parameter in relevant video processing jobs, substituting the `http://` prefix with `https://`. This can be done with the following command:

```
curl -s localhost:18810/jobs | jq -r '.[]["id"]' | xargs -I {} curl -X PATCH -d '{
↪"router_url": "https://my-example-domain.com/video-detector/frame"}' http://
↪localhost:18810/job/{}
```

2.6.4 Enable Card Index Protection

If the card index security is disabled, the card photos and attachments will be available by direct link regardless of the user rights. Configure FindFace Multi to run all media requests through the DJANGO application for ACL checks to increase card index security.

Important: Enable the card media security only if you need it, as this setting severely negatively impacts the system performance.

Important: For the ACL checks to work properly, you must set the view permission for the card photos of faces, bodies, and cars. To do so, navigate *Preferences* → *Roles* → specific role → *Permissions* and set *View* for the `faceobject`, `bodyobject`, and `carobject` entities, subject to the object types in the cards. See *Create Custom Role* for details.

See also:

Set Up Object Monitoring and Card Index.

To enable card index security, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Uncomment `OVERPROTECT_MEDIA` and set it `True`.

```
...

'OVERPROTECT_MEDIA': False,
```

3. Open the nginx configuration file `/etc/nginx/sites-available/ffsecurity-nginx.conf`. Uncomment `internal` in the `location /uploads` section.

```
location /uploads/ {
   internal; # Uncomment if you intend to enable OVERPROTECT_MEDIA
   ...
}
```

4. Restart `findface-security` and nginx.

```
sudo systemctl restart findface-security.service
sudo systemctl restart nginx.service
```

5. After the new security policy is applied, logged-in users must re-authenticate. To make the users do so, execute the logout-all command:

```
sudo findface-security logout_all_users
```

2.6.5 Disable ACL

You can turn off FindFace Multi ACL if you do not need it, as the constant permission checks consume a significant amount of system resources.

Do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

   ```
   sudo vi /etc/findface-security/config.py
   ```

2. Set `ENABLE_ACL = False`.

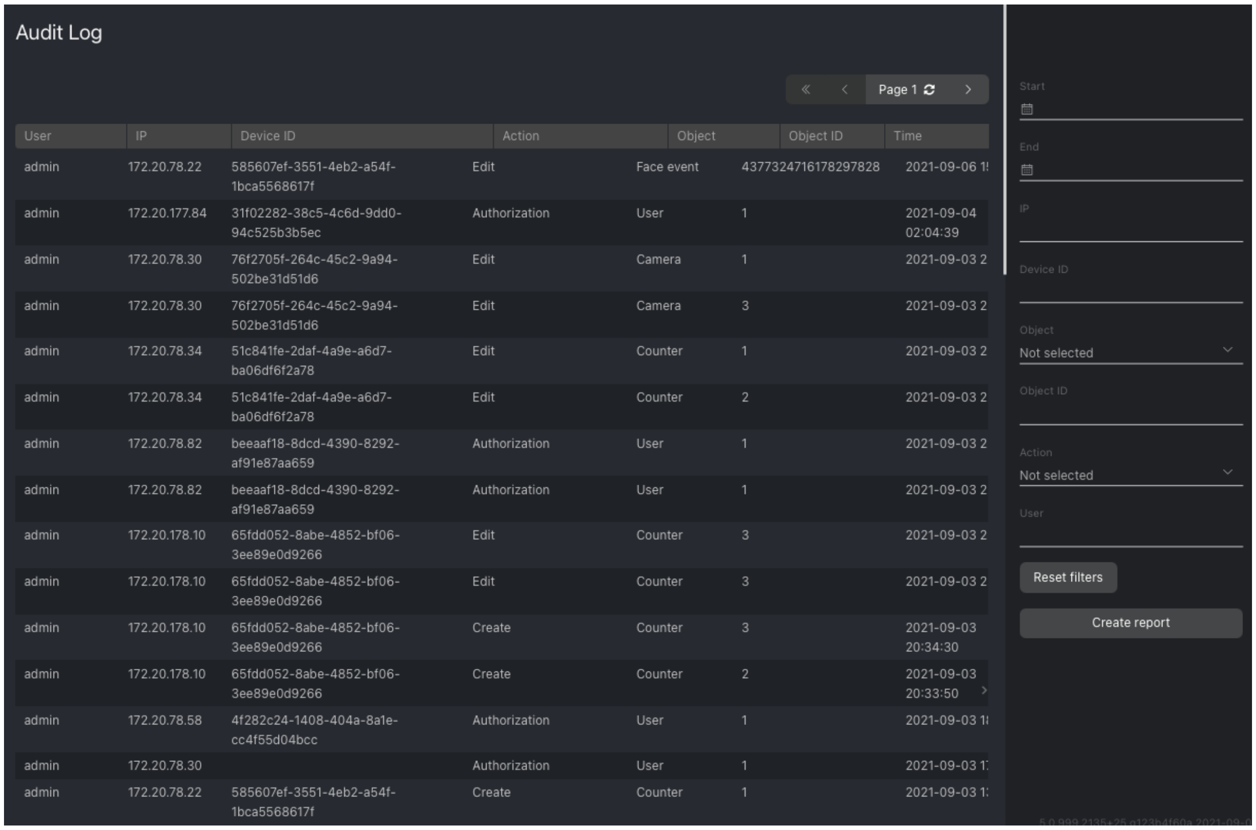
   ```
   ...

   ENABLE_ACL = False
   ```

3. Restart `findface-security`.

   ```
   sudo systemctl restart findface-security.service
   ```

2.6.6 Audit Logs

The FindFace Multi comprehensive and searchable audit logs are an excellent complementary tool for user management that provides you with a thorough audit of the user actions and strengthens your system protection. You can access this functionality on the *Audit Logs* tab.



User	IP	Device ID	Action	Object	Object ID	Time
admin	172.20.78.22	585607ef-3551-4eb2-a54f-1bca5568617f	Edit	Face event	4377324716178297828	2021-09-06 1
admin	172.20.177.84	31f02282-38c5-4c6d-9dd0-94c525b3b5ec	Authorization	User	1	2021-09-04 02:04:39
admin	172.20.78.30	76f2705f-264c-45c2-9a94-502be31d51d6	Edit	Camera	1	2021-09-03 2
admin	172.20.78.30	76f2705f-264c-45c2-9a94-502be31d51d6	Edit	Camera	3	2021-09-03 2
admin	172.20.78.34	51c841fe-2daf-4a9e-a6d7-ba06df6f2a78	Edit	Counter	1	2021-09-03 2
admin	172.20.78.34	51c841fe-2daf-4a9e-a6d7-ba06df6f2a78	Edit	Counter	2	2021-09-03 2
admin	172.20.78.82	beeaaf18-8dcd-4390-8292-af91e87aa659	Authorization	User	1	2021-09-03 2
admin	172.20.78.82	beeaaf18-8dcd-4390-8292-af91e87aa659	Authorization	User	1	2021-09-03 2
admin	172.20.178.10	65fdd052-8abe-4852-bf06-3ee89e0d9266	Edit	Counter	3	2021-09-03 2
admin	172.20.178.10	65fdd052-8abe-4852-bf06-3ee89e0d9266	Edit	Counter	3	2021-09-03 2
admin	172.20.178.10	65fdd052-8abe-4852-bf06-3ee89e0d9266	Create	Counter	3	2021-09-03 20:34:30
admin	172.20.178.10	65fdd052-8abe-4852-bf06-3ee89e0d9266	Create	Counter	2	2021-09-03 20:33:50
admin	172.20.78.58	4f282c24-1408-404a-8a1e-cc4f55d04bcc	Authorization	User	1	2021-09-03 1
admin	172.20.78.30		Authorization	User	1	2021-09-03 1
admin	172.20.78.22	585607ef-3551-4eb2-a54f-1bca5568617f	Create	Counter	1	2021-09-03 1

Each record provides the following data:

- username of the user who performed the action
- IP address where the request came from
- device id: the unique identifier of the client device
- action type such as authorization, search, object modification, restart, and so on
- object type to which the action applies, for example, a card or a camera
- object identifier
- details, subject to the action type
- timestamp

Use the filter panel to the right to set up the search conditions.

2.6.7 List of User Sessions. Blocklist

In this chapter:

FindFace Multi allows you to monitor user sessions and learn associated data, such as the connected device UUID, type of user interface (mobile app or web interface), IP address, last ping time, and so on.

If necessary, you can add a device to the blocklist without deactivating the user account. The device block may come in handy in various situations. For example, if you want users to access the system only from their workplaces. Use the blocklist functionality to take your system safety to the next level.

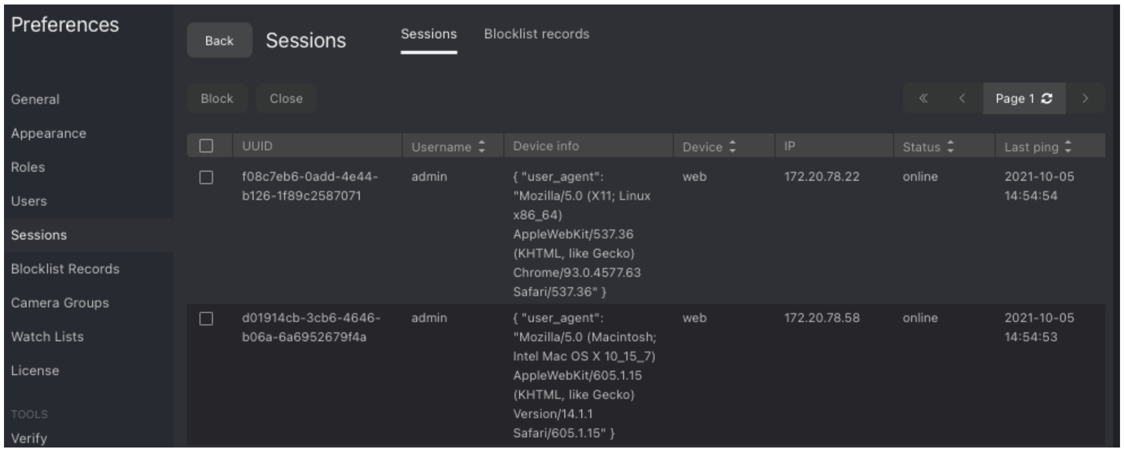
Grant Permissions to Work with Sessions

A user's access to the list of sessions depends on the granted *permissions*:

- Administrator: can view and close sessions of all users
- User with the `all_own_sessions` permissions: can view/close all sessions initiated with their username
- User without the `all_own_sessions` permissions: can only view/close their current session

View User Sessions

To view the list of user sessions, navigate to *Preferences* -> *Sessions*.



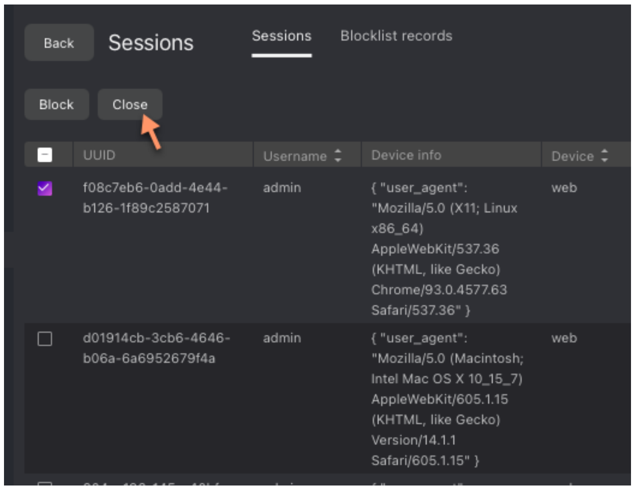
	UUID	Username	Device info	Device	IP	Status	Last ping
☐	f08c7eb6-0add-4e44-b126-1f89c2587071	admin	{ "user_agent": "Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/93.0.4577.63 Safari/537.36" }	web	172.20.78.22	online	2021-10-05 14:54:54
☐	d01914cb-3cb6-4646-b06a-6a6952679f4a	admin	{ "user_agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/605.1.15 (KHTML, like Gecko) Version/14.1.1 Safari/605.1.15" }	web	172.20.78.58	online	2021-10-05 14:54:53

Each session record provides the following data:

- device UUID
- username
- device information
- type of the user interface (mobile/web)
- IP address
- status (online, offline, blocked)
- last ping time

Use the filter panel to the right to set up the search conditions.

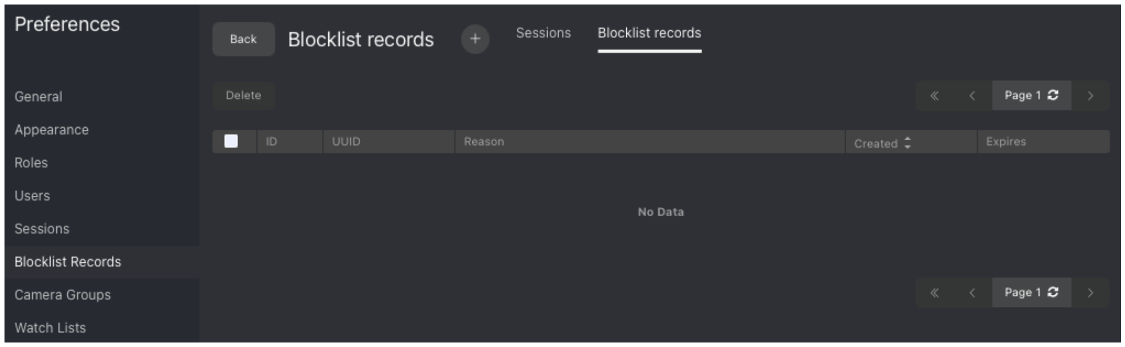
To close a session, select it in the list and click *Close*.



	UUID	Username	Device info	Device
✓	f08c7eb6-0add-4e44-b126-1f89c2587071	admin	{ "user_agent": "Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/93.0.4577.63 Safari/537.36" }	web
☐	d01914cb-3cb6-4646-b06a-6a6952679f4a	admin	{ "user_agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/605.1.15 (KHTML, like Gecko) Version/14.1.1 Safari/605.1.15" }	web

Block Device

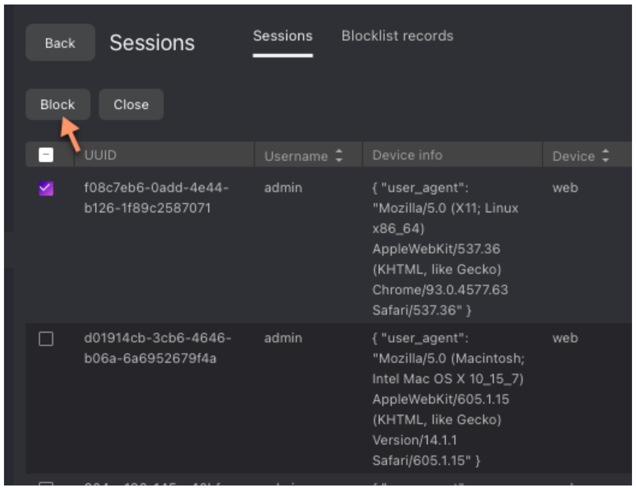
The list of blocked devices is available on the *Blocklist Records* tab (*Preferences*).



You can add a device to the blocklist on both the *Sessions* and *Blocklist Records* tabs. Blocking a device leads to the user's automatic log-out.

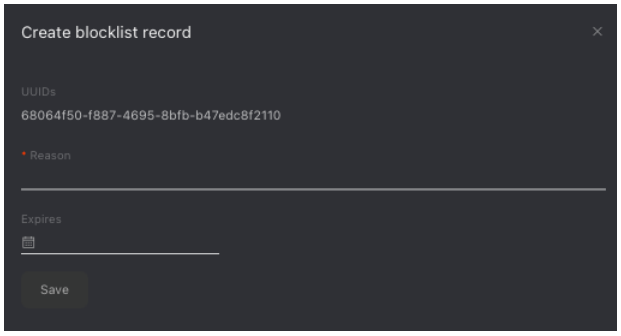
To block a device on the *Sessions* tab, do the following:

1. Select the relevant session record(s).
2. Click *Block*.



	UUID	Username	Device info	Device
✓	f08c7eb6-0add-4e44-b126-1f89c2587071	admin	{ "user_agent": "Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/93.0.4577.63 Safari/537.36" }	web
☐	d01914cb-3cb6-4646-b06a-6a6952679f4a	admin	{ "user_agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/605.1.15 (KHTML, like Gecko) Version/14.1.1 Safari/605.1.15" }	web

3. Specify the reason for the device to be blocked (mandatory) and the block expiry date (optional). If no date is specified, the block will be permanent.
4. Click *Save*.

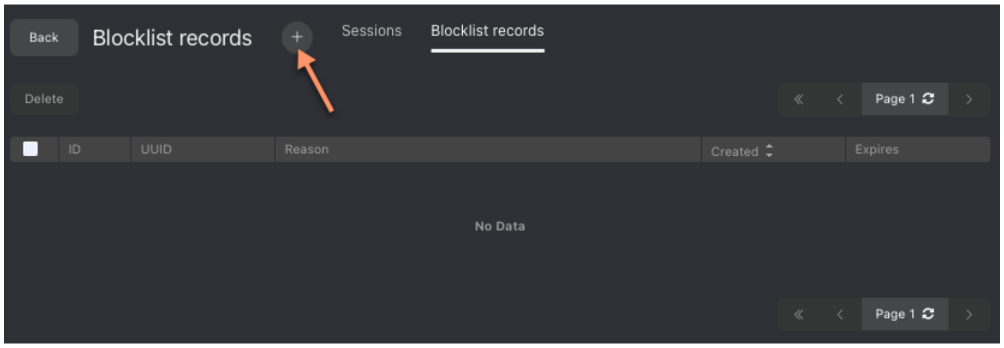


UUIDs
68064f50-f887-4695-8bfb-b47edc8f2110

* Reason

Expires

Blocking a device on the *Blocklist Records* tab is similar:



1. Click +.
2. Manually enter the device UUID.
3. Specify the reason and the block expiry date.
4. Click *Save*.

2.6.8 Allowed File Extensions in Cards

By default, you can attach a file of any extension to a *card*. It is possible to strengthen your system safety by creating the allowlist of file extensions. It will prevent your users from uploading files of unwanted formats, including those that might contain hidden malicious code, such as `.js`, `.swf`, and such.

To create the allowlist of file extensions, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. In the `FFSECURITY` section, find the `CARD_ATTACHMENTS_FILENAME_REGEXP` parameter. Set an expression with the allowed file extensions. Any valid Python regular expression will do.

   Examples:

   - `r'.*\.png'`: allows only files with the `.png` extension
   - `r'.*\(png|jpg)'`: allows the `.png` and `.jpg` extensions
   - `r'.*'`: allows all file extensions
   - `None`: allows all file extensions
   - `'XXXXXX'`: uploading files of any extension is prohibited

```
FFSECURITY = {
   ...
   'CARD_ATTACHMENTS_FILENAME_REGEXP': r'.*\.txt',
   ...

   }
```

Tip: Commenting out the `CARD_ATTACHMENTS_FILENAME_REGEXP` parameter also allows all file extensions.

3. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

2.7 Advanced Functionality Setup

2.7.1 Enable Face Attribute Recognition

Subject to your needs, you can enable automatic recognition of such face attributes as gender, age, emotions, glasses, beard, and face mask. This functionality can be activated on both GPU- and CPU-accelerated video object detectors.

To enable automatic recognition of face attributes, do the following:

1. Open the `/etc/findface-extraction-api.ini` configuration file.

```
sudo vi /etc/findface-extraction-api.ini
```

2. Specify the relevant recognition models in the `extractors` section, as shown in the example below. Be sure to indicate the right acceleration type for each model, matching the acceleration type of `findface-extraction-api`: CPU or GPU. Be aware that `findface-extraction-api` on CPU can work only with CPU-models, while `findface-extraction-api` on GPU supports both CPU- and GPU-models.

```
extractors:
  face_age: faceattr/age.v2.gpu.fnk
  face_beard: faceattr/beard.v0.gpu.fnk
  face_emotions: faceattr/emotions.v1.gpu.fnk
  face_gender: faceattr/gender.v2.gpu.fnk
  face_glasses3: faceattr/glasses3.v0.gpu.fnk
  face_medmask3: faceattr/medmask3.v2.gpu.fnk
```

The following models are available:

Face attribute	Acceleration	Configure as follows
age	CPU	`face_age: faceattr/age.v2.cpu.fnk`
	GPU	`face_age: faceattr/age.v2.gpu.fnk`
gender	CPU	`face_gender: faceattr/gender.v2.cpu.fnk`
	GPU	`face_gender: faceattr/gender.v2.gpu.fnk`
emotions	CPU	`face_emotions: faceattr/emotions.v1.cpu.fnk`
	GPU	`face_emotions: faceattr/emotions.v1.gpu.fnk`
glasses	CPU	`face_glasses3: faceattr/glasses3.v0.cpu.fnk`
	GPU	`face_glasses3: faceattr/glasses3.v0.gpu.fnk`
beard	CPU	`face_beard: faceattr/beard.v0.cpu.fnk`
	GPU	`face_beard: faceattr/beard.v0.gpu.fnk`
face mask	CPU	`face_medmask3: faceattr/medmask3.v2.cpu.fnk`
	GPU	`face_medmask3: faceattr/medmask3.v2.gpu.fnk`

Tip: To leave a recognition model disabled, pass the empty value "" to the relevant parameter. Do not remove the parameter itself. Otherwise, the system will be searching for the default model.

```
extractors:
  face_age: ""
  face_beard: ""
```

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```
  face_emotions: ""
  face_gender: ""
  face_glasses3: ""
  face_medmask3: ""
```

Note: You can find face attribute recognition models at `/usr/share/findface-data/models/faceattr/`.

```
ls /usr/share/findface-data/models/faceattr/
age.v2.cpu.fnk  age.v2.gpu.fnk  beard.v0.cpu.fnk  beard.v0.gpu.fnk  emotions.v1.cpu.
↪fnk  emotions.v1.gpu.fnk  gender.v2.cpu.fnk  gender.v2.gpu.fnk  glasses3.v0.cpu.
↪fnk  glasses3.v0.gpu.fnk medmask3.v2.cpu.fnk medmask3.v2.gpu.fnk liveness.colombo.
↪cpu.fnk liveness.colombo.gpu.fnk liveness.pacs.v0.cpu.fnk liveness.pacs.v0.gpu.
↪fnk quality.v1.cpu.fnk quality.v1.gpu.fnk
```

3. Restart `findface-extraction-api`.

```
sudo systemctl restart findface-extraction-api
```

4. To display the face attribute recognition results in the event list, open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

5. Specify the required models in the following line of the `FFSECURITY` section, subject to the list of enabled models:

```
FFSECURITY = {
    ...
    'FACE_EVENTS_FEATURES': ['gender', 'age', 'emotions', 'beard', 'glasses',
↪'medmask'],
    ...
}
```

6. Restart `findface-security`.

```
sudo systemctl restart findface-security
```

2.7.2 Enable Car and Car Attribute Recognition

FindFace Multi allows you to recognize individual cars and car attributes.

The car attributes are the following:

- license plate number (for selected countries),
- color,
- make,
- model,
- car body style,
- whether a car is a special vehicle (police, ambulance, rescue service, or taxi).

Important: Recognition of individual cars is an experimental feature. Therefore, we highly recommend enabling the additional attribute analysis to improve the recognition quality. In this case, the system compares not only the feature vectors of two cars but also their attributes such as color, body style, make, model, and belonging to a special vehicle type. A conclusion about the cars' match is only made if both the feature vectors and attributes of the cars coincide.

See the detailed description of how to enable the additional attribute analysis in the step-by-step instructions below.

To enable recognition of cars and their attributes, do the following:

1. Specify neural network models for individual car recognition and car attribute recognition in the `/etc/findface-extraction-api.ini` configuration file. Do the following:

   Important: Be sure to choose the right acceleration type for each model, matching the acceleration type of `findface-extraction-api`: CPU or GPU. Be aware that `findface-extraction-api` on CPU can work only with CPU-models, while `findface-extraction-api` on GPU supports both CPU- and GPU-models.

   1. Open the `/etc/findface-extraction-api.ini` configuration file.

      ```
      sudo vi /etc/findface-extraction-api.ini
      ```

   2. Specify the car detector model in the `detectors -> models` section by pasting the following code:

      GPU

      ```
      detectors:

        ...
        models:
          ...
          efreitor:
            aliases:
            - car
            model: cadet/efreitor.gpu.fnk
            options:
              min_object_size: 32
              resolutions: [256x256, 384x384, 512x512, 768x768, 1024x1024, 1536x1536,␣
      ↪2048x2048]

        ...
      ```

      CPU

      ```
      detectors:

        ...
        models:
          ...
          efreitor:
            aliases:
      ```

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```
      - car
      model: cadet/efreitor.cpu.fnk
      options:
        min_object_size: 32
        resolutions: [256x256, 384x384, 512x512, 768x768, 1024x1024, 1536x1536,␣
↪2048x2048]

  ...
```

3. Specify the extraction models in the `extractors -> models` section, subject to the extractors you want to enable:

GPU

```
extractors:
   ...
   models:
    car_color: ''
    car_description: carattr/description.v0.gpu.fnk
    car_emben: carrec/alonso.gpu.fnk
    car_license_plate: carattr/carattr.license_plate.v4.gpu.fnk
    car_license_plate_quality: carattr/carattr.license_plate_quality.v0.gpu.fnk
    car_make: ''
    car_quality: carattr/carattr.quality.v0.gpu.fnk
    car_special_types: carattr/carattr.special_types.v0.gpu.fnk
```

CPU

```
extractors:
   ...
   models:
    car_color: ''
    car_description: carattr/description.v0.cpu.fnk
    car_emben: carrec/alonso.cpu.fnk
    car_license_plate: carattr/carattr.license_plate.v4.cpu.fnk
    car_license_plate_quality: carattr/carattr.license_plate_quality.v0.cpu.fnk
    car_make: ''
    car_quality: carattr/carattr.quality.v0.cpu.fnk
    car_special_types: carattr/carattr.special_types.v0.cpu.fnk
```

The following extractors are available:

Extractor	Configure as follows
individual car object	`car_emben: carrec/alonso.cpu.fnk`
	`car_emben: carrec/alonso.gpu.fnk`
license plate number	`car_license_plate: carattr/carattr.license_plate.v4.cpu.fnk car_license_plate_quality: carattr/carattr.license_plate_quality.v0.cpu.fnk`
	`car_license_plate: carattr/carattr.license_plate.v4.gpu.fnk car_license_plate_quality: carattr/carattr.license_plate_quality.v0.gpu.fnk`
set of attributes: make / color / model / body style	`car_description: carattr/description.v0.cpu.fnk`
	`car_description: carattr/description.v0.gpu.fnk`
car image quality	`car_quality: carattr/carattr.quality.v0.cpu.fnk`
	`car_quality: carattr/carattr.quality.v0.gpu.fnk`
special vehicle	`car_special_types: carattr/carattr.special_types.v0.cpu.fnk`
	`car_special_types: carattr/carattr.special_types.v0.gpu.fnk`

Tip: To leave a model disabled, pass the empty value `''` to the relevant parameter. Do not remove the parameter itself. Otherwise, the system will be searching for the default model.

```
extractors:
   ...
   models:
    car_color: ""
    car_description: ""
    car_emben: ""
    car_license_plate: ""
    car_license_plate_quality: ""
    car_make: ""
    car_quality: ""
    car_special_types: ""
```

4. Specify the normalizers required for the extractors specified in the previous step. For example, if you need license plate recognition, specify the `carlicplate` normalizer.

Normalizer	Normalizer model	Used for extractors
carlicplate	`carnorm/anaferon.v3.gpu.fnk` `carnorm/anaferon.v3.cpu.fnk`	`car_license_plate`
cropbbox	`facenorm/cropbbox.v2.gpu.fnk` `facenorm/cropbbox.v2.cpu.fnk`	`car_license_plate_quality`, `car_description`, `car_quality`, `car_special_types`

GPU

```
normalizers:
  ...

  models:
    carlicplate:
      model: carnorm/anaferon.v3.gpu.fnk
    ...
    cropbbox:
      model: facenorm/cropbbox.v2.gpu.fnk
```

CPU

```
normalizers:
  ...

  models:
    carlicplate:
      model: carnorm/anaferon.v3.cpu.fnk
    ...
    cropbbox:
      model: facenorm/cropbbox.v2.cpu.fnk
```

5. Make sure that the `objects -> car` section contains the `quality_attribute:  car_quality`:

GPU

```
objects:
  ...
  car:
    base_normalizer: facenorm/cropbbox.v2.gpu.fnk
    quality_attribute: car_quality
  ...
```

CPU

```
objects:
  ...
  car:
    base_normalizer: facenorm/cropbbox.v2.cpu.fnk
    quality_attribute: car_quality
```

6. Restart `findface-extraction-api`.

```
sudo systemctl restart findface-extraction-api
```

2. Modify the `/etc/findface-video-worker-gpu.ini` (`/etc/findface-video-worker-cpu.ini`) configuration file. In the `car` section, specify the neural network models by analogy with the example below. Restart `findface-video-worker-gpu` (`findface-video-worker-cpu`).

GPU

```
sudo vi /etc/findface-video-worker-gpu.ini


#------------------------------
[car]
#------------------------------
## detector param
## type:number env:CFG_CAR_MIN_SIZE longopt:--car-min-size
min_size = 60

## path to car detector
## type:string env:CFG_CAR_DETECTOR longopt:--car-detector
detector = /usr/share/findface-data/models/cadet/efreitor.gpu.fnk

## path to normalizer (usually crop2x)
## type:string env:CFG_CAR_NORM longopt:--car-norm
norm = /usr/share/findface-data/models/facenorm/cropbbox.v2.gpu.fnk

## path to car quality extractor
## type:string env:CFG_CAR_QUALITY longopt:--car-quality
quality = /usr/share/findface-data/models/carattr/carattr.quality.v0.gpu.fnk

## path to car quality normalizer
## type:string env:CFG_CAR_NORM_QUALITY longopt:--car-norm-quality
norm_quality = /usr/share/findface-data/models/facenorm/cropbbox.v2.gpu.fnk

## path to car track features extractor
## type:string env:CFG_CAR_TRACK_FEATURES longopt:--car-track-features
track_features =

## path to car track features normalizer
## type:string env:CFG_CAR_TRACK_FEATURES_NORM longopt:--car-track-features-norm
track_features_norm =
```

```
sudo systemctl restart findface-video-worker-gpu.service
```

CPU

```
sudo vi /etc/findface-video-worker-cpu.ini


#------------------------------
[car]
#------------------------------
## detector param
## type:number env:CFG_CAR_MIN_SIZE longopt:--car-min-size
min_size = 60

## path to car detector
```

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```
## type:string env:CFG_CAR_DETECTOR longopt:--car-detector
detector = /usr/share/findface-data/models/cadet/efreitor.cpu.fnk

## path to normalizer (usually crop2x)
## type:string env:CFG_CAR_NORM longopt:--car-norm
norm = /usr/share/findface-data/models/facenorm/cropbbox.v2.cpu.fnk

## path to car quality extractor
## type:string env:CFG_CAR_QUALITY longopt:--car-quality
quality = /usr/share/findface-data/models/carattr/carattr.quality.v0.cpu.fnk

## path to car quality normalizer
## type:string env:CFG_CAR_NORM_QUALITY longopt:--car-norm-quality
norm_quality = /usr/share/findface-data/models/facenorm/cropbbox.v2.cpu.fnk
```

```
sudo systemctl restart findface-video-worker-cpu.service
```

3. Open the `/etc/findface-video-manager.conf` configuration file and make sure it contains the `car` section in `detectors` that looks similar to the example below.

Tip: As a reference value for the `filter_min_quality` parameter, you can take the `MINIMUM_CAR_QUALITY` parameter value from the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-video-manager.conf

detectors:
  ...
  car:
    filter_min_quality: 0.65
    filter_min_size: 1
    filter_max_size: 8192
    roi: ""
    fullframe_crop_rot: false
    fullframe_use_png: false
    jpeg_quality: 95
    overall_only: false
    realtime_post_first_immediately: false
    realtime_post_interval: 1
    realtime_post_every_interval: false
    track_interpolate_bboxes: true
    track_miss_interval: 1
    track_overlap_threshold: 0.25
    track_max_duration_frames: 0
    track_send_history: false
    post_best_track_frame: true
    post_best_track_normalize: true
    post_first_track_frame: false
    post_last_track_frame: false
    tracker_type: simple_iou
    track_deep_sort_matching_threshold: 0.65
    track_deep_sort_filter_unconfirmed_tracks: true
```

4. Enable the recognition of cars and car attributes in the `/etc/findface-security/config.py` configuration file. Do the following:

   1. In the `FFSECURITY` section, set `'ENABLE_CARS': True`.

      ```
      sudo vi /etc/findface-security/config.py

      FFSECURITY = {
          ...

          # optional objects to detect
          'ENABLE_CARS': True,
          ...
      ```

   2. In the same section, specify the car attributes you want to display for the car recognition events.

      ```
      # available features are: description, license_plate, special_vehicle_type
      'CAR_EVENTS_FEATURES': ['description', 'license_plate', 'special_vehicle_type'],
      ```

   3. To improve the quality of individual car recognition, we highly recommend you enable the additional attribute analysis. In this case, the system compares not only the feature vectors of two cars but also their attributes. A conclusion about the cars' match is only made if both the feature vectors and attributes of the cars coincide.

      You can use the following attributes for additional analysis:

      - `color`: car color,
      - `body`: body style,
      - `make`: make,
      - `model`: model,
      - `special_vehicle_type`: belonging to a special vehicle type.

      To enable the additional attribute analysis, set `True` in the `FFSECURITY` -> `EXTRA_CAR_MATCHING` section for the attributes that you want to compare.

      ```
      FFSECURITY = {
          # use additional features for extra confidence when matching cars by emben
          'EXTRA_CAR_MATCHING': {
              'color': {'enabled': False, 'min_confidence': 0},
              'body': {'enabled': False, 'min_confidence': 0},
              'make': {'enabled': False, 'min_confidence': 0},
              'model': {'enabled': False, 'min_confidence': 0},
              'special_vehicle_type': {'enabled': False, 'min_confidence': 0}
          },
      ```

      Important: For the attribute analysis to function, the `description` model must be enabled in the `/etc/findface-extraction-api.ini` and `/etc/findface-security/config.py` configuration files (see above).

      Note: Enabling the additional attribute analysis reduces the number of false positives. However, the system might miss out on some real matches as well.

> **Warning:** Do not change the default values of `min_confidence` without consulting with our technical experts (support@ntechlab.com).

4. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

2.7.3 Enable Body and Body Attribute Recognition

FindFace Multi allows you to recognize individual human bodies and body attributes.

The body attributes are the following:

- clothing type:
  - generalized category of upper body wear: long sleeves, short sleeves, no sleeve
  - specific type of upper body wear: jacket, coat, sleeveless vest, sweatshirt, T-shirt, shirt, dress
  - type of lower body wear: pants, skirt, shorts, obscured
  - type of headgear: hat/cap, hood/headscarf, none
- clothing color (top/bottom)

To enable recognition of human bodies and their attributes, do the following:

1. Specify neural network models for body object and body attribute recognition in the `/etc/findface-extraction-api.ini` configuration file. Do the following:

   Important: Be sure to choose the right acceleration type for each model, matching the acceleration type of `findface-extraction-api`: CPU or GPU. Be aware that `findface-extraction-api` on CPU can work only with CPU-models, while `findface-extraction-api` on GPU supports both CPU- and GPU-models.

   1. Open the `/etc/findface-extraction-api.ini` configuration file.

      ```
      sudo vi /etc/findface-extraction-api.ini
      ```

   2. Specify the body detector model in the `detectors -> models` section by pasting the following code:

GPU

```
detectors:

  ...
  models:
    ...
    glenn:
      aliases:
      - body
      - silhouette
      model: pedet/glenn_005.gpu.fnk
      options:
```

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```
        min_object_size: 32
        resolutions: [256x256, 384x384, 512x512, 768x768, 1024x1024, 1536x1536,␣
↪2048x2048]

  ...
```

CPU

```
detectors:

  ...
  models:
    ...
    glenn:
      aliases:
      - body
      - silhouette
      model: pedet/glenn_005.cpu.fnk
      options:
        min_object_size: 32
        resolutions: [256x256, 384x384, 512x512, 768x768, 1024x1024, 1536x1536,␣
↪2048x2048]

  ...
```

3. Specify the extraction models in the `extractors -> models` section, subject to the extractors you want to enable:

GPU

```
extractors:
   ...
   models:
    body_clothes: pedattr/pedattr.clothes_type.v0.gpu.fnk
    body_color: pedattr/pedattr.color.v1.gpu.fnk
    body_emben: pedrec/andariel.gpu.fnk
    body_quality: pedattr/pedattr.quality.v0.gpu.fnk
```

CPU

```
extractors:
   ...
   models:
    body_clothes: pedattr/pedattr.clothes_type.v0.cpu.fnk
    body_color: pedattr/pedattr.color.v1.cpu.fnk
    body_emben: pedrec/andariel.cpu.fnk
    body_quality: pedattr/pedattr.quality.v0.cpu.fnk
```

The following extractors are available:

Recognition type	Configure as follows
clothing type	`body_clothes: pedattr/pedattr.clothes_type.v0.gpu.fnk`
	`body_clothes: pedattr/pedattr.clothes_type.v0.cpu.fnk`
clothing color	`body_color: pedattr/pedattr.color.v1.gpu.fnk`
	`body_color: pedattr/pedattr.color.v1.cpu.fnk`
individual body object	`body_emben: pedrec/andariel.gpu.fnk`
	`body_emben: pedrec/andariel.cpu.fnk`
body quality	`body_quality: pedattr/pedattr.quality.v0.gpu.fnk`
	`body_quality: pedattr/pedattr.quality.v0.cpu.fnk`

Tip: To leave a model disabled, pass the empty value `''` to the relevant parameter. Do not remove the parameter itself. Otherwise, the system will be searching for the default model.

```
extractors:
   ...
   models:
    body_clothes: ''
    body_color: ''
    body_emben: ''
    body_quality: ''
```

4. Make sure that the `normalizers` section contains a model for the `cropbbox` normalizer, as shown in the example below. This normalizer is required for the extractors specified in the previous step.

GPU

```
normalizers:
  ...

  models:
    ...
    cropbbox:
      model: facenorm/cropbbox.v2.gpu.fnk
```

CPU

```
normalizers:
  ...

  models:
    ...
    cropbbox:
      model: facenorm/cropbbox.v2.cpu.fnk
```

5. Make sure that the `objects -> body` section contains the `quality_attribute: body_quality`:

GPU

```
objects:
  ...
  body:
    base_normalizer: facenorm/cropbbox.v2.gpu.fnk
    quality_attribute: body_quality
  ...
```

CPU

```
objects:
  ...
  body:
    base_normalizer: facenorm/cropbbox.v2.cpu.fnk
    quality_attribute: body_quality
```

6. Restart `findface-extraction-api`.

```
sudo systemctl restart findface-extraction-api
```

2. Modify the `/etc/findface-video-worker-gpu.ini` (`/etc/findface-video-worker-cpu.ini`) configuration file. In the body section, specify the neural network models by analogy with the example below. Restart `findface-video-worker-gpu` (`findface-video-worker-cpu`).

GPU

```
sudo vi /etc/findface-video-worker-gpu.ini

#------------------------------
[body]
#------------------------------
## detector param
## type:number env:CFG_BODY_MIN_SIZE longopt:--body-min-size
min_size = 60

## path to body detector
## type:string env:CFG_BODY_DETECTOR longopt:--body-detector
detector = /usr/share/findface-data/models/pedet/glenny_005_fast.gpu.fnk

## path to normalizer (usually crop2x)
## type:string env:CFG_BODY_NORM longopt:--body-norm
norm = /usr/share/findface-data/models/facenorm/cropbbox.v2.gpu.fnk

## path to body quality extractor
## type:string env:CFG_BODY_QUALITY longopt:--body-quality
quality = /usr/share/findface-data/models/pedattr/pedattr.quality.v0.gpu.fnk

## path to body quality normalizer
## type:string env:CFG_BODY_NORM_QUALITY longopt:--body-norm-quality
norm_quality = /usr/share/findface-data/models/facenorm/cropbbox.v2.gpu.fnk
```

```
sudo systemctl restart findface-video-worker-gpu.service
```

CPU

```
sudo vi /etc/findface-video-worker-cpu.ini

#------------------------------
[body]
#------------------------------
## detector param
## type:number env:CFG_BODY_MIN_SIZE longopt:--body-min-size
min_size = 60

## path to body detector
## type:string env:CFG_BODY_DETECTOR longopt:--body-detector
detector = /usr/share/findface-data/models/pedet/glenny_005_fast.cpu.fnk

## path to normalizer (usually crop2x)
## type:string env:CFG_BODY_NORM longopt:--body-norm
norm = /usr/share/findface-data/models/facenorm/cropbbox.v2.cpu.fnk

## path to body quality extractor
## type:string env:CFG_BODY_QUALITY longopt:--body-quality
quality = /usr/share/findface-data/models/pedattr/pedattr.quality.v0.cpu.fnk

## path to body quality normalizer
## type:string env:CFG_BODY_NORM_QUALITY longopt:--body-norm-quality
norm_quality = /usr/share/findface-data/models/facenorm/cropbbox.v2.cpu.fnk

## path to body track features extractor
## type:string env:CFG_BODY_TRACK_FEATURES longopt:--body-track-features
track_features =

## path to body track features normalizer
## type:string env:CFG_BODY_TRACK_FEATURES_NORM longopt:--body-track-features-norm
track_features_norm =
```

```
sudo systemctl restart findface-video-worker-cpu.service
```

3. Open the `/etc/findface-video-manager.conf` configuration file and make sure it contains the body section in `detectors` that looks similar to the example below.

Tip: As a reference value for the `filter_min_quality` parameter, you can take the `MINIMUM_BODY_QUALITY` parameter value from the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-video-manager.conf

detectors:
  ...
  body:
```

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```
    filter_min_quality: 0.65
    filter_min_size: 1
    filter_max_size: 8192
    roi: ""
    fullframe_crop_rot: false
    fullframe_use_png: false
    jpeg_quality: 95
    overall_only: false
    realtime_post_first_immediately: false
    realtime_post_interval: 1
    realtime_post_every_interval: false
    track_interpolate_bboxes: true
    track_miss_interval: 1
    track_overlap_threshold: 0.25
    track_max_duration_frames: 0
    track_send_history: false
    post_best_track_frame: true
    post_best_track_normalize: true
    post_first_track_frame: false
    post_last_track_frame: false
    tracker_type: simple_iou
    track_deep_sort_matching_threshold: 0.65
    track_deep_sort_filter_unconfirmed_tracks: true
```

4. Enable the recognition of bodies and body attributes in the `/etc/findface-security/config.py` configuration file. Do the following:

   1. In the `FFSECURITY` section, set `'ENABLE_BODIES': True`.

   ```
   sudo vi /etc/findface-security/config.py

   FFSECURITY = {
       ...

       # optional objects to detect
       'ENABLE_BODIES': True,
       ...
   ```

   2. In the same section, specify the body attributes that you want to display for the body recognition events.

   ```
   # available features are: color, clothes
   'BODY_EVENTS_FEATURES': ['color', 'clothes'],
   ```

   3. Restart the `findface-security` service.

   ```
   sudo systemctl restart findface-security.service
   ```

2.7.4 Real-time Face Liveness Detection

Note: The *liveness detector* is much slower on CPU than on GPU.

To spot fake faces and prevent photo attacks, use the integrated 2D anti-spoofing system that distinguishes a live face from a face image. Due to the analysis of not one, but a number of frames, the algorithm captures any changes in a facial expression and skin texture. This ensures that it is a live person in front of a camera and eliminates the possibility of fraud using images on paper or mobile device screens.

The liveness detector estimates a face liveness with a certain level of confidence and returns the confidence score along with a binary result `real/fake`, depending on the pre-defined liveness threshold.

In this section:

Enable Face Liveness Detector

To enable the face liveness detector, do the following:

1. Open the `/etc/findface-video-worker-gpu.ini` (`/etc/findface-video-worker-cpu.ini`) configuration file. In the `liveness` section, specify the path to the neural network model (`fnk`) used in the face liveness detector.

```
sudo vi /etc/findface-video-worker-gpu.ini

#------------------------------
[liveness]
#------------------------------
## path to liveness fnk
## type:string env:CFG_LIVENESS_FNK longopt:--liveness-fnk
fnk = /usr/share/findface-data/models/faceattr/liveness.pacs.v0.gpu.fnk
```

```
sudo vi /etc/findface-video-worker-cpu.ini

#------------------------------
[liveness]
#------------------------------
## path to liveness fnk
## type:string env:CFG_LIVENESS_FNK longopt:--liveness-fnk
fnk = /usr/share/findface-data/models/faceattr/liveness.pacs.v0.cpu.fnk
```

2. Restart `findface-video-worker`.

```
sudo systemctl restart findface-video-worker-gpu
sudo systemctl restart findface-video-worker-cpu
```

Configure Liveness Threshold

If necessary, you can adjust the liveness `threshold` in the `/etc/findface-security/config.py` configuration file. The liveness detector will estimate a face liveness with a certain level of confidence. Depending on the threshold value, it will return a binary result `real` or `fake`.

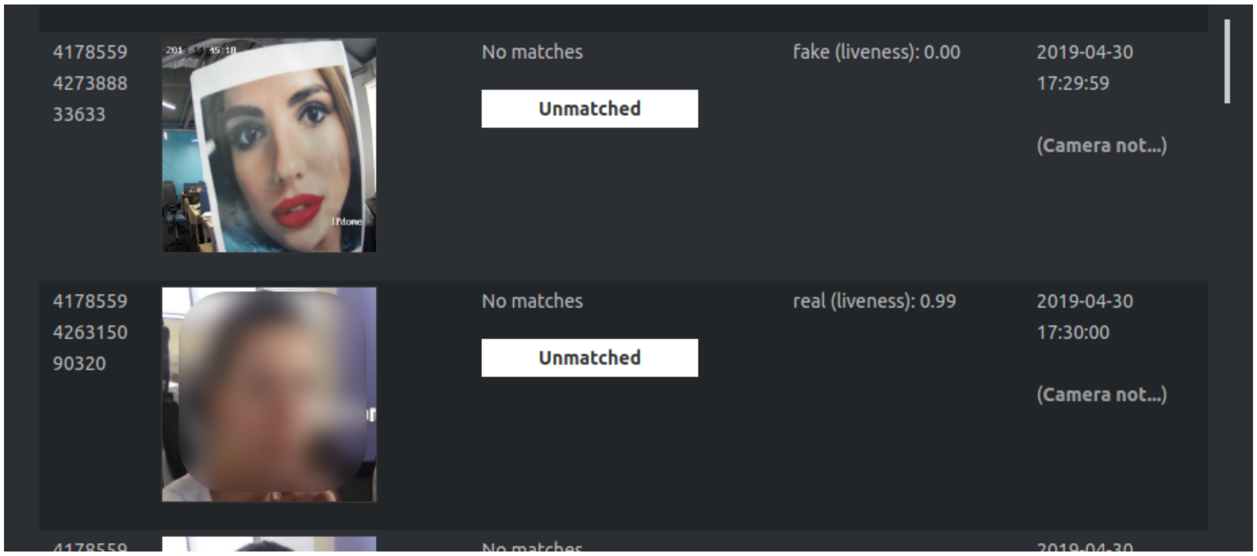
Note: The default value is optimal. Before changing the threshold, we recommend you to seek advice from our experts by support@ntechlab.com.

```
sudo vi /etc/findface-security/config.py

'LIVENESS_THRESHOLD': 0.85,
```

Face Liveness in Web Interface

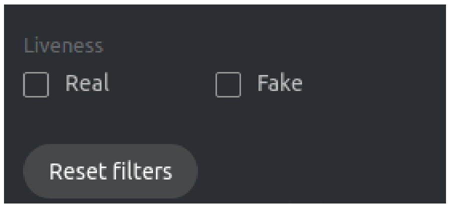
Once the face liveness detector configured, you will see liveness estimation for each event.


4178559
4273888
33633
No matches
Unmatched
fake (liveness): 0.00
2019-04-30
17:29:59
(Camera not...)

4178559
4263150
90320
No matches
Unmatched
real (liveness): 0.99
2019-04-30
17:30:00
(Camera not...)

Note: The liveness score is `null` when the liveness detector is unable to estimate the face liveness in the provided image.

Use the *Liveness* filter to display only real or only fake faces in the event list.



See also:

Liveness Detection as Standalone Service

2.7.5 Liveness Detection as Standalone Service

See also:

Real-time Face Liveness Detection

Besides the *integrated* anti-spoofing system that distinguishes a live face from a face image, FindFace Multi provides an API-based face liveness detection service `findface-liveness-api`.

The `findface-liveness-api` service takes a specific number of frames from a provided video fragment and returns the best quality face, along with a decimal liveness result for it, averaged across the taken frames. If configured, the service can also return full-frame and normalized face images and save the detection result in the `findface-sf-api` cache, returning `detection_id`.

The `findface-liveness-api` service is automatically installed and activated, as FindFace Multi requires it for face-based *authentication*.

You can install and use the `findface-liveness-api` service standalone, apart from FindFace Multi. This is what this section is about.

In this section:

Install and Configure `findface-liveness-api`

To install the service standalone, install the FindFace Multi *APT repository* and execute the following commands:

```
sudo apt update
sudo apt install findface-liveness-api
```

You can configure the `findface-liveness-api` parameters in the `/etc/findface-liveness-api.ini` configuration file:

```
sudo vi /etc/findface-liveness-api.ini

listen: :18301
liveness-threshold: 0.95
fullframe-jpeg-quality: 75
max-decoded-frames: 30
min-selected-frames: 10
mf-selector: reject
extraction-api:
  request-batch-size: 16
  timeouts:
    connect: 5s
    response_header: 30s
    overall: 35s
    idle_connection: 10s
  extraction-api: http://127.0.0.1:18666
sf-api:
```

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```
  timeouts:
    connect: 5s
    response_header: 30s
     overall: 35s
    idle_connection: 10s
  sf-api: http://127.0.0.1:18411
limits:
  video-size: 10485760
  video-length-sec: 60
  video-fps: 30
  video-width-px: 1920
  video-height-px: 1080
```

Parameter	Description
`fullframe-jpeg-quality`	JPEG quality of full frames in the `photo` field.
`max-decoded-frames`	Finish decoding after reaching the specified number of frames.
`min-selected-frames`	The minimum number of final frames successfully passed through decoding and liveness extraction. Must be equal or less than `max-decoded-frames`.
`mf-selector`	Service behavior upon having multiple faces in the video frame: `reject` - reject this frame, `biggest` - use the biggest face for liveness detection.
`extraction-api` -> `request-batch-size`	Batch size for liveness extraction.
`limits` -> `video-size`	Maximum video size, bytes.
`limits` -> `video-length-sec`	Maximum video length, seconds.
`limits` -> `video-fps`	Maximum video FPS.
`limits` -> `video-width-px`	Maximum video width, pixels.
`limits` -> `video-height-px`	Maximum video height, pixels.

To start the `findface-liveness-api` service and enable its autostart, execute:

```
sudo systemctl start findface-liveness-api.service && sudo systemctl enable findface-
↪liveness-api.service
```

HTTP API Requests to `findface-liveness-api`

To interact with the `findface-liveness-api` service, use HTTP API requests. In the example below, the POST request is sent with the following optional parameters:

- `return_detection` (`default=False`): save the best face in the `findface-sf-api` cache and return its `detection_id`.
- `return_normalized` (`default=False`): return the face normalized image in the `normalized` field.
- `return_photo` (`default=False`): return the full frame in the `photo` field.

Example

Request

```
curl -i -X POST \
  'http://127.0.0.1:18301/v1/video-liveness?return_detection=true&return_normalized=true&
↪return_photo=true' \
  -H 'Content-Type: video/mp4' \
  --data-binary '@/home/my_video.mp4'
```

Response

```
HTTP/1.1 100 Continue
HTTP/1.1 200 OK
Content-Type: application/json
X-Request-Id: LA:WSP2NcHc
Date: Mon, 07 Sep 2020 15:30:05 GMT
Transfer-Encoding: chunked
{
        "alive": true,
        "average_liveness": 0.9706386,
        "best_face": {
                "liveness": 0.97768883,
                "quality": 0.89638597,
                "bbox": {
                        "left": 0,
                        "top": 578,
                        "right": 307,
                        "bottom": 1154
                },
                "detection_id": "btb53vbp688s1njt3bv0",
                "photo": "/9j/2wCEAAgGBgcGBQgHBwcJ...",
                "normalized": "iVBORw0KGgoAAAANSUhEU...",
                "frame_no": 1,
                "frame_ts": 0.033275817
        }
}
```

See also:

Deactivate findface-liveness-api installed with FindFace Multi

2.7.6 Allocate `findface-video-worker` to Camera Group

In a distributed architecture, it is often necessary that video streams from a group of cameras be processed *in situ*, without being redistributed across remote `findface-video-worker` instances by the principal server.

Note: Among typical use cases are hotel chains, chain stores, several security checkpoints in the same building, etc.

In this case, allocate the local `findface-video-worker` to the camera group.

Do the following:

1. Navigate to the *Preferences* tab. Click *Camera Groups*.
2. Open the camera group settings.
3. In the *Labels*, create or select one or several allocation labels. Save changes.
4. Open the `/etc/findface-video-worker-cpu.ini` (`/etc/findface-video-worker-gpu.ini`) configuration file and specify the allocation labels in the following format: `label_name=true` (label `terminal_1` in the example below).

   ```
   sudo vi /etc/findface-video-worker-cpu.ini
   sudo vi /etc/findface-video-worker-gpu.ini

   labels = terminal_1=true
   ```

5. Restart `findface-video-worker`.

   ```
   sudo systemctl restart findface-video-worker-cpu.service
   sudo systemctl restart findface-video-worker-gpu.service
   ```

Note: If a camera is assigned an allocation label, its video stream can be processed by a `findface-video-worker` instance with the same label, as well as by all unlabeled `findface-video-worker` instances.

Warning: If a labeled camera is processed by an unlabeled `findface-video-worker` instance and a free similar-labeled instance appears, the camera won't automatically switch to the latter. To switch the camera, restart the similar-labeled `findface-video-worker` instance.

2.7.7 Card Custom Tabs, Fields, and Filters

See also:

To create custom fields in the feature vector database, refer to *Custom Metadata in Tarantool*.

To add custom tabs and fields to the person and car cards, do the following:

1. Prepare the list of custom tabs and fields you want to add to your cards.
2. Open the `/etc/findface-security/config.py` configuration file.

   ```
   sudo vi /etc/findface-security/config.py
   ```

3. Customize the person cards. To do so, uncomment the `FFSECURITY` -> `CUSTOM_FIELDS` -> `human_card` section and modify the exemplary content, considering the following:
   - `'items'`: the list of fields in a card. Describe each field with the following parameters:
     - `'name'`: field's internal name, string.
     - `'default'`: field's default value. If a default value exceeds '1e14 – 1', use a string data type to specify it, for example, `"123123.."` instead of `123123..`.
     - `'label'`: field's label in a card, string.
     - `'tab'`: tab that features the field. If not specified, the field appears on the main card page (that with a photograph).

  - `'display'`: display format (`form` or `list`), string or array.
  - `'description'`: field's description, string.
  - `'editable'`: field's editability, boolean.
  - `'type'`: field data type, string. Possible values:
    * `list`: requires `items`, additional parameter for lists (see below), expects objects {id, name} in dictionaries;
    * `valuelist`: expects elements of primitive types.
    * `objectlist`: allows for creating arrays of objects of required types.
    * `datetime`: primitive data type displayed as a datetime list.
    * `date`: primitive data type displayed as a date picker.
    * `boolean`: primitive data type displayed as a checkbox.
    * `string`: primitive data type `string`.
  - additional parameters for lists (type=list, type=valuelist):
    * `multiple`: possibility of selecting several items in the list, boolean.
    * `items`: dictionary used as a data source for the list.
    * `allow_create`: possibility of adding new items to the list.
    * `custom_id`: custom field for id (type=list).
  - additional parameters for object lists (type=objectlist).
    * `object`: objects used as a data source for the object list.
    * `simple`: indicator that the field expects data of a primitive type instead of objects, for example, expects strings with phone numbers.
- `'filters'`: the list of search filters associated with the custom fields. Parameters:
  - `'name'`: filter's internal name,
  - `'label'`: filter's label in the web interface,
  - `'field'`: associated field in the format `[field name]`.
- `'tabs'`: the list of tabs in a card. The first listed tab corresponds to the main card page.

```
FFSECURITY = {

...

# -- Custom model fields --
# Edit CUSTOM_FIELDS -> `human_card` section to customize human card fields.
# Edit CUSTOM_FIELDS -> `car_card` section to customize car card fields.
...
  'CUSTOM_FIELDS': {
      'human_card': {
          'items': [
              {
                  'name': 'personid',
                  'default': '',
                  'label': 'PersonID',
```

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```
                    'display': ['list', 'form'],
                    'description': 'Sigur person ID',
                    'editable': False
                },
                {
                    'name': 'firstname',
                    'default': '',
                    'label': 'First Name',
                    'display': ['list', 'form'],
                    'description': 'Sigur first name',
                    'editable': False
                },
                {
                    'name': 'lastname',
                    'default': '',
                    'label': 'Last Name',
                    'display': ['list', 'form'],
                    'description': 'Sigur last name',
                    'editable': False
                },
                {
                    'name': 'version',
                    'default': '',
                    'label': 'Version',
                    'display': ['list', 'form'],
                    'description': 'Sigur photo version',
                    'editable': False
                }
            ],
            'filters': [
                {
                    'name': 'personid',
                    'label': 'Sigur person ID filter',
                    'field': 'personid'
                }
            ]
        },
        'car_card': {}, # same fields are available
    },
}
```

4. Customize the car cards. To do so, duplicate the `human_card` section content into the `car_card` section and modify it by analogy.
5. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

You will see the custom content appear in the cards.

2.7.8 Custom Metadata in Tarantool

It is often necessary to assign additional metadata to the objects extracted from images uploaded to the card index and now stored in the feature vector database.

In this section:

Customize Meta Fields of Face Objects

To assign custom meta fields to the face objects, do the following:

1. Prepare the list of custom meta fields to assign.
2. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

3. In the `FFSECURITY` section, uncomment the `CUSTOM_FIELDS` -> `face_object` section and modify the exemplary content, considering the following:

   - `field_name`: field's name;
   - `type`: data type;
   - `default`: field's default value. If a default value exceeds '1e14 – 1', use a string data type to specify it, for example, `"123123.."` instead of `123123...`

```
FFSECURITY = {

...

    # -- Custom model fields --
    ...
    # Edit CUSTOM_FIELDS -> `face_object` section to customize face object fields.
    ...
    # 'CUSTOM_FIELDS': {
          ...
          'face_object': {
              'items': [
                  {
                      "field_name": "tag_name_1",
                      "type": "string",
                      "default": "change_me"
                  },
                  {
                      "field_name": "tag_name_2",
                      "type": "uint",
                      "default": 123
                  },
```

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```
                    {
                        "field_name": "tag_name_3",
                        "type": "bool",
                        "default": True
                    },
                ]
            }
        },
}
```

4. *Add the new meta fields* to the feature vector database structure.
5. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

You can work with the new meta fields through *HTTP API* using the `objects/faces/` methods.

Customize Meta Fields of Body and Car Objects

Assigning custom meta fields to the body and car objects are similar to the faces. The only difference is that you will need to manually create the `CUSTOM_FIELDS -> body_object` and `CUSTOM_FIELDS -> car_object` sections. It is a good idea to duplicate the `CUSTOM_FIELDS -> face_object` section and use it as a starting point for further modifications.

```
FFSECURITY = {

...

    # -- Custom model fields --
    ...
    # Edit CUSTOM_FIELDS -> `face_object` section to customize face object fields.
    ...
    # 'CUSTOM_FIELDS': {
          ...
          'body_object': {
              'items': [
                  {
                      "field_name": "tag_name_1",
                      "type": "string",
                      "default": "change_me"
                  },
                  {
                      "field_name": "tag_name_2",
                      "type": "uint",
                      "default": 123
                  },
                  {
                      "field_name": "tag_name_3",
                      "type": "bool",
                      "default": True
                  },
```

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```
            ]
        }
        'car_object': {
            'items': [
                {
                    "field_name": "tag_name_1",
                    "type": "string",
                    "default": "change_me"
                },
                {
                    "field_name": "tag_name_2",
                    "type": "uint",
                    "default": 123
                },
                {
                    "field_name": "tag_name_3",
                    "type": "bool",
                    "default": True
                },
            ]
        }
    },
}
```

Similarly, you can work with the new meta fields using the `objects/bodies/` and `objects/cars/` methods of *HTTP API*.

See also:

To create custom tabs, fields, and filters in cards, refer to *Card Custom Tabs, Fields, and Filters*.

2.7.9 Console Bulk Photo Upload

In addition to the *web interface upload*, you can bulk-upload photos to the card index via the **`findface-security-uploader`** console utility. We recommend preferring this utility over the web interface if the number of uploaded photos is more than 10,000.

Warning: In the current version, the **`findface-security-uploader`** utility does not support cars and bodies, only faces.

Tip: To view the **`findface-security-uploader`** help, execute:

```
findface-security-uploader --help

Usage: findface-security-uploader [OPTIONS] COMMAND [ARGS]...

Options:
  --job PATH        Job file (default: enroll-job.db)
  --log-level TEXT  Log level
  --fsync BOOLEAN   Call fsync() to prevent data loss on power failure
```

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```
  --help            Show this message and exit.

Commands:
  add    Add items from CSV or TSV file to job
  print  Print contents of job file as JSON
  run    Run upload job
```

```
findface-security-uploader add --help

Usage: findface-security-uploader add [OPTIONS] FILES...

Options:
  --format [csv|tsv]  Input file format - CSV or TSV
  --delimiter TEXT    Field delimiter - by default it's "\t" for TSV and ","
                      for CSV
  --help              Show this message and exit.
```

```
findface-security-uploader print --help

Usage: findface-security-uploader print [OPTIONS]

Print contents of job file as JSON

Options:
 --failed  Show only failed images
 --noface  Show only images without detection
 --help    Show this message and exit.
```

```
findface-security-uploader run --help

Usage: uploader.py run [OPTIONS]

Run upload job

Options:
  --parallel INTEGER       Number of enroll threads (default: 10)
  --api TEXT               API url (default: http://127.0.0.1:80/)  [required]
  --user TEXT              API username  [required]
  --password TEXT          API password  [required]
  --watch-lists TEXT       Comma-separated list of card list ids  [required]
  --inactive               Mark new cards as inactive
  --failed                 Include failed images
  --noface                 Include images without detection
  --all-faces              Enroll all found faces on each image
  --logging-delta INTEGER  Logging period delta
  --help                   Show this message and exit.
```

Do the following:

1. Write the list of photos and metastrings to a CSV or TSV file.

Important: The file used as a metadata source must have the following format: `path to photo | metastring`.

To prepare a TSV file, use either a `script` or the `find` command.

Note: Both the script and the command in the examples below create the `images.tsv` file. Each image in the list will be associated with a metastring coinciding with the image file name in the format `path to photo | metastring`.

To build a TSV file listing photos from a specified directory (`/home/user/25_celeb/` in the example below), run the following command:

```
python3 tsv_builder.py /home/user/25_celeb/
```

The `find` usage example:

```
find photos/ -type f -iname '*g' | while read x; do y="${x%.*}"; printf "%s\t%s\n" "
↪$x" "${y##*/}"; done
```

2. Create a job file out of a CSV or TSV file by using `add`. As a result, a file `enroll-job.db` will be created and saved in a current directory.

```
findface-security-uploader add images.tsv
```

The `add` options:

- `--format`: input file format, `tsv` by default,
- `--delimiter`: field delimiter, by default `"\t"` for TSV, and `","` for CSV.

Note: A job file represents a sqlite database which can be opened on the **sqlite3** console.

3. Process the job file by using `run`.

```
findface-security-uploader run --watch-lists 2 --api http://127.0.0.1:80 --user␣
↪admin --password password
```

The important `run` options:

- `--parallel`: the number of photo upload threads, 10 by default. The more threads you use, the faster the bulk upload is completed, however it requires more resources too.
- `--all-faces`: upload all faces from a photo if it features several faces.
- `--api`: `findface-security` API URL, `http://127.0.0.1:80/` by default. Mandatory option.
- `--user`: login. Mandatory option.
- `--password`: password. Mandatory option.
- `--watch-lists`: comma-separated list of the watch lists id's. Mandatory option.
- `--failed`: should an error occur during the job file processing, correct the mistake and try again with this option.
- `--inactive`: mark new cards as inactive.

    - `--noface`: by default, images classified as having no faces will be assigned the `NOFACE` status and automatically excluded from the upload. To attempt re-detecting faces in such images, re-run the job file with this option. If the re-detection gives a negative result again, an image will be skipped and a relevant record will appear in the upload log.

4. (Optional) Print the job processing results as JSON. If necessary, you can print only failed images/ images without detected faces.

```
findface-security-uploader print --failed
findface-security-uploader print --noface
```

2.7.10 Deduplicate Events

In this section:

Consider enabling deduplication to exclude coinciding object recognition events within one camera group.

Enable Deduplication

To enable event deduplication, do the following:

1. Enable the offline video detection mode for each camera in the group. See *Add Camera* for details.
2. Navigate to the *Preferences* tab. Click *Camera Groups*.
3. Open the camera group settings.
4. Check *Deduplicate Events* and specify the deduplication interval in seconds.

How It Works

The deduplication algorithm works as follows. In the offline mode, the server receives one best object snapshot per tracking session on a camera.

Note: A tracking session continues until an object disappears from the camera field.

If there are several tracking sessions on a camera(s) of a camera group within the specified deduplication interval, FindFace Multi handles the received snapshots in the following way:

- If there is a match with a card within the preceding deduplication interval, FindFace Multi drops a newly acquired snapshot. Otherwise, it saves the snapshot to the database.
- For unmatched objects, FindFace Multi considers both the similarity between objects and snapshot quality when performing deduplication. As a result, FindFace Multi drops all snapshots within the deduplication interval unless a new object snapshot is of higher quality. Thus, it guarantees the system deduplicates events without skipping high-quality objects, which are essential for further video analytics.

2.7.11 Enable Personal Data Protection

FindFace Multi supports laws related to the processing of personal data of individuals (GDPR and similar).

To apply personal data protection to your system, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Disable saving unmatched events by setting `'IGNORE_UNMATCHED': True`.

```
...

FFSECURITY = {
    ...

    # do not save unmatched events (GDPR support)
    'IGNORE_UNMATCHED': False,

    ...

}
```

3. For events with matches, enable blurring all unmatched objects in full frames. To do so, set `'BLUR_UNMATCHED_OBJECTS': True`. Optionally, you can modify the default JPEG quality of those frames.

```
...

FFSECURITY = {
    ...
    # blur all unmatched objects on the full frame of the matched event (GDPR␣
↪support)
    'BLUR_UNMATCHED_OBJECTS': False,

    # full frame jpeg quality when `BLUR_UNMATCHED_OBJECTS` is enabled
    'BLURRED_FULLFRAME_JPEG_QUALITY': 85,
    ...

}
```

4. Enable blurring all unmatched objects on the *Video Wall*. To do so, set `"gdpr": True` in the `FFSECURITY_UI_CONFIG` -> `available_video_wall_features` section.

```
FFSECURITY_UI_CONFIG = {
    ...
    "available_video_wall_features": {
        ...
        "gdpr": True
    }
}
```

5. Restart `findface-security`.

```
sudo systemctl restart findface-security.service
```

See also:

Video Wall

2.7.12 Configure Video Recorder

The FindFace Core internal *architecture* allows for embedding Video Recorder, an additional functionality that records, stores, and plays back video data from cameras.

This section is about the Video Recorder configuration.

Note: If you haven't deployed it yet, do so by using the FindFace Multi *console installer* or *step-by-step instructions*.

In this section:

Enable Video Recorder

To enable Video Recorder, do the following:

1. Enable the `findface-video-worker` service to transfer video chunks to the `findface-video-storage` service.

   Important: This setting makes the Video Recorder functionality available over *HTTP API*. It's also obligatory if you want to harness Video Recorder as part of the FindFace Multi *web interface*.

   Do the following:

   1. Open the `/etc/findface-video-worker-cpu.ini` (`/etc/findface-video-worker-gpu.ini`) configuration file for each `findface-video-worker` instance that will supply Video Recorder with video.

      ```
      sudo vi /etc/findface-video-worker-cpu.ini
      sudo vi /etc/findface-video-worker-gpu.ini
      ```

   2. Set `enabled = true` in the `recorder` section.

      ```
      #------------------------------
      [recorder]
      #------------------------------
      ## video recording enabled
      ## type:bool env:CFG_RECORDER_ENABLED longopt:--recorder-enabled
      enabled = true
      ```

   3. Restart each `findface-video-worker` instance involved.

```
sudo systemctl restart findface-video-worker*
```

2. Configure Video Recorder to work as part of the FindFace Multi web interface.

Note: Omit the following steps if you do not need the Video Recorder tools to appear in the FindFace Multi web interface.

Do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Find the `FFSECURITY_UI_CONFIG` -> `vms` section.

The list of parameters to configure is the following:

Parameter	Description
`"enabled"`	Set `True` to add the *Enable recording* checkbox to *camera settings*.
`"video_player"`	Set `True` to enable the video player to open in *event notifications* and *camera preview* (instead of static frames). This setting requires `"enabled": True`.
`"timeline" -> "min_zoom"`	Defines the largest possible scale on the *video player timeline*, seconds per pixel.
`"timeline" -> "max_zoom"`	Defines the smallest possible scale on the timeline, seconds per pixel.
`"timeline" -> "objects" -> "faces" -> "enabled"`	Set `True` to enable marking face events on the timeline.
`"timeline" -> "objects" -> "faces" -> "limit"`	The maximum number of face events simultaneously marked on the timeline. If there is more face events than that, you will be asked to zoom in.
`"timeline" -> "objects" -> "cars" -> "enabled"`	Set `True` to enable marking car events on the timeline.
`"timeline" -> "objects" -> "cars" -> "limit"`	The maximum number of car events simultaneously marked on the timeline. If there is more car events than that, you will be asked to zoom in.

```
FFSECURITY_UI_CONFIG = {
    "vms": {
        "enabled": True,
        "video_player": True,
        "timeline": {
            "min_zoom": 0.2,
            "max_zoom": 200,
            "objects": {
                "events": {
                    "faces": {
                        "enabled": True,
                        "limit": 500,
                    },
```

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```
                    "cars": {
                        "enabled": False,
                        "limit": 500,
                    },
                },
            },
        },
    },
}
```

3. Set the maximum storage time for the recorded video chunks in the `VMS_VIDEOS_MAX_AGE` parameter. Video chunks older than the given number of days will be automatically deleted.

   Tip: To roughly estimate the required storage time, consider that a `1920×1080` camera produces around 60 GB of video per day. We recommend that you measure the exact video volume from your cameras and calculate the required storage time, based on the video volume and the available disk space.

   Tip: If you are going to keep the video chunks for a long time, be sure to monitor the remaining free space using Zabbix, Prometheus, or a similar software. It will prevent the video from occupying the entire space and thus having blocked up the server operation.

   ```
   # VMS video chunks will be deleted older than VMS_VIDEOS_MAX_AGE
   'VMS_VIDEOS_MAX_AGE': 7,
   ```

4. Restart the `findface-security` service.

   ```
   sudo systemctl restart findface-security.service
   ```

Nuances of Disabling Video Recorder

If Video Recorder is running and recording video on selected cameras, and you need to disable it, be sure to disable video recording on the cameras first, before proceeding with the `/etc/findface-security/config.py` and `/etc/findface-video-worker-*.ini` configuration files.

Remove Video Manually

You can manually remove video chunks older than the given number of days by executing the command below. To set the number of days, use the `--vms-videos-max-age` argument.

```
sudo findface-security cleanup_vms --vms-videos-max-age=30
```

See also:

- *Deploy Video Recorder Step-by-Step*
- *Enable Video Recording from Camera*
- *Video Player in Event Notification*
- *Back Up and Recover FindFace Multi and Its Data*

- *Video Recorder Database Backup and Recovery (MongoDB)*

2.8 Maintenance and Troubleshooting

2.8.1 Update to FindFace Multi 1.2

Tip: If you use our product FindFace Security deployed on Ubuntu 18.04, upgrade it to FindFace Multi 1.0 and then update it to FindFace Multi 1.2.

To update FindFace Multi from earlier versions to 1.2, do the following:

1. Open the `/etc/findface-security/config.py` (`/etc/ffsecurity/config.py`) configuration file. Save the values of the following parameters for later use: `EXTERNAL_ADDRESS`, `SECRET_KEY`, `VIDEO_DETECTOR_TOKEN`, `ROUTER_URL`.

```
sudo vi /etc/findface-security/config.py

EXTERNAL_ADDRESS = "http://172.20.77.58"

...
# use pwgen -sncy 50 1|tr "'" "." to generate your own unique key
SECRET_KEY = 'c8b533847bbf7142102de1349d33a1f6'

FFSECURITY = {
    'VIDEO_DETECTOR_TOKEN': '381b0f4a20495227d04185ab02f5085f',
    ...
    'ROUTER_URL': 'http://172.20.77.58',
    ...
}
```

2. In FindFace Multi 1.2, we significantly refined the internal structure of the `report` entity. However, it misses backward compatibility with the product earlier versions. Before the update, be sure to *download* all the reports that you need from the *Reports* tab. They can later be used as the samples to recreate the previously existing reports in the updated system.

3. Stop the `findface-security` service.

```
sudo systemctl stop findface-security*.service
```

4. Create a backup of the Tarantool-based feature vector database in any directory of your choice, for example, `/etc/findface_dump`.

   Tip: See *Back Up and Recover FindFace Multi and Its Data* for details.

```
sudo mkdir -p /etc/findface_dump
cd /etc/findface_dump
sudo findface-storage-api-dump -config /etc/findface-sf-api.ini
```

5. Install the apt repository with FindFace Multi, using the console installer as described in *this section*.

Tip: On the stage of installing neural network models (`APT repository doesn't include recognition models. Do you want to install them now?`), use one of the following options:

- Choose `No`
- Choose `Yes` and leave all the neural network models selected. Enter `Done`

Take a look at the step #9 comments to decide which option suits you best.

6. Install NATS, enable its autostart, and launch the service.

Important: Omit this step if updating from FindFace Multi 1.1.

```
sudo apt install -y nats-server
sudo systemctl enable nats-server
sudo systemctl restart nats-server
```

7. Install the FindFace Multi services from the repository, following your architecture outline.

CPU-version:

```
sudo apt update
sudo apt install findface-security findface-security-ui findface-extraction-api␣
↪findface-ntls findface-sf-api findface-tarantool-server findface-upload findface-
↪video-manager findface-video-worker-cpu findface-counter findface-liveness-api
```

GPU-version:

```
sudo apt update
sudo apt install findface-security findface-security-ui findface-extraction-api-gpu␣
↪findface-ntls findface-sf-api findface-tarantool-server findface-upload findface-
↪video-manager findface-video-worker-gpu findface-counter findface-liveness-api
```

Important: FindFace Multi on GPU requires the prior installation of *NVIDIA drivers*.

Important: At some moment, you will be prompted to choose which version of the `findface-security` configuration file to keep. Opt for `Install the packages maintainer's version`. Do the same if such a message appears for another component (`findface-extraction-api`, `findface-video-worker`, etc.). Always prefer a newer version of a configuration file.

8. Open the `/etc/findface-security/config.py` configuration file and paste the saved `EXTERNAL_ADDRESS`, `SECRET_KEY`, `VIDEO_DETECTOR_TOKEN`, and `ROUTER_URL` into it. Fill in the `DATABASES` section by analogy: `'PORT': 5439, 'USER': 'ntech', 'PASSWORD': '9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3'` (password from `/etc/pgbouncer/userlist.txt`).

```
sudo vi /etc/findface-security/config.py
...
# Database is used by FindFace Security to store cameras,
# camera groups, watchlists and so on. Only PostgreSQL is supported.
DATABASES = {
```

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```
    'default': {
        'ENGINE': 'django.db.backends.postgresql',
        'DISABLE_SERVER_SIDE_CURSORS': True,
        'NAME': 'ffsecurity',
        'PORT': 5439, 'USER': 'ntech', 'PASSWORD': '9T3g1nXy9yx3y8MIGm9fbef3dia8UTc3
↪',
    }
}
...
# Use pwgen -sncy 50 1|tr "'" "." to generate your own unique key
SECRET_KEY = '002231ccb690586f4d33e98322c591bb'
...
SERVICE_EXTERNAL_ADDRESS = 'http://172.20.77.58'
# EXTERNAL_ADDRESS is used to access objects created inside FFSecurity via external␣
↪links.
EXTERNAL_ADDRESS = 'http://172.20.77.58'
...
    # findface-video-worker authorization token
    'VIDEO_DETECTOR_TOKEN': '8977e1b0067d43f6c908d0bf60363255',
...
    # findface-video-worker face posting address,
    # it must be set to either FFSecurity EXTERNAL_ADDRESS (by default)
    # or findface-facerouter url (in some specific cases)
    'ROUTER_URL': 'http://127.0.0.1:80',
```

9. Open the old version of the `findface-ntls` configuration file available at `/etc/findface-ntls.cfg.dpkg-old` and check it against the new version `/etc/findface-ntls.cfg`. Move all the custom parameters from the old version to the new one. Do the same for other components, e.g. for `findface-extraction-api`, check `/etc/findface-extraction-api.ini.ucf-old` against `/etc/findface-extraction-api.ini`, etc.

```
sudo vi /etc/findface-ntls.cfg.dpkg-old
sudo vi /etc/findface-ntls.cfg
sudo vi /etc/findface-extraction-api.ini.ucf-old
sudo vi /etc/findface-extraction-api.ini

...
```

Important: Be aware that the new version of the `findface-extraction-api` configuration file by default contains the `liveness.colombo` model that was absent in the product older versions. This can potentially cause the system to fail. Use one of the following ways to prevent the failure:

- Revert the `face_liveness` parameter to the previous value: `liveness.alleyn.v2.cpu.fnk/liveness.alleyn.v2.gpu.fnk`
- Install `liveness.colombo.cpu.fnk/liveness.colombo.gpu.fnk` on the step #5

10. Open the new version of the `/etc/findface-video-worker-cpu.ini` (`/etc/findface-video-worker-gpu.ini`) configuration file. In the `streamer` section, set `tracks = true` and `tracks_last = true` to ensure bboxes on the Video Wall are appropriately displayed.

```
sudo vi /etc/findface-video-worker-cpu.ini
sudo vi /etc/findface-video-worker-gpu.ini

[streamer]
#------------------------------
...

## use tracks instead detects for streamer
## type:bool env:CFG_STREAMER_TRACKS longopt:--streamer-tracks
tracks = true

## use tracks with lastFrameId=currentFrameId (.tracks must be true)
## type:bool env:CFG_STREAMER_TRACKS_LAST longopt:--streamer-tracks-last
tracks_last = true
```

11. Restart the services.

```
sudo systemctl restart findface-ntls findface-extraction-api findface-video-worker* ␣
↪findface-video-manager findface-sf-api findface-counter findface-liveness-api
```

12. Modify the Tarantool database structure by applying the `tnt_schema.lua` file from FindFace Multi.

```
sudo findface-security make_tnt_schema | sudo tee /etc/findface-security/tnt_schema.
↪lua
```

13. Stop the `findface-tarantool-server` shards. Purge data from all the directories relevant to active shards.

```
sudo systemctl stop 'tarantool@*'

sudo rm /opt/ntech/var/lib/tarantool/shard-*/{index,snapshots,xlogs}/*
```

14. Navigate to the directory with Tarantool configuration file(s) `/etc/tarantool/instances.available/`. Check whether each configuration file `shard-*.lua` contains the `dofile` command, `meta_indexes` and `meta_scheme` definitions, as in the example below.

```
sudo vi /etc/tarantool/instances.available/shard-*.lua

...
dofile("/etc/findface-security/tnt_schema.lua")
...
FindFace.start("127.0.0.1", 8101, {
    license_ntls_server="127.0.0.1:3133",
    meta_indexes=meta_indexes,
    meta_scheme = meta_scheme
})
```

15. Restart the `findface-tarantool-server` shards.

```
TNT=$(ls /etc/tarantool/instances.enabled/ | cut -c 7,8,9)
for i in $TNT; do sudo systemctl restart tarantool@shard-$i.service ; done
```

16. Restore the Tarantool database from the backup.

```
cd /etc/findface_dump

for x in *.json; do sudo findface-storage-api-restore -config /etc/findface-sf-api.
↪ini < "$x"; done
```

17. Migrate the main database architecture from FindFace Multi to **PostgreSQL**, re-create *predefined* user roles and the first administrator.

```
sudo findface-security migrate
sudo findface-security create_groups
sudo findface-security create_default_user
```

18. Restart the `findface-security` and `nginx` services.

```
sudo systemctl restart findface-security.service nginx.service
```

19. Recreate the previously existing reports.

Important: The following tabs got evolved and renamed in FindFace Multi 1.2:

- *Dossiers* got evolved into *Cards*
- *Episodes* became *Episodes -> Humans*
- *Persons* got evolved into *Clusters*

Important: We highly recommend disabling the Ubuntu automatic update to preserve the FindFace Multi compatibility with the installation environment. In this case, you will be able to update your OS manually, fully controlling which packages to update.

To disable the Ubuntu automatic update, execute the following commands:

```
sudo apt-get remove unattended-upgrades
sudo systemctl stop apt-daily.timer
sudo systemctl disable apt-daily.timer
sudo systemctl disable apt-daily.service
sudo systemctl daemon-reload
```

Note: You can additionally deploy Video Recorder. See *Deploy Video Recorder Step-by-Step*.

2.8.2 Back Up and Recover FindFace Multi and Its Data

This section is all about the backup and recovery of the FindFace Multi data storages and your system as a whole.

In this section:

List of Data Storages

FindFace Multi uses the following data storages:

- Tarantool-based feature vector database that stores object feature vectors and events.
- PostgreSQL-based main system database `ffsecurity` that stores internal system data, cards, user accounts, and camera settings.
- The `/var/lib/findface-security/uploads` directory that stores uploaded card photos, video files, full frames of events and counters, and object thumbnails.
- The `/var/lib/ffupload/` directory that stores such event artifacts as normalized object images.

  Note: It also stores video chunks if you are using *Video Recorder*.

- (Only with Video Recorder) MongoDB-based database that stores meta-information of the video chunks, including their exact location in the storage, `/var/lib/ffupload/`.

Feature Vector Database Backup and Recovery (Tarantool)

There are the following galleries in the Tarantool-based feature vector database:

- `ffsec_body_events`: feature vectors extracted from bodies detected in the video.
- `ffsec_body_objects`: feature vectors extracted from body images uploaded to the card index.
- `ffsec_body_clusters`: centroids of body clusters.
- `ffsec_car_events`: feature vectors extracted from cars detected in the video.
- `ffsec_car_objects`: feature vectors extracted from car images uploaded to the card index.

- `ffsec_car_clusters`: centroids of car clusters.
- `ffsec_face_events`: feature vectors extracted from faces detected in the video.
- `ffsec_face_objects`: feature vectors extracted from face images uploaded to the card index.
- `ffsec_face_clusters`: centroids of face clusters.
- `ffsec_user_face`: feature vectors extracted from the FindFace Multi users' photos for face-based authentication.

The database backup/recovery functionality allows you to fully restore all the galleries when needed.

To avoid data loss, we recommend you back up a feature vector database at least once a week. Overall, the backups' frequency depends on the number of cards and object recognition events, and available disk space.

Be sure to back up the database before *migrating* your system to another neural network model.

Utilities

To back up and recover the FindFace Multi feature vector database, the following utilities are needed:

1. backup: `findface-storage-api-dump`,
2. recovery: `findface-storage-api-restore`.

These utilities are automatically installed along with `findface-sf-api`.

Back Up Database

To back up the feature vector database, use the `findface-storage-api-dump` utility as follows:

Important: The following services must be active: `findface-tarantool-server`, `findface-sf-api`.

Note: The backup functionality can be applied to a distributed database. In this case, the `findface-storage-api-dump` utility will back up galleries on all the shards specified in `/etc/findface-sf-api.ini`.

1. On the server with `findface-sf-api`, create a directory to store the backup files (`/etc/findface_dump` in the example below).
2. Launch the `findface-storage-api-dump` utility by executing:

   ```
   sudo findface-storage-api-dump -output-dir=/etc/findface_dump -config /etc/findface-
   ↪sf-api.ini
   ```

   The utility will back up at once all the galleries into the files with corresponding names (`ffsec_body_events.json`, `ffsec_face_events`, etc.) and save them into the directory. These files contain all the data needed to restore the entire database.

Recover Database

To recover the feature vector database from the backup, launch the `findface-storage-api-restore` utility for all the files in the backup folder:

```
sudo findface-storage-api-restore -config /etc/findface-sf-api.ini /etc/findface_dump/*.
↪json
```

The recovery process can be interrupted and resumed whenever necessary. To resume the process after the interruption, launch the `findface-storage-api-restore` utility again.

See also:

- *Backup Options*
- *Restore Options*

Main Database Backup and Recovery (PostgreSQL)

To back up the main database `ffsecurity` based on PostgreSQL, execute:

```
sudo -u postgres pg_dump ffsecurity > ffsecurity_postgres_backup.sql
```

To recover the main database, do the following:

1. Stop the `findface-security` service.

   ```
   sudo systemctl stop findface-security.service
   ```

2. Stop the `pgbouncer` service to delete its active sessions with the `ffsecurity` database.

   ```
   sudo systemctl stop pgbouncer.service
   ```

3. Open the PostgreSQL interactive terminal.

   ```
   sudo -u postgres psql
   ```

4. Remove the old `ffsecurity` database.

   ```
   DROP DATABASE ffsecurity;
   ```

5. Create a new `ffsecurity` database. Leave the PostgreSQL interactive terminal.

   ```
   CREATE DATABASE ffsecurity WITH OWNER ntech ENCODING 'UTF-8' LC_COLLATE='C.UTF-8'␣
   ↪LC_CTYPE='C.UTF-8' TEMPLATE template0;
   ```

6. Start the `pgbouncer` service.

   ```
   sudo systemctl start pgbouncer.service
   ```

7. Recover the database content from the backup.

   ```
   sudo -u postgres psql -d ffsecurity -f ffsecurity_postgres_backup.sql
   ```

8. Migrate the database architecture from FindFace Multi to **`PostgreSQL`**, re-create user groups with *predefined* rights and the first user with administrator rights.

```
sudo findface-security migrate
sudo findface-security create_groups
sudo findface-security create_default_user
```

9. Start the `findface-security` service.

```
sudo systemctl start findface-security.service
```

Artifacts Backup and Recovery (`findface-upload`)

The FindFace Multi artifacts, such as photos uploaded to the card index, video files, and such event artifacts as full frames, object thumbnails, and normalized object images, are stored in the following directories:

- `/var/lib/findface-security/uploads`
- `/var/lib/ffupload/`

Note: The `/var/lib/ffupload/` directory also stores video chunks if there is a running instance of Video Recorder in your system.

Note: Both directories are operated by the `findface-upload` component.

To back up the artifacts, execute:

```
sudo tar -cvzf /home/some_directory/var_lib_ffsecurity_uploads.tar.gz /var/lib/findface-
↪security/uploads/
sudo tar -cvzf /home/some_directory/var_lib_ffupload.tar.gz /var/lib/ffupload/
```

To recover the artifacts, execute the following commands from the root directory:

```
cd /
sudo tar -xvf /home/some_directory/var_lib_ffsecurity_uploads.tar.gz
sudo tar -xvf /home/some_directory/var_lib_ffupload.tar.gz
```

Video Recorder Database Backup and Recovery (MongoDB)

MongoDB is a third-party software that implements the Video Recorder database. This database stores meta-information of the video chunks, including their exact location in the storage, `/var/lib/ffupload/`.

To back up MongoDB, execute:

```
sudo mongodump -o=/home/some_directory/mongodb_backup
```

To recover MongoDB, execute:

```
sudo mongorestore /home/some_directory/mongodb_backup
```

Settings Backup and Recovery

The entire set of FindFace Multi configuration files including the Tarantool structural schema is automatically backed up during the instance *removal*. It is saved to the `~/ffmulti_bak_${datetime}/etc/` directory.

When re-installing FindFace Multi, recover the settings after completing the *console installation*, or right after installing services from the *APT repository*.

The entire set of backed up files is the following:

```
ls -R -p
.:
findface-counter.ini.bak         findface-liveness-api.ini.bak  findface-security/      ␣
↪findface-video-manager.conf.bak  findface-video-streamer-cpu.ini.bak  nginx/
findface-extraction-api.ini.bak  findface-ntls.cfg.bak          findface-sf-api.ini.bak ␣
↪findface-video-storage.conf.bak  findface-video-worker-cpu(gpu).ini.bak

./findface-security:
config.py  tnt_schema.lua

./nginx:
sites-enabled/

./nginx/sites-enabled:
ffsecurity-nginx.conf
```

To recover the FindFace Multi settings, do the following:

1. Open the `/etc/findface-security/config.py` configuration file of the fresh FindFace Multi instance. Find the `DATABASES -> default -> PASSWORD` parameter that stores the `ntech` user password from the `findface-security` database of PostgreSQL. Copy/paste it to the `~/ffmulti_bak_${datetime}/etc/findface-security/config.py` backup.

   ```
   sudo vi /etc/findface-security/config.py

   DATABASES = {
      'default':
        'PASSWORD': 'some_pass'
   ```

2. In the `~/ffmulti_bak_${datetime}/etc/` directory, use any method to eliminate the `.bak` extension from the files. For example, you can execute the following command.

   ```
   sudo rename 's/.ini.bak/.ini/' * && sudo rename 's/.conf.bak/.conf/' * && sudo␣
   ↪rename 's/.cfg.bak/.cfg/' *
   ```

   Tip: If the `rename` command is absent in your system, you can install it as follows:

   ```
   sudo apt install rename
   ```

3. Recursively copy the backup files to the `/etc` directory.

   ```
   sudo cp -r * /etc
   ```

4. Modify the database structure by applying the initial `tnt_schema.lua` file.

```
sudo findface-security make_tnt_schema | sudo tee /etc/findface-security/tnt_schema.
↪lua
```

5. Restart the services.

   On CPU:

   ```
   sudo systemctl restart findface-counter findface-liveness-api findface-video-
   ↪manager findface-extraction-api findface-ntls findface-sf-api findface-video-
   ↪worker-cpu findface-security
   ```

   On GPU:

   ```
   sudo systemctl restart findface-counter findface-liveness-api findface-video-
   ↪manager findface-extraction-api findface-ntls findface-sf-api findface-video-
   ↪worker-gpu findface-security
   ```

   Video Recorder services:

   ```
   sudo systemctl restart findface-video-streamer-cpu findface-video-storage
   ```

Back Up and Recover Entire System

If you intend to back up FindFace Multi before uninstalling it, it will be sufficient to follow the step-by-step instructions in the *Remove FindFace Multi Instance* section. The provided `ffmulti_uninstall.sh` script can automatically back up the FindFace Multi configuration files and all data storages to the `~/ffmulti_bak_${datetime}/` directory.

To recover FindFace Multi after uninstalling it, use the following algorithm:

1. *Deploy FindFace Multi*.
2. *Recover the settings from the backed up configuration files*.
3. *Recover Tarantool*.
4. *Recover PostgreSQL*.
5. *Recover the artifacts*.
6. *Recover MongoDB* (if you are using Video Recorder).

2.8.3 Add Custom Language

By default, only English and Russian languages are available in the web interface. Other languages are provided by request (support@ntechlab.com) and added to the system via the `/etc/findface-security/config.py` configuration file.

To add a custom language to the system, do the following:

1. Download the localization file provided by our experts into the `/usr/share/ffsecurity-ui/ui-static/` directory on the FindFace Multi principal server.

2. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

3. Into the `FFSECURITY_UI_CONFIG` section, insert the `languages` section and fill it by analogy with the example below.

```
FFSECURITY_UI_CONFIG = {
...
  "languages": {
    "items": [
      {
        "name": "es",
        "label": "Español",
        "url": "/ui-static/es_i18n_ffsec.po"
      },
    ]
  },
```

4. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

The new language will be automatically applied to the system and from now on be available on the *Preferences -> Appearance* tab. You can at any time switch between it and other available languages.

See also:

Web Interface Language

2.8.4 Multiple Video Cards Usage

Should you have several video cards installed on a physical server, you can create additional `findface-extraction-api-gpu` or `findface-video-worker-gpu` instances and distribute them across the video cards, one instance per card.

In this section:

Distribute `findface-extraction-api-gpu` Instances Across Several Video Cards

To distribute the `findface-extraction-api-gpu` instances across several video cards, do the following:

1. Prepare the initial configuration file of `findface-extraction-api-gpu` for future copying. Open `/etc/findface-extraction-api.ini`. Limit the number of the `findface-extraction-api-gpu` instances down to 1 per video card.

```
sudo vi /etc/findface-extraction-api.ini

...
extractors:
    instances: 1
```

Tip: If necessary, make other adjustments. For example, you can enable other attribute recognition. See *Enable Face Attribute Recognition*, *Enable Car and Car Attribute Recognition*, *Enable Body and Body Attribute Recognition*.

2. Create several copies of the `/etc/findface-extraction-api.ini` configuration file, subject to how many video cards you are going to use for feature vector extraction. Append numbers of the GPU devices that will be running the instances to the new names (GPU devices #0 and #7 in the example below).

   Note: By default, GPU device numeration in a system starts from #0. To list the video cards in use, execute:

   ```
   nvidia-smi
   ```

   ```
   cp findface-extraction-api.ini findface-extraction-api-0.ini
   cp findface-extraction-api.ini findface-extraction-api-7.ini
   ```

3. Open the new configuration files. Specify the relevant GPU device numbers and adjust the listening ports. Be sure to associate each instance to a unique port.

   ```
   sudo vi /etc/findface-extraction-api-0.ini

   listen: 127.0.0.1:18667
   ...

   gpu_device: 0
   ...
   ```

   ```
   sudo vi /etc/findface-extraction-api-7.ini

   listen: 127.0.0.1:18668
   ...

   gpu_device: 7
   ...
   ```

4. For the `findface-extraction-api-gpu` instances to work within one system, bind them via a load balancer, e.g., `nginx`. For simplicity, we recommend enabling `nginx` on the standard `findface-extraction-api` port `18666` (see details below).

   To set up load balancing, do the following:

   1. Create a new configuration file for `nginx`.

      ```
      sudo vi /etc/nginx/sites-available/lb_extractions
      ```

   2. Insert the following entry into the just created file. Be sure to specify the actual listening ports of the `findface-extraction-api-gpu` instances in the `server` directive (`18667`, `18668` in our example).

```
upstream extractions {
    server 127.0.0.1:18667 max_fails=3 fail_timeout=30s;
    server 127.0.0.1:18668 max_fails=3 fail_timeout=30s;
    }

    server {
    listen 18666 default_server;

    server_name _;

    location / {
        client_max_body_size 100m;
        proxy_pass http://extractions;
    }
    }
```

3. Start the load balancer.

```
ln -s /etc/nginx/sites-available/lb_extractions /etc/nginx/sites-enabled/lb_
↪extractions
nginx -t
nginx -s reload
```

5. Stop the initial `findface-extraction-api-gpu` service and disable its starting on boot.

```
systemctl stop findface-extraction-api.service
systemctl disable findface-extraction-api.service
```

6. Create a new service for the `findface-extraction-api-gpu` instances.

```
/etc/systemd/system/findface-extraction-api@.service
```

Insert the following entry:

```
[Unit]
Description=Findface Extraction API service %i instance

[Service]
User=ntech
Restart=always
RestartSec=5
Type=notify
ExecStart=/usr/bin/findface-extraction-api -config="/etc/findface-extraction-api-%i.
↪ini"
TimeoutStartSec=60m

[Install]
WantedBy=multi-user.target
```

7. Start the `findface-extraction-api-gpu` instances. The first start might take up to 10 minutes.

```
systemctl daemon-reload
systemctl enable findface-extraction-api@{0,7}
systemctl start findface-extraction-api@{0,7}
```

Tip: To check the status, use the following command:

```
sudo systemctl list-units 'findface*' -a
```

Allocate `findface-video-worker-gpu` to Additional Video Card

To create an additional `findface-video-worker-gpu` instance and allocate it to a different video card, do the following:

1. Display the status of the `findface-video-worker-gpu` primary service by executing:

   ```
   sudo systemctl status findface-video-worker-gpu.service
   ```

2. Find the full path to the service in the following line:

   ```
   Loaded: loaded (/usr/lib/systemd/system/findface-video-worker-gpu.service); enabled;
   ↪ vendor preset: enabled
   ```

   It is `findface-video-worker-gpu.service` in our example (name may vary). Create a copy of the service under a new name.

   ```
   sudo cp /usr/lib/systemd/system/findface-video-worker-gpu.service /usr/lib/systemd/
   ↪system/findface-video-worker-gpu2.service`
   ```

3. In the same manner, create a copy of the primary service configuration file under a new name.

   ```
   sudo cp /etc/findface-video-worker-gpu.ini /etc/findface-video-worker-gpu2.ini
   ```

4. Open the just created configuration file and actualize the GPU device number to use. Modify the streamer port number by the following formula: `18999 (port number for GPU #0) - GPU device number`, i.e. for the GPU #1, `port = 18998`, for the GPU #2, `port = 18997`, and so on.

   ```
   sudo vi /etc/findface-video-worker-gpu2.ini

   ## cuda device number
   device_number = 1

   ...

   #------------------------------
   [streamer]
   #------------------------------
   ## streamer/shots webserver port, 0=disabled
   ## type:number env:CFG_STREAMER_PORT longopt:--streamer-port
   port = 18999
   ...
   ```

5. Open the new service and specify the just created configuration file.

   ```
   sudo vi /usr/lib/systemd/system/findface-video-worker-gpu2.service

   ```

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```
ExecStart=/usr/bin/findface-video-worker-gpu --config /etc/findface-video-worker-
↪gpu2.ini
```

6. Reload the `systemd` daemon to apply the changes.

```
sudo systemctl daemon-reload
```

7. Enable the new service autostart.

```
sudo systemctl enable findface-video-worker-gpu2.service

Created symlink from /etc/systemd/system/multi-user.target.wants/findface-video-
↪worker-gpu2.service to /usr/lib/systemd/system/findface-video-worker-gpu2.service
```

8. Launch the new service.

```
sudo systemctl start findface-video-worker-gpu2.service
```

9. Check the both `findface-video-worker-gpu` services status.

```
sudo systemctl status findface-video-worker-* | grep -i 'Active:' -B 3

 findface-video-worker-gpu2.service - findface-video-worker-gpu daemon
  Loaded: loaded (/usr/lib/systemd/system/findface-video-worker-gpu2.service;␣
↪enabled; vendor preset: enabled)
  Active: active (running) since Thu 2019-07-18 10:32:02 MSK; 1min 11s ago

...

 findface-video-worker-gpu.service - findface-video-worker-gpu daemon
  Loaded: loaded (/usr/lib/systemd/system/findface-video-worker-gpu.service;␣
↪enabled; vendor preset: enabled)
  Active: active (running) since Mon 2019-07-15 15:18:33 MSK; 2 days ago
```

2.8.5 Migrate Feature Vectors to Different Neural Network Model

Tip: Do not hesitate to contact our experts on migration by support@ntechlab.com.

Important: In the case, you are doing migration as part of the system update to a newer version, *complete the update* first. Only after that can you proceed to the migration.

This section is about how to migrate object feature vectors to another neural network model.

Do the following:

1. Create a backup of the Tarantool-based feature vector database in any directory of your choice, for example, `/etc/findface_dump`.

   Tip: See *Back Up and Recover FindFace Multi and Its Data* for details.

```
sudo mkdir -p /etc/findface_dump
sudo cd /etc/findface_dump
sudo findface-storage-api-dump -config /etc/findface-sf-api.ini
```

2. Stop the `findface-sf-api` service.

```
sudo systemctl stop findface-sf-api.service
```

3. Create new shards that will host regenerated feature vectors.

   1. Open the `/etc/tarantool/instances.available/` directory and find out the number of shards by counting the number of configuration files `shard-*.lua`.

      Note: There are four shards in the example below.

      ```
      cd /etc/tarantool/instances.available/

      ls -l

      shard-001.lua
      shard-002.lua
      shard-003.lua
      shard-004.lua
      ```

   2. Create the same number of new shards by copying the configuration files `shard-*.lua`.

      Note: For convenience, the second digit in the new names is 1: `shard-01*.lua`.

      ```
      sudo cp shard-001.lua shard-011.lua
      sudo cp shard-002.lua shard-012.lua
      sudo cp shard-003.lua shard-013.lua
      sudo cp shard-004.lua shard-014.lua
      ```

   3. Modify the following lines in each new shard's configuration file, subject to its name (`shard-011`, `shard-012`, etc., in our example):

Old value	New value
listen = ‘127.0.0.1:32001’	Listen = ‘127.0.0.1:32011’
vinyl_dir = ‘/opt/ntech/var/lib/tarantool/shard-001’	vinyl_dir = ‘/opt/ntech/var/lib/tarantool/shard-011’
work_dir = ‘/opt/ntech/var/lib/tarantool/shard-001’	work_dir = ‘/opt/ntech/var/lib/tarantool/shard-011’
memtx_dir = ‘/opt/ntech/var/lib/tarantool/shard-001/snapshots’	memtx_dir = ‘/opt/ntech/var/lib/tarantool/shard-011/snapshots’
wal_dir = ‘/opt/ntech/var/lib/tarantool/shard-001/xlogs’	wal_dir = ‘/opt/ntech/var/lib/tarantool/shard-011/xlogs’
FindFace.start(“127.0.0.1”, 8101, {	FindFace.start(“127.0.0.1”, 8111, {

   4. Create symbolic links to the new shards.

```
cd /etc/tarantool/instances.enabled/

sudo ln -s /etc/tarantool/instances.available/shard-01*.lua /etc/tarantool/
↪instances.enabled/
```

5. Create directories that will host files of the new shards. Assign permissions for the created directories.

```
cd /opt/ntech/var/lib/tarantool/

mkdir -p shard-01{1..4}/{index,snapshots,xlogs}

chown tarantool:tarantool shard-01* shard-01*/*
```

4. Open the /etc/findface-extraction-api configuration file and replace the extraction models with the new ones in the body_emben, car_emben, and face_emben parameters, depending on the object types to migrate.

```
sudo vi /etc/findface-extraction-api.ini

extractors:
  ...
  models:
    ...
    body_emben: pedrec/<new_model_body>.gpu.fnk
    ...
    car_emben: carrec/<new_model_car>.gpu.fnk
    ...
    face_emben: face/<new_model_face>.gpu.fnk
```

Restart the findface-extraction-api service.

```
sudo systemctl restart findface-extraction-api.service
```

5. Start the new shards.

```
for i in {11..14}; do sudo systemctl start tarantool@shard-0$i; done
```

6. Create a configuration file with migration settings <migration.ini> based on the example below.

```
extraction-api:
  timeouts:
    connect: 5s
    response_header: 30s
    overall: 35s
    idle_connection: 0s
  extraction-api: http://127.0.0.1:18666
storage-api-from: # current location of the gallery
  timeouts:
    connect: 5s
    response_header: 30s
    overall: 35s
    idle_connection: 10s
  max-idle-conns-per-host: 20
  shards:
    - master: http://127.0.0.1:8101/v2/
```

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```
      slave: ""
    - master: http://127.0.0.1:8102/v2/
      slave: ""
    - master: http://127.0.0.1:8103/v2/
      slave: ""
    - master: http://127.0.0.1:8104/v2/
      slave: ""
storage-api-to:
  timeouts:
    connect: 5s
    response_header: 30s
    overall: 35s
    idle_connection: 10s
  max-idle-conns-per-host: 20
  shards:
    - master: http://127.0.0.1:8111/v2/
      slave: ""
    - master: http://127.0.0.1:8112/v2/
      slave: ""
    - master: http://127.0.0.1:8113/v2/
      slave: ""
    - master: http://127.0.0.1:8114/v2/
      slave: ""
workers_num: 3
faces_limit: 100
extraction_batch_size: 8
normalized_storage:
  type: webdav
  enabled: True
  webdav:
    upload-url: http://127.0.0.1:3333/uploads/
  s3:
    endpoint: ""
    bucket-name: ""
    access-key: ""
    secret-access-key: ""
    secure: False
    region: ""
    public-url: ""
    operation-timeout: 30
```

In the storage-api-from section, specify the old shards to migrate the data from.

```
storage-api-from: # current location of the gallery
  ...
  shards:
    - master: http://127.0.0.1:8101/v2/
      slave: ""
    - master: http://127.0.0.1:8102/v2/
      slave: ""
    - master: http://127.0.0.1:8103/v2/
      slave: ""
```

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```
    - master: http://127.0.0.1:8104/v2/
  ...
```

In the `storage-api-to` section, specify the new shards that will host migrated data.

```
storage-api-to:
  ...
  shards:
    - master: http://127.0.0.1:8111/v2/
      slave: ""
    - master: http://127.0.0.1:8112/v2/
      slave: ""
    - master: http://127.0.0.1:8113/v2/
      slave: ""
    - master: http://127.0.0.1:8114/v2/
      slave: ""
  ...
```

7. Launch the `findface-sf-api-migrate` utility with the `-config` option and provide the <`migration.ini`> configuration file.

```
findface-sf-api-migrate -config migration.ini
```

Note: The migration process can take up a significant amount of time if there are many events and cards in the system.

8. After the migration is complete, stop the old shards and disable their autostart in OS (do not remove them).

```
for i in {01..04}; do sudo systemctl stop tarantool@shard-0$i.service ; done

for i in {01..04}; do sudo systemctl disable tarantool@shard-0$i.service ; done
```

9. Open the `/etc/findface-sf-api.ini` configuration file and adjust the shards ports, subject to the new shards settings. Restart the `findface-sf-api` service.

```
sudo vi /etc/findface-sf-api.ini

shards:
  - master: http://127.0.0.1:8111/v2/
    slave: ""
  - master: http://127.0.0.1:8112/v2/
    slave: ""
  - master: http://127.0.0.1:8113/v2/
    slave: ""
  - master: http://127.0.0.1:8114/v2/
    slave: ""

sudo systemctl start findface-sf-api.service
```

10. Import the new database structure from the `tnt_schema.lua` file.

```
sudo findface-security make_tnt_schema | sudo tee /etc/findface-security/tnt_schema.
↪lua
```

See also:

Modify Feature Vector Database Structure.

11. Migrate the main database architecture from FindFace Multi to **PostgreSQL**, re-create *predefined* user roles and the first administrator.

```
sudo findface-security migrate
sudo findface-security create_groups
sudo findface-security create_default_user
```

12. Restart the services.

```
sudo systemctl restart findface-security.service
sudo systemctl restart findface-extraction-api findface-video-worker* findface-
↪video-manager findface-sf-api
```

13. Migrate clusters as well if *this functionality* is enabled in your system. To do so, execute the following command:

Note: List the object types to migrate as the command options: `--face`, `--body`, `--car`.

```
sudo findface-security migrate_clusters --face --body --car --use-best-event --use-
↪thumbnail --force-clusterin
```

As a result, the system will regenerate feature vectors for the existing cluster events and automatically launch the scheduled clustering to rebuild clusters.

2.8.6 Modify Feature Vector Database Structure

Sometimes it may be necessary to apply a new structural schema to your Tarantool-based feature vector database, for example, when updating to the latest version of the product, or when you want to enhance the default database structure with additional parameters, advanced object metadata, and so on.

In this section:

About Database Structure

In FindFace Multi, the database structure is set via the `/etc/findface-security/tnt_schema.lua` file.

The structure is created as a set of fields. Each field is described with the following parameters:

- id: field id;
- name: field name, must be the same as the name of a relevant object parameter;
- field_type: data type;
- default: field default value. If a default value exceeds '1e14 – 1', use a string data type to specify it, for example, `"123123.."` instead of `123123...`

You can find the default `tnt_schema.lua` file `here`.

Structure Modification

To modify the database structure, do the following:

1. Stop the `findface-security` service.

```
sudo systemctl stop findface-security.service
```

2. Create a backup of the Tarantool-based feature vector database in any directory of your choice, for example, `/etc/findface_dump`.

Tip: See *Back Up and Recover FindFace Multi and Its Data* for details.

```
mkdir -p /etc/findface_dump
cd /etc/findface_dump
sudo findface-storage-api-dump -config /etc/findface-sf-api.ini
```

3. Prepare the `tnt_schema.lua` file containing the new database structure.

4. Modify the database structure by applying the new `tnt_schema.lua` file.

```
sudo findface-security make_tnt_schema | sudo tee /etc/findface-security/tnt_schema.
↪lua
```

5. Navigate to the directory with Tarantool configuration file(s) `/etc/tarantool/instances.available/`. For each shard, make sure that there is a line `dofile("/etc/findface-security/tnt_schema.lua")` before the `FindFace.start` section and `meta_scheme` and `meta_indexes` are defined in the `FindFace.start` parameters.

```
sudo vi /etc/tarantool/instances.available/<shard_00N>.lua

dofile("/etc/findface-security/tnt_schema.lua")

FindFace.start("127.0.0.1", 8101, {
    license_ntls_server="127.0.0.1:3133",
    meta_indexes=meta_indexes,
    meta_scheme = meta_scheme
})
```

6. Stop the `findface-tarantool-server` shards. Purge data from all the directories relevant to active shards.

```
sudo systemctl stop 'tarantool@*'

sudo rm /opt/ntech/var/lib/tarantool/shard-*/{index,snapshots,xlogs}/*
```

7. Restart the `findface-tarantool-server` shards.

```
TNT=$(ls /etc/tarantool/instances.enabled/ | cut -c 7,8,9)
for i in $TNT; do sudo systemctl restart tarantool@shard-$i.service ; done
```

8. Restore the Tarantool database from the backup.

   Important: If some fields were removed from the new database structure, you have to first manually delete the corresponding data from the backup copy.

```
cd /etc/findface_dump
for x in *.json; do curl -X POST "http://127.0.0.1:18411/v2/galleries/${x%%.json}";␣
↪done
for x in *.json; do sudo findface-storage-api-restore -config /etc/findface-sf-api.
↪ini < "$x"; done
```

9. Start the `findface-security` service.

```
sudo systemctl start findface-security.service
```

See also:

Custom Metadata in Tarantool

2.8.7 Remove FindFace Multi Instance

You can automatically remove FindFace Multi along with the *data storages* by using the `ffmulti_uninstall.sh` script. The FindFace Multi configuration files and data storages will be backed up if you request it.

Important: Regarding directories with the FindFace Multi *artifacts*, the script will back up and clean only `/var/lib/findface-security/uploads` and `/var/lib/ffupload/` (set by default). If you modified the artifacts' location, you will have to create a backup and purge them by yourself. See *Back Up and Recover FindFace Multi and Its Data* for reference.

Do the following:

1. Download the `ffmulti_uninstall.sh` script to some directory on a designated host (for example, to `/home/username/`).
2. From this directory, make the script executable.

```
sudo chmod +x ffmulti_uninstall.sh
```

3. Run the script.

```
sudo ./ffmulti_uninstall.sh
```

4. Answer **backup** to create a backup and then remove FindFace Multi along with the data storages. Answer **all** to completely wipe out FindFace Multi and the data storages without a backup.

5. The script purges all content from the `/var/lib/ffupload` directory. However, the directory itself will remain in your file system. Remove `/var/lib/ffupload` manually by executing:

```
sudo rmdir /var/lib/ffupload
```

Important: To recover FindFace Multi from the backup, see *Back Up and Recover FindFace Multi and Its Data*.

2.8.8 Check Component Status

Check the status of components once you have encountered a system problem.

Component	Command to view service status
`findface-extraction-api`	sudo systemctl status findface-extraction-api.service
`findface-sf-api`	sudo systemctl status findface-sf-api.service
`findface-tarantool-server`	sudo systemctl status tarantool.service
`findface-tarantool-server` shards	sudo systemctl status tarantool@shard-00*
`findface-video-manager`	sudo systemctl status findface-video-manager.service
`findface-video-worker`	sudo systemctl status findface-video-worker*.service
`findface-ntls`	sudo systemctl status findface-ntls
`findface-security`	sudo systemctl status findface-security.service
`findface-counter`	sudo systemctl status findface-counter.service
`findface-liveness-api`	sudo systemctl status findface-liveness-api.service
`etcd`	sudo systemctl status etcd.service
`NginX`	sudo systemctl status nginx.service
`memcached`	sudo systemctl status memcached.service
`postgresql`	sudo systemctl status postgresql*
`nats`	sudo systemctl status nats.service
`pgbouncer`	sudo systemctl status pgbouncer.service

2.8.9 Service Logs

Service logs provide a complete record of each FindFace Multi component activity. Consulting logs is one of the first things you should do to identify a cause for any system problem.

In this section:

Configure Logging

The FindFace Multi services log a large amount of data, which can eventually lead to disc overload. To prevent this from happening, we advise you to disable `rsyslog` due to its suboptimal log rotation scheme and use the appropriately configured `systemd-journal` service instead.

Do the following:

1. Check whether the `/var/log/journal` directory already exists. If not, create it by executing the following command:

   ```
   sudo mkdir /var/log/journal
   sudo chmod 2755 /var/log/journal
   ```

2. Open the `/etc/systemd/journald.conf` configuration file. Enable saving `journald` logs to your hard drive by uncommenting the `Storage` parameter and changing its value to `persistent`. Disable filtering in `systemd-journal` as well:

   ```
   sudo vi /etc/systemd/journald.conf

   [Journal]
   ...
   Storage=persistent
   ...
   RateLimitInterval=0
   RateLimitBurst=0
   ...
   ```

   If necessary, uncomment and edit the `SystemMaxUse` parameter. This parameter determines the maximum volume of log files on your hard drive. Specify its value in bytes or use K, M, G, T, P, E as units for the specified size (equal to 1024, 1024^2, … bytes).

   ```
   ...
   SystemMaxUse=3G
   ```

3. Restart the `journald` service.

   ```
   sudo systemctl restart systemd-journald.service
   ```

4. Stop and disable the `syslog` service.

   ```
   sudo systemctl stop syslog.socket rsyslog.service
   sudo systemctl disable syslog.socket rsyslog.service
   ```

5. If necessary, delete the existing log files created through `syslog`, and the kernel logs.

   ```
   sudo rm /var/log/syslog*
   sudo rm /var/log/kern.log*
   ```

Consult Service Logs

Use the `journalctl -u <component>` command to consult a component log, for example as follows:

```
journalctl -u findface-extraction-api
```

See also:

Audit Logs

2.8.10 Troubleshoot Licensing and `findface-ntls`

When troubleshooting licensing and `findface-ntls` (see *Licensing Info*), the first step is to retrieve the licensing information and `findface-ntls` status. You can do so by sending an API request to `findface-ntls`. Necessary actions are then to be undertaken, subject to the response content.

Tip: Please do not hesitate to contact our experts on troubleshooting by support@ntechlab.com.

Note: The online licensing is done via the NtechLab Global License Manager `license.ntechlab.com`. Check its availability. A stable internet connection and DNS are required.

To retrieve the FindFace Multi *licensing* information and `findface-ntls` status, execute on the `findface-ntls` host console:

```
curl http://localhost:3185/license.json -s | jq
```

The response will be given in JSON. One of the most significant parameters is `last_updated`. It indicates in seconds how long ago the local license has been checked for the last time.

Interpret the `last_updated` value as follows:

- [0, 5] — everything is alright.
- (5, 30] — there may be some problems with connection, or with the local drive where the license file is stored.
- (30; 120] — almost certainly something bad happened.
- (120; ∞) — the licensing source response has been timed out. Take action.
- `"valid" -> "value": false`: connection with the licensing source was never established.

```
curl http://localhost:3185/license.json -s | jq
{
  "name": "NTLS",
  "time": 1565186356,
  "type": "online",
  "license_id": "61063ce4b86945e1b70c3bdbedea453b",
  "generated": 1514467939,
  "last_updated": 5,
  "valid": {
    "value": true,
    "description": ""
  },
  "source": "/opt/ntech/license/import_
```

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```
↪b68d7b7ec9a7310d18832035318cff0c9ddf11e3a9ab0ae962fbe48645e196d1.lic",
  "limits": [
    {
      "type": "time",
      "name": "end",
      "value": 1609161621
    },
    {
      "type": "number",
      "name": "faces",
      "value": 9007199254740991,
      "current": 0
    },
    {
      "type": "number",
      "name": "cameras",
      "value": 4294967295,
      "current": 0
    },
    {
      "type": "number",
      "name": "extraction_api",
      "value": 256,
      "current": 0
    },
    {
      "type": "boolean",
      "name": "gender",
      "value": true
    },
    {
      "type": "boolean",
      "name": "age",
      "value": true
    },
    {
      "type": "boolean",
      "name": "emotions",
      "value": true
    },
    {
      "type": "boolean",
      "name": "fast-index",
      "value": true
    },
    {
      "type": "boolean",
      "name": "sec-genetec",
      "value": false
    },
    {
      "type": "boolean",
```

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```
      "name": "beard",
      "value": false
    },
    {
      "type": "boolean",
      "name": "glasses",
      "value": false
    },
    {
      "type": "boolean",
      "name": "liveness",
      "value": false
    }
  ],
  "services": [
    {
      "name": "video-worker",
      "ip": "127.0.0.1:53276"
    },
    {
      "name": "FindFace-tarantool",
      "ip": "127.0.0.1:53284"
    },
    {
      "name": "FindFace-tarantool",
      "ip": "127.0.0.1:53288"
    }
  ]
}
```

2.8.11 Automatic Tarantool Recovery

Important: We highly recommend that you turn off your Tarantool servers properly in every unstable situation. This measure will prevent data corruption, so there will be no need in the functionality described in this section.

Warning: Be extremely careful with enabling this functionality as it may lead to silent data loss.

If your system architecture doesn't imply uninterrupted availability of Tarantool servers, it is recommended to enable automatic database recovery. In this case, each time an error occurs while reading a snapshot or xlog file, Tarantool will skip invalid records, read as much data as possible, and re-build the file.

To enable automatic database recovery, do the following:

1. For each Tarantool shard, open the configuration file `/etc/tarantool/instances.available/shard-*.lua` and uncomment `force_recovery = true`.

   ```
   sudo vi /etc/tarantool/instances.available/shard-*.lua
   ```

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```
box.cfg{

    force_recovery = true,
}
```

2. Restart the shards.

```
systemctl restart tarantool@shard-*
```

2.8.12 Manually Purge Old Data from Database

Tip: To schedule automatic database cleanup, see *Automatic Event And Episode Cleanup*.

To manually remove old data from the FindFace Multi database, use the `cleanup` utility. You can separately remove the following data:

- matched events (faces, bodies, cars) and related episodes,
- unmatched events (faces, bodies, cars) and related episodes,
- full frames of matched events (faces, bodies, cars),
- full frames of unmatched events (faces, bodies, cars),
- counter records,
- cluster events (faces, bodies, cars),
- audit-logs,
- area activations.

To invoke the `cleanup` help message, execute:

```
sudo findface-security cleanup --help
usage: findface-security cleanup [-h] [--as-configured]
                                 [--face-events-max-fullframe-unmatched-age FACE_EVENTS_
↪MAX_FULLFRAME_UNMATCHED_AGE]
                                 [--face-events-max-fullframe-matched-age FACE_EVENTS_
↪MAX_FULLFRAME_MATCHED_AGE]
                                 [--face-events-max-unmatched-age FACE_EVENTS_MAX_
↪UNMATCHED_AGE]
                                 [--face-events-max-matched-age FACE_EVENTS_MAX_MATCHED_
↪AGE]
                                 [--body-events-max-fullframe-unmatched-age BODY_EVENTS_
↪MAX_FULLFRAME_UNMATCHED_AGE]
                                 [--body-events-max-fullframe-matched-age BODY_EVENTS_
↪MAX_FULLFRAME_MATCHED_AGE]
                                 [--body-events-max-unmatched-age BODY_EVENTS_MAX_
↪UNMATCHED_AGE]
                                 [--body-events-max-matched-age BODY_EVENTS_MAX_MATCHED_
↪AGE]
                                 [--car-events-max-fullframe-unmatched-age CAR_EVENTS_
```

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```
↪MAX_FULLFRAME_UNMATCHED_AGE]
                                 [--car-events-max-fullframe-matched-age CAR_EVENTS_MAX_
↪FULLFRAME_MATCHED_AGE]
                                 [--car-events-max-unmatched-age CAR_EVENTS_MAX_
↪UNMATCHED_AGE]
                                 [--car-events-max-matched-age CAR_EVENTS_MAX_MATCHED_
↪AGE]
                                 [--car-cluster-events-max-age CAR_CLUSTER_EVENTS_MAX_
↪AGE]
                                 [--body-cluster-events-max-age BODY_CLUSTER_EVENTS_MAX_
↪AGE]
                                 [--face-cluster-events-max-age FACE_CLUSTER_EVENTS_MAX_
↪AGE]
                                 [--area-activations-max-age AREA_ACTIVATIONS_MAX_AGE]
                                 [--audit-logs-max-age AUDIT_LOGS_MAX_AGE]
                                 [--counter-records-max-age COUNTER_RECORDS_MAX_AGE]
                                 [--configuration CONFIGURATION] [--version]
                                 [-v {0,1,2,3}] [--settings SETTINGS]
                                 [--pythonpath PYTHONPATH] [--traceback]
                                 [--no-color] [--force-color] [--skip-checks]

Delete FFSecurity entities

optional arguments:
  -h, --help            show this help message and exit
  --as-configured       Apply config age options for events, counter records
                        and clusters. Can't be used with other arguments.
  --face-events-max-fullframe-unmatched-age FACE_EVENTS_MAX_FULLFRAME_UNMATCHED_AGE
                        face events max fullframe unmatched age to clean up
                        (in days)
  --face-events-max-fullframe-matched-age FACE_EVENTS_MAX_FULLFRAME_MATCHED_AGE
                        face events max fullframe matched age to clean up (in
                        days)
  --face-events-max-unmatched-age FACE_EVENTS_MAX_UNMATCHED_AGE
                        face events max unmatched age to clean up (in days)
  --face-events-max-matched-age FACE_EVENTS_MAX_MATCHED_AGE
                        face events max matched age to clean up (in days)
  --body-events-max-fullframe-unmatched-age BODY_EVENTS_MAX_FULLFRAME_UNMATCHED_AGE
                        body events max fullframe unmatched age to clean up
                        (in days)
  --body-events-max-fullframe-matched-age BODY_EVENTS_MAX_FULLFRAME_MATCHED_AGE
                        body events max fullframe matched age to clean up (in
                        days)
  --body-events-max-unmatched-age BODY_EVENTS_MAX_UNMATCHED_AGE
                        body events max unmatched age to clean up (in days)
  --body-events-max-matched-age BODY_EVENTS_MAX_MATCHED_AGE
                        body events max matched age to clean up (in days)
  --car-events-max-fullframe-unmatched-age CAR_EVENTS_MAX_FULLFRAME_UNMATCHED_AGE
                        car events max fullframe unmatched age to clean up (in
                        days)
  --car-events-max-fullframe-matched-age CAR_EVENTS_MAX_FULLFRAME_MATCHED_AGE
                        car events max fullframe matched age to clean up (in
```

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```
                        days)
  --car-events-max-unmatched-age CAR_EVENTS_MAX_UNMATCHED_AGE
                        car events max unmatched age to clean up (in days)
  --car-events-max-matched-age CAR_EVENTS_MAX_MATCHED_AGE
                        car events max matched age to clean up (in days)
  --car-cluster-events-max-age CAR_CLUSTER_EVENTS_MAX_AGE
                        car cluster events max age to clean up (in days)
  --body-cluster-events-max-age BODY_CLUSTER_EVENTS_MAX_AGE
                        body cluster events max age to clean up (in days)
  --face-cluster-events-max-age FACE_CLUSTER_EVENTS_MAX_AGE
                        face cluster events max age to clean up (in days)
  --area-activations-max-age AREA_ACTIVATIONS_MAX_AGE
                        area activations max age to clean up (in days)
  --audit-logs-max-age AUDIT_LOGS_MAX_AGE
                        audit logs max age to clean up (in days)
  --counter-records-max-age COUNTER_RECORDS_MAX_AGE
                        counter records max age to clean up (in days)
  --configuration CONFIGURATION
                        The name of the configuration class to load, e.g.
                        "Development". If this isn't provided, the
                        DJANGO_CONFIGURATION environment variable will be
                        used.
  --version             show program's version number and exit
  -v {0,1,2,3}, --verbosity {0,1,2,3}
                        Verbosity level; 0=minimal output, 1=normal output,
                        2=verbose output, 3=very verbose output
  --settings SETTINGS   The Python path to a settings module, e.g.
                        "myproject.settings.main". If this isn't provided, the
                        DJANGO_SETTINGS_MODULE environment variable will be
                        used.
  --pythonpath PYTHONPATH
                        A directory to add to the Python path, e.g.
                        "/home/djangoprojects/myproject".
  --traceback           Raise on CommandError exceptions
  --no-color            Don't colorize the command output.
  --force-color         Force colorization of the command output.
  --skip-checks         Skip system checks.
```

To entirely remove events and episodes older than a given number of days, use the `--*-events-max-matched-age`/`--*-events-max-unmatched-age` options, subject to the object type. For example, to remove unmatched car events older than 5 days, execute:

```
sudo findface-security cleanup --car-events-max-unmatched-age 5
```

To remove only matched car events older than 5 days, execute:

```
sudo findface-security cleanup --car-events-max-matched-age 5
```

The following commands remove only full frames of matched/unmatched body events:

```
sudo findface-security cleanup --body-events-max-fullframe-matched-age 5
sudo findface-security cleanup --body-events-max-fullframe-unmatched-age 5
```

To remove only counter records, execute:

```
sudo findface-security cleanup --counter-records-max-age 5
```

To remove only cluster events with faces, execute:

```
sudo findface-security cleanup --face-cluster-events-max-age 5
```

To remove only audit logs, execute:

```
sudo findface-security cleanup --audit-logs-max-age 5
```

To remove only area activations, execute:

```
sudo findface-security cleanup --area-activations-max-age 5
```

Important: You must provide at least one of the mentioned arguments.

2.8.13 Disable Services

You can disable the following FindFace Multi services should you no longer need them:

- episodes
- video archive queue manager
- webhooks

To do so, open the `/etc/findface-security/config.py` configuration file and modify the `SERVICES` section, setting `False` for the services that are no longer in use. Restart the `findface-security` service.

```
sudo vi /etc/findface-security/config.py

# disable unused services to increase
# overall system performance in some cases.
SERVICES = {
    "ffsecurity": {
        "episodes": True,
        "webhooks": True,
        # use queue manager to prevent drops of video archive events
        "video_archive_events_manager": True,
    }
}
```

```
sudo systemctl restart findface-security.service
```

After that, the corresponding tabs will disappear from the web interface.

Note: A tab will remain if there are some entities on it (for example, webhooks on the *Webhooks* tab). However, the service will stop working and generating data.

2.8.14 Hide Menu Items

To hide specific menu items, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Into the `FFSECURITY_UI_CONFIG` section, insert the `menu` section, as shown in the example below. List the menu items that you want to hide.

```
FFSECURITY_UI_CONFIG = {
    "menu": {
        "disabled_items": ["video-wall", "know_your_customer"]
    },
```

You can hide the following items:

Menu item	Configure as follows
Search	`"search"`
Events	`"events"`
Episodes	`"episodes"`
Clusters	`"clusters"`
Interaction Analysis	`"contacts"`
Counters	`"counters"`
Cameras	`"cameras"`
Video Wall	`"video-wall"`
Reports	`"reports"`
Audit Logs	`"audit_logs"`
Cards	`"cards"`
Videos	`"videos"`
Analytics	`"know_your_customer"`
Preferences	`"preferences"`
General Preferences	`"settings"`
Appearance	`"appearance"`
Roles	`"roles"`
Users	`"users"`
Camera Groups	`"camera-groups"`
Watch Lists	`"watch-lists"`
License	`"license"`
Tools	`"tools"`
Verify	`"verify"`
Developer	`"developer"`
Documentation	`"documentation"`
API documentation	`"api_doc"`
Webhooks	`"webhooks"`
menu items activated by custom plugins	Contact our support team for details about your plugin.

3. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

2.8.15 Reset Password

To reset a user password to the FindFace Multi web interface, execute the following command:

```
findface-security changepassword %username
```

2.8.16 Migrate Data to Another Disk

High disk load may lead to delays in event arrivals. In severe cases, it might result in complete inoperability of FindFace Multi. One of the means for reducing the disk load is to migrate the FindFace Multi data storages to another disk.

In this section:

Prepare Disk

To prepare a disk for the data migration, do the following:

1. Create a new mount point (`/mnt/ffdata` in our example).

```
sudo mkdir /mnt/ffdata
sudo chown ntech:ntech /mnt/ffdata
```

2. Create a partition.

```
sudo parted /dev/sdb
mklabel gpt
mkpart primary ext4 1MiB 100%
q
sudo mkfs.ext4 /dev/sdb1
```

3. Learn the UUID of the partition (`sdb1` in our example).

```
sudo blkid | grep sdb1
/dev/sdb1: LABEL="data" UUID="0638ebe0-853e-43ea-8f35-bfae305695d1" TYPE="ext4"␣
↪PARTUUID="8cebaacc-77d7-4757-b4c6-14147e92646c"
```

4. Add the partition to fstab to make it automatically mount on booting.

```
sudo vi /etc/fstab
------------
#DATA mount
UUID=0638ebe0-853e-43ea-8f35-bfae305695d1 /mnt/ffdata/    ext4    auto,user,rw    ␣
↪0      2
-------------
```

5. Mount all the filesystems.

```
sudo mount -a
```

Migrate Photo Storage

To migrate the FindFace Multi photo storage, do the following:

1. Stop the `findface-security` service to prevent the data loss.

   ```
   sudo systemctl stop findface-security
   ```

2. By default, the photo data are stored at `/var/lib/`. Migrate the photo storage to the *new disk*.

   ```
   sudo cp -ax /var/lib/findface-security/ -R /mnt/ffdata/
   sudo rm -r /var/lib/findface-security/
   sudo cp -ax /var/lib/ffupload/ -R /mnt/ffdata/
   sudo rm -r /var/lib/ffupload/
   ```

3. Create symbolic links for the new directories.

   ```
   sudo ln -s /mnt/ffdata/findface-security/ /var/lib/
   sudo ln -s /mnt/ffdata/ffupload/ /var/lib/
   ```

4. Ensure that the rights are correctly assigned.

   ```
   sudo chown ntech:ntech /mnt/ffdata/findface-security/
   ```

5. Start the `findface-security` service.

   ```
   sudo systemctl start findface-security
   ```

Migrate Main Database (PostgreSQL)

To migrate the PostgreSQL database, do the following:

1. Stop the `findface-security`, `pgbouncer`, and PostgreSQL services.

   ```
   sudo systemctl stop findface-security.service pgbouncer.service postgresql.service␣
   ↪postgresql@10-main.service
   ```

2. On the *new disk*, create a directory for the database.

   ```
   sudo mkdir -p /mnt/ffdata/some_directory/db
   ```

3. Migrate the database to the new directory.

   ```
   sudo mv /var/lib/postgresql /mnt/ffdata/some_directory/db
   ```

4. Create a symlink to the new directory.

   ```
   sudo ln -s /mnt/ffdata/some_directory/db/postgresql /var/lib/postgresql
   ```

5. Start the PostgreSQL, `pgbouncer`, and `findface-security` services.

```
sudo systemctl start postgresql.service postgresql@10-main.service pgbouncer.service

sudo systemctl start findface-security.service
```

2.8.17 Deactivate `findface-liveness-api` installed with FindFace Multi

If you don't utilize the `findface-liveness-api` service installed with FindFace Multi and the face-based authentication does not apply to your system, we recommend deactivating `findface-liveness-api`.

Do the following:

1. Stop the `findface-liveness-api` service and disable its autostart by executing:

```
sudo systemctl stop findface-liveness-api.service && sudo systemctl disable␣
↪findface-liveness-api.service
```

2. Open the `/etc/findface-extraction-api.ini` configuration file.

```
sudo vi /etc/findface-extraction-api.ini
```

3. Disable the neural network model used by the `findface-liveness-api` service. To do so, pass the empty value `''` to the `face_liveness` parameter.

Note: Do not remove the parameter itself. Otherwise, the system will be searching for the default model.

```
extractors:
  models:
    ...
    face_liveness: ''
    ...
```

4. Restart `findface-extraction-api`.

```
sudo systemctl restart findface-extraction-api
```

2.8.18 Troubleshoot MongoDB distribution

Tip: Please do not hesitate to contact our experts on troubleshooting by support@ntechlab.com.

The Video Recorder operation requires a third-party software MongoDB.

Note: MongoDB – document-oriented database management system.

Currently, it is not possible to install MongoDB from a public repository on the area of Russia and Belarus. If you are located in these countries and intend to use the Video Recorder functionality, you need to install manually the MongoDB database from the deb package before performing any FindFace Multi deployment procedure.

Do the following:

1. Install the MongoDB distribution package provided by technical support using the command:

```
sudo dpkg -i <mongodb-repo-bionic-4.4_2022.06.10_amd64>.deb
```

2. Deploy FindFace Multi including the Video Recorder by one of the following ways:

- When *deploying from Console Installer*, answer «No» to the question «Do you want to install NtechLab VMS?». After you've done that, *Deploy Video Recorder step-by-step*.
- When *deploying from Console Installer*, answer «Yes» to the question «Do you want to install NtechLab VMS?» to install Video Recorder.
- Do *Basic Step-by-Step Deployment from Repository* and *Deploy Video Recorder step-by-step*.

2.9 Appendices

2.9.1 Components in Depth

`findface-extraction-api`

The `findface-extraction-api` service uses neural networks to detect an object in an image, extract the object feature vector, and recognize object attributes (for example, the clothing color for bodies).

It interfaces with the `findface-sf-api` service as follows:

- Gets original images with objects and normalized object images.
- Returns the object bounding box coordinates and, if requested by `findface-sf-api`, feature vector and object attribute data.

Functionality:

- object detection in an original image (with a return of the bbox coordinates),
- object normalization,
- feature vector extraction from a normalized image,
- object attribute recognition (a person's gender, age, emotions; clothing color; car color, car model, etc.).

The `findface-extraction-api` service can be based on CPU (installed from the `findface-extraction-api` package) or GPU (installed from the `findface-extraction-api-gpu` package). For both CPU- and GPU-accelerated services, configuration is done through the `/etc/findface-extraction-api.ini` configuration file. You can find its default content `here for CPU` and `here for GPU`.

When configuring `findface-extraction-api` (on CPU or GPU), refer to the following parameters:

Parameter	Description
`cheetah -> min_object_size`	The minimum size of a face (bbox) guaranteed to be detected. The larger the value, the less resources required for face detection.
`gpu_device`	(Only for GPU) The number of the GPU device used by `findface-extraction-api-gpu`.
`license_ntls_server`	The `ntls` license server IP address and port.

If necessary, you can also enable recognition models for face attributes, body and body attributes, car and car attributes, and liveness detection. You can find the detailed step-by-step instructions in the following sections:

- *Enable Face Attribute Recognition*.
- *Real-time Face Liveness Detection*
- *Liveness Detection as Standalone Service*
- *Enable Body and Body Attribute Recognition*
- *Enable Car and Car Attribute Recognition*

Important: The acceleration type for each model must match the acceleration type of `findface-extraction-api`: CPU or GPU. Note that `findface-extraction-api` on CPU can work only with CPU-models, while `findface-extraction-api` on GPU supports both CPU- and GPU-models.

Tip: To disable an extractor model, simply pass an empty value to a relevant parameter. Do not remove the parameter itself as in this case the system will be searching for the default model.

```
...
extractors:
...
  models:
    body_color: ''
    body_emben: ''
    body_quality: ''
    car_color: ''
    car_description: ''
    car_emben: ''
    ...
```

`findface-sf-api`

The `findface-sf-api` service implements HTTP API to access the FindFace core functions such as object detection and object recognition.

Note: The mentioned functions themselves are provided by `findface-extraction-api`.

The `findface-sf-api` interfaces with the following FindFace core components:

- feature vector database powered by Tarantool via the `findface-tarantool-server` service
- `findface-extraction-api` that provides object detection and object recognition
- `findface-upload` that provides a storage for original images and FindFace core artifacts

To detect an object in an image, you need to send the image in an API request to `findface-sf-api`. The `findface-sf-api` will then redirect the request to `findface-extraction-api` for object detection and recognition.

If there is a configured video object detection module in the system (like in FindFace Multi), `findface-sf-api` also interfaces with the `findface-facerouter` service. It receives data of detected objects and processing directives from `findface-facerouter` and executes the received directives (for example, saves objects into a specific database gallery).

Note: In FindFace Multi, `findface-facerouter` functions are performed by `findface-security`.

Functionality:

- HTTP API implementation (object detection and object recognition methods, performed via `findface-extraction-api`).
- saving object data to the feature vector database (performed via `findface-tarantool-server`),
- saving original images, object thumbnails and normalized object images to an NginX-powered web server (via `findface-upload`).
- provides interaction between all the FindFace core components.

The `findface-sf-api` configuration is done through the `/etc/findface-sf-api.ini` configuration file. You can find its default content `here`.

When configuring `findface-sf-api`, refer to the following parameters:

Parameter	Description
`extraction-api` -> `extraction-api`	IP address of the `findface-extraction-api` host.
`limits` -> `body-image-length`	The maximum size of an image in an API request, bytes.
`normalized-storage` -> `webdav` -> `upload_url`	WebDAV NginX path to send original images, thumbnails and normalized object images to the `findface-upload` service.
`storage-api` -> `shards` -> `master`	IP address of the `findface-tarantool-server` master shard.
`storage-api` -> `shards` -> `slave`	IP address of the `findface-tarantool-server` replica shard.

`findface-tarantool-server`

The `findface-tarantool-server` service provides interaction between the `findface-sf-api` service and the Tarantool-based feature vector database in the following way:

Tip: See Tarantool official documentation for details.

- From `findface-sf-api`, `findface-tarantool-server` receives data, such as information of detected objects, to write into the feature vector database.
- By request from `findface-sf-api`, `findface-tarantool-server` performs database searches and returns search results.

Multiple `findface-tarantool-server` shards can be created on each Tarantool host to increase search speed. Their running concurrently leads to a remarkable increase in performance (70x-100x).

Functionality:

- saving object data to the feature vector database,
- database search,
- implementation of direct API requests to the database (see *Direct API Requests to Tarantool*).

The `findface-tarantool-server` configuration is done through the `/etc/tarantool/instances.available/<shard-*>.lua` configuration file. You can find its default content `here`.

Important: In a multi-shard environment, the configuration has to be done for each shard.

When configuring `findface-tarantool-server`, refer to the following parameters:

Parameter	Description
`force_recovery`	Enables automatic database recovery. In this case, each time an error occurs while reading a snapshot or xlog file, Tarantool will skip invalid records, read as much data as possible, and re-build the file.
`license_ntls_server`	IP address and port of the `findface-ntls` license server.
`memtx_memory`	Maximum RAM that can be used by a Tarantool shard. Set in bytes, depending on the number of objects the shard handles. Consult our experts by support@ntechlab.com before setting this parameter.
`meta_scheme`	A database structure to store the object recognition results. The structure is created as a set of fields. Describe each field with the following parameters: `id`: field id; `name`: field name, must be the same as the name of a relevant object parameter; `field_type`: data type; `default`: field default value, if a default value exceeds '1e14 – 1', use a string data type to specify it, for example, `"123123.."` instead of `123123..`

The default database structure is passed from `/etc/findface-security/tnt_schema.lua` to the `meta_scheme` parameter. See *Modify Feature Vector Database Structure* for details.

`findface-upload`

The `findface-upload` component is an NginX-based web server used as a storage for original images, thumbnails and normalized object images which it receives from the `findface-sf-api` component.

By default the original images, thumbnails and normalized images are stored at `/var/lib/ffupload/uploads/`.

The `findface-upload` component is automatically configured upon installation. Custom configuration is not supported.

Video Object Detection: `findface-video-manager` and `findface-video-worker`

Note: The `findface-video-worker` is delivered in a CPU-accelerated (`findface-video-worker-cpu`) and a GPU-accelerated (`findface-video-worker-gpu`) packages.

In this section:

Functions of `findface-video-manager`

The `findface-video-manager` service is the part of the video object detection module that is used for managing the video object detection functionality.

The `findface-video-manager` service interfaces with `findface-video-worker` as follows:

- It supplies `findface-video-worker` with settings and the list of to-be-processed video streams. To do so, it issues a so-called *job*, a video processing task that contains configuration settings and stream data.
- In a distributed system, it distributes video streams (jobs) across vacant `findface-video-worker` instances.

Note: The configuration settings passed via jobs have priority over the `/etc/findface-video-manager.conf` configuration file.

The `findface-video-manager` service functioning requires ETCD, third-party software that implements a distributed key-value store for `findface-video-manager`. In the FindFace core, ETCD is used as a coordination service, providing the video object detector with fault tolerance.

Functionality:

- allows for configuring video object detection parameters
- allows for managing the list of to-be-processed video streams

Functions of `findface-video-worker`

The `findface-video-worker` service (on CPU/GPU) is the part of the video object detection module, that recognizes objects in the video. It can work with both live streams and files, and supports most video formats and codecs that can be decoded by FFmpeg.

The `findface-video-worker` service interfaces with the `findface-video-manager` and `findface-facerouter` services as follows:

- By request, `findface-video-worker` gets a job with settings and the list of to-be-processed video streams from `findface-video-manager`.
- The `findface-video-worker` posts extracted normalized object images, along with the full frames and meta data (such as bbox, camera ID and detection time) to the `findface-facerouter` service for further processing.

Note: In FindFace Multi, the `findface-facerouter` functions are performed by `findface-security`.

Functionality:

- detects objects in the video,
- extracts normalized object images,
- searches for the best object snapshot,
- snapshot deduplication (only one snapshot per object detection event).

When processing a video, `findface-video-worker` consequently uses the following algorithms:

- **`Motion detection`**. Used to reduce resource consumption. Only when the motion detector recognizes the motion of certain intensity that the object tracker can be triggered.

- **`Object tracking`**. The object tracker traces, detects, and captures objects in the video. It can simultaneously be working with several objects. It also searches for the best object snapshot using the embedded neural network. After the best object snapshot is found, it is posted to `findface-facerouter`.

The best object snapshot can be found in one of the following modes:

- Real-time
- Offline

Real-Time Mode

In the real-time mode, `findface-video-worker` posts an object on-the-fly after it appears in the camera field. The following posting options are available:

- If `realtime_post_every_interval: true`, the object tracker searches for the best object snapshot within each time period equal to `realtime_post_interval` and posts it to `findface-facerouter`.
- If `realtime_post_every_interval: false`, the object tracker searches for the best face snapshot dynamically:
  1. First, the object tracker estimates whether the quality of an object snapshot exceeds a pre-defined internal threshold. If so, the snapshot is posted to `findface-facerouter`.
  2. The threshold value increases after each post. Each time the object tracker gets a higher quality snapshot of the same object, it is posted.
  3. When the object disappears from the camera field, the threshold value resets to default.
- If `realtime_post_first_immediately: true`, the object tracker doesn't wait for the first `realtime_post_interval` to complete and posts the first object from a track immediately after it passes through the quality, size, and ROI filters. The way the subsequent postings are sent depends on the `realtime_post_every_interval` value. If `realtime_post_first_immediately: false`, the object tracker posts the first object after the first `realtime_post_interval` completes.

Offline Mode

The offline mode is less storage intensive than the real-time one as in this mode `findface-video-worker` posts only one snapshot per track but of the highest quality. In this mode, the object tracker buffers a video stream with an object until the object disappears from the camera field. Then the object tracker picks up the best object snapshot from the buffered video and posts it to `findface-facerouter`.

Configure Video Object Detection

The video object detector configuration is done through the following configuration files:

1. The `findface-video-manager` configuration file `/etc/findface-video-manager.conf`. You can find its default content `here`

   When configuring `findface-video-manager`, refer to the following parameters:

Option	Description
`etcd -> endpoints`	IP address and port of the `etcd` service. Default value: `127.0.0.1:2379`.
`ntls -> enabled`	If true, `findface-video-manager` will send a job to `findface-video-worker` only if the total number of processed cameras does not exceed the allowed number of cameras from the license. Default value: false.
`ntls` -> `url`	IP address and port of the `findface-ntls` host. Default value: `http://127.0.0.1:3185/`.
`router_url`	IP address and port of the `findface-facerouter` host to receive detected faces from `findface-video-worker`. In FindFace Multi, `findface-facerouter` functions are performed by `findface-security`. Default value: `http://127.0.0.1:18820/v0/frame`.
`play_speed`	If less than zero, the speed is not limited. In other cases, the stream is read with the given `play_speed`. Not applicable for live streams.
`disable_drops`	Enables posting all appropriate objects without drops. By default, if `findface-video-worker` does not have enough resources to process all frames with objects, it drops some of them. If this option is active, `findface-video-worker` puts odd frames on the waiting list to process them later. Default value: false.
`imotion_threshold`	Minimum motion intensity to be detected by the motion detector. The threshold value is to be fitted empirically. Empirical units: zero and positive rational numbers. Milestones: 0 = detector disabled, 0.002 = default value, 0.05 = minimum intensity is too high to detect motion.
`router_timeout_ms`	Timeout for a `findface-facerouter` (or `findface-security` in the standard FindFace Multi configuration) response to a `findface-video-worker` API request, in milliseconds. If the timeout has expired, the system will log an error. Default value: 15000.
`router_verify_ssl`	Enables a https certificate verification when `findface-video-worker` and `findface-facerouter` (or `findface-security` in the standard FindFace Multi configuration) interact over https. Default value: true. If false, a self-signed certificate can be accepted.
`router_headers`	Additional header fields in a request when posting an object: ["key = value"]. Default value: headers not specified.
`router_body`	Additional body fields in a request body when posting an object: ["key = value"]. Default value: body fields not specified.
`ffmpeg_params`	List of a video stream ffmpeg options with their values as a key=value array: ["rtsp_transpotr=tcp", .., "ss=00:20:00"]. Check out the FFmpeg web site for the full list of options. Default value: options not specified.
`ffmpeg_format`	Pass FFMPEG format (mxg, flv, etc.) if it cannot be detected automatically.
`use_stream_timestamp`	If true, retrieve and post timestamps from a video stream. If false, post the actual date and time.
`start_stream_timestamp`	Add the specified number of seconds to timestamps from a stream.
`rot`	Enables detecting and tracking objects only inside a clipping rectangle WxH+X+Y. You can use this option to reduce `findface-video-worker` load. Default value: rectangle not specified.
`video_transform`	Change a video frame orientation right after decoding. Values (case insensitive, JPEG Exif Orientation Tag in brackets): None (1), FlipHorizontal (2), Rotate180 (3), FlipVertical (4), Transpose (5), Rotate90 (6), Transverse (7), Rotate270 (8). Default value: not specified.
`enable_recorder`	Enables video recording for Video Recorder (must be installed).

The following parameters are available for configuration for each detector type (face, body, car):

Option	Description
`filter_min_quality`	Minimum threshold value for an object image quality. Default value: subject to the object type. Do not change the default value without consulting with our technical experts (support@ntechlab.com).
`filter_min_size`	Minimum size of an object in pixels. Calculated as the square root of the relevant bbox area. Undersized objects are not posted. Default value: 1.
`filter_max_size`	Maximum size of an object in pixels. Calculated as the square root of the relevant bbox area. Oversized objects are not posted. Default value: 8192.
`roi`	Enable posting objects detected only inside a region of interest WxH+X+Y. Default value: region not specified.
`fullframe_crop_rot`	Crop posted full frames by ROT. Default value: false.
`fullframe_use_png`	Send full frames in PNG and not in JPEG as set by default. Do not enable this parameter without supervision from our team as it can affect the entire system functioning. Default value: false (send in JPEG).
`jpeg_quality`	Quality of an original frame JPEG compression, in percents. Default value: 95%.
`overall_only`	Enables the offline mode for the best object search. Default value: true (CPU), false (GPU).
`realtime_post_first_immediately`	Enable posting an object image right after it appears in a camera field of view (real-time mode). Default value: false.
`realtime_post_interval`	Only for the real-time mode. Defines the time period in seconds within which the object tracker picks up the best snapshot and posts it to `findface-facerouter`. Default value: 1.
`realtime_post_every_interval`	Only for the realtime mode. Post best snapshots obtained within each `realtime_post_interval` time period. If false, search for the best snapshot dynamically and send snapshots in order of increasing quality. Default value: false.
`track_interpolate_bboxes`	Interpolate missed bboxes of objects in track. For example, if frames #1 and #4 have bboxes and #2 and #3 do not, the system will reconstruct the absent bboxes #2 and #3 based on the #1 and #4 data. Enabling this option allows you to increase the detection quality on account of performance. Default value: true.
`track_miss_interval`	The system closes a track if there has been no new object in the track within the specified time (seconds). Default value: 1.
`track_max_duration_frames`	The maximum approximate number of frames in a track after which the track is forcefully completed. Enable it to forcefully complete "eternal tracks," for example, tracks with objects from advertisement media. The default value: 0 (option disabled).
`track_send_history`	Send track history. Default value: false.
`post_best_track_frame`	Send full frames of detected objects. Default value: true.
`post_best_track_normalize`	Send normalized images for detected objects. Default value: true.
`post_first_track_frame`	Post the first frame of a track. Default value: false.
`post_last_track_frame`	Post the last frame of a track. Default value: false.

2. The `findface-video-worker` configuration file `/etc/findface-video-worker-cpu.ini` or `/etc/findface-video-worker-gpu.ini`, subject to the acceleration type in use.

   When configuring `findface-video-worker` (on CPU/GPU), refer to the following parameters:

CPU	GPU	Description
`batch_size`		Post faces in batches of the given size.
`capacity`		Maximum number of video streams to be processed by `findface-video-worker`.
N/a	`cpu`	If necessary, decode video on CPU.
N/a	`device_number`	GPU device number to use.
`exit_on_first_finished`		(Only if `input` is specified) Exit on the first finished job.
`input`		Process streams from file, ignoring stream data from `findface-video-manager`.
`labels`		Labels used to allocate a video object detector instance to a certain group of cameras. See *Allocate findface-video-worker to Camera Group*.
`mgr-cmd`		(Optional, instead of the `mgr-static` parameter) A command to obtain the IP address of the `findface-video-manager` host.
`mgr-static`		IP address of the `findface-video-manager` host to provide `findface-video-worker` with settings and the list of to-be-processed streams.
`metrics_port`		HTTP server port to send metrics. If 0, the metrics are not sent.
`min_size`		Minimum object size to be detected.
`ntls-addr`		IP address and port of the `findface-ntls` host.
`resize_scale`		Rescale video frames with the given coefficient.
`resolutions`		Preinitialize `findface-video-worker` to work with specified resolutions. Example: "640x480;1920x1080".
`save_dir`		(For debug) Save detected objects to the given directory.
`streamer` -> `port`, `url`		IP address and port to access the *video wall*.
`use_time_from_sei`		(For MPEG-2) Use SEI (supplemental enhancement information) timestamps.

If necessary, you can also enable neural network models and normalizers to detect bodies, cars, and liveness. You can find the detailed step-by-step instructions in the following sections:

- *Real-time Face Liveness Detection*
- *Enable Body and Body Attribute Recognition*
- *Enable Car and Car Attribute Recognition*

See also:

Configure Video Recorder

Jobs

The `findface-video-manager` service provides `findface-video-worker` with a so-called job, a video processing task that contains configuration settings and stream data.

You can find a job example `here`.

Each job has the following parameters:

- `id`: job id.
- `enabled`: active status.
- `url`: URL/address of video stream/file to process.
- `labels`: tag(s) that will be used by the `findface-facerouter` component (`findface-security` in the standard FindFace Multi configuration) to find processing directives for faces detected in this stream.
- `single_pass`: if true, disable restarting video processing upon error (by default, false).

- `stream_settings`: video stream settings that duplicate *those* in the `/etc/findface-video-manager.conf` configuration file (while having priority over them).
- `status`: job status.
- `msg`: additional job status info.
- `statistic`: job progress statistics (progress duration, number of posted and not posted objects, processing fps, the number of processed and dropped frames, job start time, etc.).
- service and reference job information.

`findface-ntls`

The `findface-ntls` service is to be installed on a designated host to verify the FindFace license. For verification purposes, `findface-ntls` uses one of the following sources:

- Ntech Lab global license center if you opt for the online licensing, direct or via a proxy server.
- USB dongle if you opt for the on-premise licensing.

Use the FindFace Multi web interface (*Preferences* -> *License*) to manage `findface-ntls` in the following way:

- view the list of purchased features,
- view license limitations,
- upload a license file,
- view the list of currently active components.

The following components are licensable:

- `findface-tarantool-server`,
- `findface-extraction-api`,
- `findface-video-manager`,
- `findface-video-worker`.

Important: After connection between `findface-ntls` and a licensable component, or between `findface-ntls` and the global license server is broken, you will have 4 hours to restore it before the licensable components will be automatically stopped. It is possible to prolongate the off-grid period for up to 2 days. Inform your manager if you need that.

The `findface-ntls` configuration is done through a configuration file `/etc/findface-ntls.cfg`. You can find its default content `here`.

When configuring `findface-ntls`, refer to the following parameters:

Parameter	Description
`license_dir`	Directory to store a license file.
`listen`	IP address from which licensable services access `findface-ntls`. To allow access from any IP address, use `0.0.0.0:3133`.
`proxy`	(Optional) IP address and port of your proxy server.
`ui`	IP address from which accessing the `findface-ntls` web interface must originate. To allow access from any remote host, set “0.0.0.0”.

`findface-security`

The `findface-security` component serves as a gateway to the FindFace core. It provides interaction between the FindFace Core and the web interface, the system functioning as a whole.

The `findface-security` component also performs the functions of `findface-facerouter` (part of the FindFace Core), setting processing directives for detected objects. It accepts an object bbox and normalized image along with the original image and other data (for example, the detection date and time) from the `findface-video-worker` service and redirect them to `findface-sf-api` for further processing.

The `findface-security` configuration is done through the `/etc/findface-security/config.py` configuration file. You can find its default content `here`.

The `/etc/findface-security/config.py` file has detailed comments for each setting. Refer to them when configuring `findface-security`.

`findface-facerouter` and Custom Plugins

Important: The `findface-facerouter` is not included in the FindFace Multi standard configuration. Use it for integration if necessary.

The `findface-facerouter` service sets processing directives for objects detected in the video. The directives are set through custom plugins.

The `findface-facerouter` service accepts an object bbox and normalized image along with the original image and other data (for example, the detection date and time) from the `findface-video-worker` service.

In general, `findface-facerouter` allows you to apply arbitrary processing directives to the received objects, including directly sending objects to a partner application. In FindFace Multi, the `findface-facerouter` functions are performed by the `findface-security` service that redirects the objects to `findface-sf-api`.

Functionality:

- sets processing directives for objects detected in the video,
- redirects objects detected in the video to `findface-sf-api` or other service (including a third-party application) for further processing.

The `findface-facerouter` configuration is done through a configuration file `/etc/findface-facerouter.py`. You can find its default content `here`.

When configuring `findface-facerouter`, refer to the following parameters:

Parameter	Description
`sfapi_url`	IP address and port of the `findface-sf-api` host.
`plugin_dir`	Directory with plugins to define object processing directives.

Deploy `findface-facerouter` in FindFace Multi

To deploy the `findface-facerouter` component, do the following:

1. Install `findface-facerouter` either from the *console installer* or from the apt repository as such:

```
sudo apt update
sudo apt install -y findface-facerouter
```

2. Open the `/etc/findface-facerouter.py` configuration file.

```
sudo vi /etc/findface-facerouter.py
```

3. If the `findface-facerouter` and `findface-sf-api` components are installed on different hosts, uncomment the `sfapi_url` parameter and specify the `findface-sf-api` host IP address.

```
sfapi_url                    = 'http://localhost:18411'
```

4. Open the `/etc/findface-security/config.py` configuration file. In the `ROUTER_URL` parameter, actualize the `findface-facerouter` IP address and port (18820 by default). Specify either external or internal IP address, subject to the network through which `findface-video-worker` interacts with `findface-facerouter`.

```
sudo vi /etc/findface-security/config.py

...
FFSECURITY = {
   'ROUTER_URL': 'http://127.0.0.1:18820/v0/frame?',
```

5. Enable the `findface-facerouter` service autostart and launch the service.

```
sudo systemctl enable findface-facerouter.service && sudo systemctl start findface-
↪facerouter.service
```

6. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

Configure `findface-facerouter` to Use Plugins

Important: Be sure to *change* the Tarantool database structure prior, according to the processing directive in the plugin.

Important: The `findface-facerouter` component must be *installed and configured*.

To configure `findface-facerouter` to use plugins, do the following:

1. Put a plugin into a directory of your choice. All plugins in use have to be in the same directory.
2. Open the `/etc/findface-facerouter.py` configuration file. Uncomment the `plugin_dir` parameter and specify the plugin directory.

Warning: The `findface-facerouter.py` content must be correct Python code.

```
sudo vi /etc/findface-facerouter.py

plugin_dir                    = '/etc/findface/plugins/'
```

3. Restart `findface-facerouter`.

```
sudo systemctl restart findface-facerouter.service
```

Plugin Basics

In this section:

Plugin Architecture

After the `findface-video-worker` component detects a face, the face is posted to the `findface-facerouter` component via an HTTP API request. To process this request, each `findface-facerouter` plugin must export the `activate(app, ctx, plugin_name, plugin_source)` function.

The `activate` function has the following parameters:

- `app`: a `tornado.web.Application` entity of the `findface-facerouter` component.
- `ctx`: data context to be passed to a plugin upon activation.
- `plugin_name`: the name of the plugin to be activated.
- `plugin_source`: source object to load the plugin from.

Upon activation, a plugin is passed the following data context:

1. `request.ctx.sfapi`: a set up `ntech.sfapi_client.Client` instance that can be invoked directly to process the result of video face detection (for example, to create a new gallery, add a face to a gallery, etc.).
2. `plugins`: `OrderedDict` with all the plugins as (`key`: plugin name, `value`: the result returned by the `activate` function).
3. `idgen`: id generator that can be invoked as `ctx.idgen()`.

The `activate(app, ctx, plugin_name, plugin_source)` function must return an object with the following methods:

1. `preprocess`,
2. `process`,
3. `shutdown` (optional).

The `preprocess` method

In this method, a `findface-facerouter` plugin decides if it is interested in the face received from the `findface-video-worker` component. If so, it returns a tuple or a list that contains one or several strings `'facen'`, `'gender'`, `'age'`, `'emotions'`. This means that it is necessary to extract a feature vector, recognize gender, age, emotions respectively. If the returned tuple/list is non-empty, the `findface-facerouter` redirects the face to the `findface-sf-api` in a `/detect POST` request with relevant query string parameters (`facen=on`, `gender=on`, `age=on`, `emotions=on`).

The basic `preprocess` method to inherit from has the following syntax (see the `Plugin` class):

`preprocess`(*self*, *request: FrHTTPRequest*, *labels: Mapping[str, str]*) → Tuple[str]

Parameters

- **`FrHTTPRequest`** (*`tornado.httpserver.HTTPRequest`*) – a HTTP API request that includes an extra argument `params`
- **`labels`** (*`dictionary`*) – a custom set of a frame labels, which are initially specified in a job parameters for `findface-video-worker` and then assigned to the frame

The `params` argument of FrHTTPRequest includes the following fields:

Parameters

- **`photo`** (*`bytes`*) – JPEG video frame featuring a detected face
- **`face0`** (*`bytes`*) – normalized face image
- **`bbox`** (list of integers [[x1,y1,x2,y2]], where `x1`: x coordinate of the top-left corner, `y1`: y coordinate of the top-left corner, `x2`: x coordinate of the bottom-right corner, `y2`: y coordinate of the bottom-right corner) – coordinates of the face region in the video frame
- **`cam_id`** (*`string`*) – camera id
- **`timestamp`** (*`datetime.datetime`*) – video frame timestamp
- **`detectorParams`** (*`dictionary`*) – debug information from the video face detector
- **`bs_type`** (*`string`*) – best face search mode. Available options: overall (the `findface-video-worker` posts only one snapshot per track, but of the highest quality.), realtime (the `findface-video-worker` posts the best snapshot within each of consecutive time intervals).
- **`labels`** (*`dictionary`*) – (duplicates params.labels) a custom set of a frame labels, which are specified in a job parameters for `findface-video-worker` and then assigned to the frame

The decision about face processing is made based on the data in the `request.params`, including the custom set of labels, as well as for any other reasons.

The `process` method

This method is called if the `preprocess` method returns a non-empty tuple or list (i.e. with ‘facen’, ‘gender’, ‘age’, an/or ‘emotions’ strings). After the `findface-sf-api` returns a response with the result of face detection (see the `/detect POST` request) with all the requested face features, the `findface-facerouter` component calls the `process` method of the plugin in order to the perform face processing itself.

To process a face, a plugin uses `request.ctx.sfapi`.

The basic `process` method to inherit from has the following syntax (see the `Plugin` class):

> **`process`**(*self*, *request: FrHTTPRequest*, *photo: bytes*, *bbox: List[int]*, *event_id: int*, *detection: DetectFace*)

The `shutdown` method

This method is only called before the `findface-facerouter` shutdown.

The basic `shutdown` method to inherit from has the following syntax (see the `Plugin` class):

> **`shutdown`**(*self*)

Plugin Classes and Methods

In this section:

Basic Classes

`class facerouter.plugin.`**`Plugin`**

Provides the basic methods for writing a plugin (see *Plugin Basics*). A custom class that wraps a plugin must inherit from the `Plugin` class.

`preprocess`(*self*, *request: FrHTTPRequest*, *labels: Mapping[str, str]*) → Tuple[str]

Returns a tuple that contains one or several strings `'facen'`, `'gender'`, `'age'`, `'emotions'`. This means that `findface-facerouter` must request `findface-extraction-api` to extract a biometric sample, recognize gender, age, emotions respectively.

Parameters

- **`FrHTTPRequest`** (*`tornado.httpserver.HTTPRequest`*) – a HTTP API request that includes an extra argument `params`
- **`labels`** (*`dictionary`*) – a custom set of a frame labels from `request.params`

Returns
one or several strings `'facen'`, `'gender'`, `'age'`, `'emotions'`

Return type
tuple

The `params` argument of `FrHTTPRequest` includes the following fields:

Parameters

- **photo** (*bytes*) – JPEG video frame featuring a detected face
- **face0** (*bytes*) – normalized face image
- **bbox** (list of integers [[x1,y1,x2,y2]], where `x1`: x coordinate of the top-left corner, `y1`: y coordinate of the top-left corner, `x2`: x coordinate of the bottom-right corner, `y2`: y coordinate of the bottom-right corner) – coordinates of the face region in the video frame
- **cam_id** (*string*) – camera id
- **timestamp** (*datetime.datetime*) – video frame timestamp
- **detectorParams** (*dictionary*) – debug information from the video face detector
- **bs_type** (*string*) – best face search mode. Available options: overall (the `findface-video-worker` posts only one snapshot per track, but of the highest quality.), realtime (the `findface-video-worker` posts the best snapshot within each of consecutive time intervals).
- **labels** (*dictionary*) – (duplicates params.labels) a custom set of a frame labels, which are specified in a job parameters for `findface-video-worker` and then assigned to the frame

process(*self*, *request: FrHTTPRequest*, *photo: bytes*, *bbox: List[int]*, *event_id: int*, *detection:* DetectFace)

Accepts the detected face features.

Parameters

- **request** (*tornado.httpserver.HTTPRequest*) – a HTTP API request from `findface-video-worker`
- **photo** (*bytes*) – JPEG video frame featuring a detected face, from `request.params`
- **bbox** (list of integers [[x1,y1,x2,y2]], where `x1`: x coordinate of the top-left corner, `y1`: y coordinate of the top-left corner, `x2`: x coordinate of the bottom-right corner, `y2`: y coordinate of the bottom-right corner) – coordinates of the face region in the video frame, from `request.params`
- **event_id** (*uint64*) – id of the face automatically set by `findface -facerouter` upon receiving it from `findface-video-worker`. Can be used as a face custom identifier in the biometric database.
- **detection** (`objects.DetectFace`) – detection result received from `findface-sf-api`, that contains requested face features such as faces, gender, age and emotions.

Returns
n/a

Return type
n/a

`shutdown`(*self*)

This method is invoked before the `findface-facerouter` shutdown.

Parameters
n/a

Returns
n/a

Object Classes

class `objects.BBox`

Represents coordinates of the rectangle around a face.

class `objects.DetectFace`

Represents a detection result with the following fields:

Parameters

- **id** (*string*) – id of the detection result in memcached
- **bbox** (*objects.Bbox*) – coordinates of the rectangle around a face
- **features** (*dictionary*) – (optional) information about gender, age and emotions

class `objects.DetectResponse`

Represents a list of `objects.DetectionFace` objects with an additional field `orientation` featuring information about the face EXIF orientation in the image.

Parameters
orientation (*EXIF orientation*) – orientation of a detected face

class `objects.FaceId`(*namedtuple('FaceId', ('gallery', 'face'))*)

Represents a custom face identifier object in the gallery.

Parameters

- **gallery** (*string*) – gallery name
- **face** (*integer*) – custom face identifier in the gallery

class `objects.Face`

Represents a result of database search by biometric sample

Parameters

- **id** (`objects.FaceId`) – FaceId object.
- **features** (*dictionary*) – information about gender, age and emotions
- **meta** (*dictionary*) – face meta data
- **confidence** (*float*) – similarity between the biometric sample and a face in the search result

class `objects.ListResponse`

Represents a list of `objects.Face` objects (i.e. a list of biometric sample search results) with an additional field `next_page` featuring the cursor for the next page with search results.

Parameters
next_page (*string*) – cursor for the next page with search results

Face Detection and Gallery Management

class `ntech.sfapi_client.client.`**`Client`**

Represents basic methods to detect faces in images and work with galleries.

`detect`(*self*, ***, *url=None*, *image=None*, *facen=False*, *gender=False*, *age=False*, *emotions=False*, *return_facen=False*, *autorotate=False*, *detector: str = None*, *timeout=None*) → *DetectResponse*

Detects a face and returns the result of detection.

Parameters

- **`url`** (*URL*) – image URL if you pass an image that is publicly accessible on the internet
- **`image`** (*`bytes`*) – PNG/JPG/WEBP image file is you pass an image as a file
- **`facen`** (*`boolean`*) – extract a biometric sample from the detected face. To save the detection result in memcached pass `facen=True`
- **`gender`** (*`boolean`*) – extract and return information about gender
- **`age`** (*`boolean`*) – extract and return information about age
- **`emotions`** (*`boolean`*) – extract and return information about emotions
- **`return_facen`** (*`boolean`*) – return facen in the method result
- **`autorotate`** (*`boolean`*) – automatically rotate the image in 4 different orientations to detect faces in each of them. Overlapping detections with IOU > 0.5 will be merged
- **`detector`** (*`boolean`*) – nnd or normalized. The `normalized` detector is used to process normalized images, for example, those which are received from `fkvideo_worker`.
- **`timeout`** (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns

Detection result

Return type

`DetectorResponse` object.

`gallery`(*self*, *name*)

Returns a gallery object `sfapi_client.Gallery` to refer to it later (for example, to list gallery faces).

Parameters

`name` (*`string`*) – gallery name

Returns

a gallery object

Return type

sfapi_client.Gallery

`list_galleries(self, timeout=None):`

Returns the list of galleries.

Parameters

`timeout` (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns

list of galleries with the fields `name` (a gallery name, string) and `number` (the number of faces in the gallery, number)

Return type
list of GalleryListItem

class `ntech.sfapi_client.gallery.`**`Gallery`**

Provides methods to work with galleries and faces.

`list`(*self*, *, *filters: Iterable[*filters.Filter*] = None*, *limit: int = 1000*, *sort: str = ''*, *page=None*, *ignore_errors=False*, *timeout=None*) → *ListResponse*

Returns a list-like object with faces from the gallery, that match the given filters. The returned list-like object has an additional property `next_page` which can be used as a value for the `page` parameter in next requests.

Parameters

- **`filters`** (`sfapi_client.filters.Filter`) – list of filters
- **`limit`** (*`integer`*) – maximum number of returned faces
- **`sort`** (*`string`*) – sorting order. Pass one of the following values: `id`: increasing order by id, `-id`: decreasing order by id (sorting by id is used if you have NOT specified a feature vector to search for), `-confidence`: decreasing order by face similarity (only if you have specified a feature vector to search for). By default, the method uses the `id` order (no feature vector specified), or `-confidence` (with feature vector).
- **`page`** – cursor of the next page with search results. The `page` value is returned in the response in the `next_page` parameter along with the previous page results.
- **`ignore_errors`** (*`boolean`*) – By default, if one or several `findface-tarantool-server` shards are out of service during face identification, `findface-sf-api` returns an error. Enable this Boolean parameter to use available `findface-tarantool-server` shards to obtain face identification results.
- **`timeout`** (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
list with faces from the gallery, that match the given filters.

Return type
ListResponse object

`add`(*self*, *new_id: Union[int, Callable]*, *source: Union[*DetectFace, Face, *str]*, *, *meta: Dict[str, Union[int, str, List[str]]] = None*, *regenerate_attempts=None*, *timeout=None*) → *Face*

Creates a face in the gallery.

Parameters

- **`new_id`** (*`integer or callable`*) – custom face identifier (Face ID) in the database gallery. May be a (async) callable which returns the id. To generate id, you can use the `ctx.idgen()` function delivered with the context.
- **`source`** (*`sfapi_client.DetectFace, sfapi_client.Face, sfapi_client.FaceId, or string`*) – face source: create a face using another face in the database or a detection result as a source.
- **`meta`** (*`dictionary`*) – face metadata. Keys must be strings and values must be either ints, strings or lists of strings. Metadata keys and types must be previously specified in the storage configuration files (`/etc/tarantool/instances.available/*.lua`).
- **`regenerate_attempts`** – number of attempts to regenerate a unique Face ID with the `ctx.idgen()` function if new_id is callable

- **`timeout`** (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
representation of the newly created face

Return type
Face object

`delete`(*self*, *face: Union[Face, int]*, *timeout=None*) → None

Removes a face from the gallery.

Parameters

- **`face`** (*`sfapi_client.Face, sfapi_client.FaceId or id in integer`*) – face to be removed
- **`timeout`** (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
None

`get`(*self*, *face: Union[Face, int]*, *timeout=None*) → *Face*

Retrieves a face from the gallery.

Parameters

- **`face`** (*`sfapi_client.Face, sfapi_client.FaceId or id in integer`*) – face to be retrieved
- **`timeout`** (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
representation of the face

Return type
Face object

`create`(*self*, *timeout=None*) → None

Creates a gallery in `findface-sf-api` as a `sfapi_client.Gallery` object. Being a proxy object, `sfapi_client.Gallery` doesn't require a gallery to be existing on the server.

Parameters
`timeout` (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
None

`drop`(*self*, *timeout=None*) → None:

Removes a gallery from `findface-sf-api`.

Parameters
`timeout` (*`number`*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
None

update(*self*, *face: Union[Face, str]*, ***, *meta: Dict[str, Union[int, str, List[str]]] = None*, *timeout=None*) → *Face*

Update face meta data in the gallery.

Parameters

- **face** (*sfapi_client.Face, sfapi_client.FaceId or id in integer*) – face to be updated
- **meta** (*dictionary*) – face meta data to be updated. Keys must be strings and values must be either ints, strings or lists of strings. If a meta string is not passed or passed as null, it won't be updated in the database.
- **timeout** (*number*) – FindFace core response timeout, in seconds (if `none`, the default value is used)

Returns
representation of the updated face

Return type
Face object

Filters for Database Search

class `ntech.sfapi_client.filters.`**Filter**

Generic class. Represents a list of filters (with assigned values) that have to be applied to the gallery content.

serialize(*self*)

Method that passes the list of filters with assigned values to the `findface-sf-api` component.

Returns
filter names and filter values

Return type
tuple ('filtername', ["value1", "value2"]).

class `ntech.sfapi_client.filters.`**Id**

Represents methods for filtering gallery content by id. Don't instantiate, use relevant classmethods to call a filter.

classmethod lte(*cls*, *value: int*) → *Filter*

LTE filter. Select all faces with `id` less or equal to `value`.

Parameters
value (*integer*) – id value

Returns
filter name (LTE) and its value.

Return type
object of `Filter` class.

Example: `Id.lte(1234)` selects faces with id less or equal to `1234`.

classmethod gte(*cls*, *value: int*) → *Filter*

GTE filter. Select all faces with `id` greater or equal to `value`.

Parameters
value (*integer*) – id value

Returns
filter name (GTE) and its value.

Return type
object of `Filter` class.

Example: `Id.lte(1234)` selects faces with id greater or equal to `1234`.

`classmethod oneof`(*cls*, **value: Union[int]*) → *Filter*

IN filter. Select a face(s) with id from a given set.

Parameters
value (*list of integers*) – list of id values

Returns
filter name (IN) and its value.

Return type
object of `Filter` class.

Example: `Id.oneof(1234, 5678)` selects a face(s) with id `1234` and/or `5678`.

`class ntech.sfapi_client.filters.Meta`

Represents methods for filtering gallery content by metadata. Don't instantiate, use relevant classmethods to call a filter.

`classmethod lte`(*self*, *value: Union[str, int]*) → *Filter*

LTE filter. Select all faces with a metastring less or equal to `value`

Parameters
value (*string or integer*) – metastring value

Returns
filter name (LTE) and its value.

Return type
object of `Filter` class.

Example: `Meta('foo').lte(1234)` selects faces with a metastring `foo` less or equal to `1234`.

`classmethod gte`(*self*, *value: Union[str, int]*) → *Filter*

GTE filter. Select all faces with a metastring greater or equal to `value`

Parameters
value (*string or integer*) – metastring value

Returns
filter name (GTE) and its value.

Return type
object of `Filter` class.

Example: `Meta('foo').gte(1234)` selects faces with a metastring `foo` greater or equal to `1234`.

`classmethod oneof`(*self*, **value: Union[str, int]*) → *Filter*

IN filter. Select a face(s) with a metastring from a given set.

Parameters
value (*list of strings or integers*) – list of metastring values

Returns
filter name (IN) and its value.

Return type
object of `Filter` class.

Example: `Meta.oneof(1234, 5678)` selects a face(s) with a metastring `1234` and/or `5678`.

classmethod subset(*self*, **value: str*) → *Filter*

SUBSET filter. Select all faces with a metastring featuring all values from a given set.

Parameters
value (*list of strings or integers*) – list of metastring values

Returns
filter name (SUBSET) and its value.

Return type
object of `Filter` class.

Example: `Meta('foo').subset("male", "angry")` selects face with a metastring `foo` featuring all values from the set [“male”, “angry”].

class ntech.sfapi_client.filters.**Detection**(*Filter*)

Represents a method that identifies a detected face (searches the database for similar faces).

__init__(*self*, *id: Union[str, objects.DetectFace]*, *threshold: float*)

Parameters

- **id** (`objects.DetectFace` or temporary face id in memcached returned by sfapi_client.Client.detect(), string) – face (detection result) to be identified
- **threshold** (*float*) – identification threshold similarity between faces from 0 to 1.

Example: `Detection(det1, 0.77)` selects faces similar to the detection result `det1` with similarity greater or equal to `0.77`.

class ntech.sfapi_client.filters.**Face**(*Filter*)

Represents a method that searches the database for faces similar to a given face from a gallery.

__init__(*self*, *id: Union[str, objects.Face]*, *threshold: float*)

Parameters

- **id** (`objects.Face`, `objects.FaceId` or custom face id in the gallery, string) – face from a gallery to be identified
- **threshold** (*float*) – identification threshold similarity between faces from 0 to 1.

Example: Detection(FaceId(“gal1”, 1234), 0.77) selects faces similar to the face 1234 from the `gal1` gallery with similarity greater or equal than 0.77.

Several Filters Usage Example

```
filters=[filters.Id.gte(123456), filters.Meta('age').gte(45), filters.Meta('camera').
↪oneof('abc', 'def')]
```

Display Error Messages

class sfapi_client.**SFApiRemoteError**

This error message appears if the error occurred for a reason other than a network failure.

The error body always includes at least two fields:

- `code` is a short string in `CAPS_AND_UNDERSCORES`, usable for automatic decoding.
- `reason` is a human-readable description of the error and should not be interpreted automatically.

Common Error Codes

Error code	Description
UNKNOWN_ERROR	Error with unknown origin.
BAD_PARAM	The request can be read, however, some method parameters are invalid. This response type contains additional attributes `param` and``value`` to indicate which parameters are invalid.
CONFLICT	Conflict.
EXTRACTION_ERROR	Error upon a face feature vector extraction.
LICENSE_ERROR	The system configuration does not match license.
MALFORMED_REQUEST	The request is malformed and cannot be read.
OVER_CAPACITY	The `findface-extraction-api` queue length has been exceeded.
SOURCE_NOT_FOUND	The face in the `from` parameter does not exist.
SOURCE_GALLERY_NOT_FOUND	The gallery in the `from` parameter does not exist.
STORAGE_ERROR	The biometric database not available.
CACHE_ERROR	Memcached not available.
NOT_FOUND	Matching faces not found.
NOT_IMPLEMENTED	This functionality not implemented.
GALLERY_NOT_FOUND	Matching galleries not found.

class sfapi_client.**SFApiMalformedResponseError**

This error message appears if the error occurred due to a network failure, or if Client was unable to read an API response from `findface-sf-api`.

Video Recorder: `findface-video-storage` and `findface-video-streamer-cpu`

Video Recorder is an optional part of the FindFace Core. It works in the following way:

- The `findface-video-storage` service implements video chunk management. It takes video chunks from the `findface-video-worker` component, puts them into the storage (`findface-upload`), and writes their meta-information and whereabouts to the Video Recorder database (MongoDB). By request from `findface-security`, it issues information about existing video chunks in the form of Websocket-links to the corresponding streams. These links are further used by `findface-video-streamer-cpu` to deliver the video to a user for viewing and downloading.
- By request from `findface-security-ui`, the `findface-video-streamer-cpu` service extracts requested video chunks from `findface-video-storage` and `findface-video-worker` (only the last chunk if it's not yet recorded to the storage). Then it merges the video chunks into a one-piece video and delivers it to a user for viewing and downloading.

The `findface-video-storage` configuration is done through the `/etc/findface-video-storage.conf` configuration file. You can find its default content `here`.

The `findface-video-streamer-cpu` configuration is done through the `/etc/findface-video-streamer-cpu.ini` configuration file. You can find its default content `here`.

To configure Video Recorder, refer to *this section*.

2.9.2 Installation File

FindFace Multi installation configuration is automatically saved to a file `/tmp/<findface-installer-*>.json`. You can edit this file and use it to install FindFace Multi on other hosts without having to answer the installation questions again.

Tip: See *Deploy from Console Installer* to learn more about the FindFace Multi installer.

Important: Be sure to remove fields `*.config`, `exp_ip`, and `int_ip` before installing FindFace Multi on a host with a different IP address.

Here is an example of the `installation file`.

2.9.3 Neural Network Models

Here you can see a summary for neural network models created by our Lab and used in FindFace Multi.

You can find installed models at `/usr/share/findface-data/models/`.

Important: The default face biometrics model upon a clean install is `kiwi_320`.

Face detection

```
ls /usr/share/findface-data/models/facedet/

cheetah.cpu.fnk  cheetah_fast.cpu.fnk  cheetah_fast.gpu.fnk  cheetah.gpu.fnk
```

Face and body image normalization

```
ls /usr/share/findface-data/models/facenorm/

bee_fast.cpu.fnk  bee.v2.gpu.fnk                crop2x.v2_maxsize400.cpu.fnk  crop2x.v2_
↪no_maxsize.gpu.fnk
bee_fast.gpu.fnk  crop1x.v2_maxsize400.cpu.fnk  crop2x.v2_maxsize400.gpu.fnk  cropbbox.
↪v2.cpu.fnk
bee.v2.cpu.fnk    crop1x.v2_maxsize400.gpu.fnk  crop2x.v2_no_maxsize.cpu.fnk  cropbbox.
↪v2.gpu.fnk
```

Face recognition

```
ls /usr/share/findface-data/models/face/

kiwi_160.cpu.fnk  kiwi_320.cpu.fnk
kiwi_160.gpu.fnk  kiwi_320.gpu.fnk
```

Face attribute recognition

```
ls /usr/share/findface-data/models/faceattr/

age.v2.cpu.fnk    emotions.v1.cpu.fnk  glasses3.v0.cpu.fnk       liveness.pacs.v0.cpu.
↪fnk  quality.v1.cpu.fnk
age.v2.gpu.fnk    emotions.v1.gpu.fnk  glasses3.v0.gpu.fnk       liveness.pacs.v0.gpu.
↪fnk  quality.v1.gpu.fnk
beard.v0.cpu.fnk  gender.v2.cpu.fnk    liveness.colombo.cpu.fnk  medmask3.v2.cpu.fnk
beard.v0.gpu.fnk  gender.v2.gpu.fnk    liveness.colombo.gpu.fnk  medmask3.v2.gpu.fnk
```

Car detection

```
ls /usr/share/findface-data/models/cadet/

efreitor.cpu.fnk  efreitor.gpu.fnk
```

Car image normalization

```
ls /usr/share/findface-data/models/carnorm/

anaferon.v3.cpu.fnk  anaferon.v3.gpu.fnk
```

Car recognition

```
ls /usr/share/findface-data/models/carrec/

alonso.cpu.fnk  alonso.gpu.fnk
```

Car attribute recognition

```
ls /usr/share/findface-data/models/carattr/

carattr.license_plate_quality.v0.cpu.fnk  carattr.quality.v0.cpu.fnk        description.
↪v0.cpu.fnk
carattr.license_plate_quality.v0.gpu.fnk  carattr.quality.v0.gpu.fnk        description.
↪v0.gpu.fnk
carattr.license_plate.v4.cpu.fnk          carattr.special_types.v0.cpu.fnk
carattr.license_plate.v4.gpu.fnk          carattr.special_types.v0.gpu.fnk
```

Body detection

```
ls /usr/share/findface-data/models/pedet/

glenn_005.cpu.fnk  glenn_005.gpu.fnk  glenny_005_fast.cpu.fnk  glenny_005_fast.gpu.fnk
```

Body recognition

```
ls /usr/share/findface-data/models/pedrec/

andariel.cpu.fnk  andariel.gpu.fnk
```

Body attribute recognition

```
ls /usr/share/findface-data/models/pedattr/

pedattr.clothes_type.v0.cpu.fnk  pedattr.color.v1.cpu.fnk  pedattr.quality.v0.cpu.fnk
pedattr.clothes_type.v0.gpu.fnk  pedattr.color.v1.gpu.fnk  pedattr.quality.v0.gpu.fnk
```

2.9.4 FindFace Multi Data Storages

In this section:

List of Storages

FindFace Multi uses the following data storages:

- Tarantool-based feature vector database that stores object feature vectors and events.
- PostgreSQL-based main system database `ffsecurity` that stores internal system data, cards, user accounts, and camera settings.
- The `/var/lib/findface-security/uploads` directory that stores uploaded card photos, video files, full frames of events and counters, and object thumbnails.
- The `/var/lib/ffupload/` directory that stores such event artifacts as normalized object images.

  Note: It also stores video chunks if you are using *Video Recorder*.

- (Only with Video Recorder) MongoDB-based database that stores meta-information of the video chunks, including their exact location in the storage, `/var/lib/ffupload/`.

Feature Vector Database Galleries

There are the following galleries in the Tarantool-based feature vector database:

- `ffsec_body_events`: feature vectors extracted from bodies detected in the video.
- `ffsec_body_objects`: feature vectors extracted from body images uploaded to the card index.
- `ffsec_body_clusters`: centroids of body clusters.
- `ffsec_car_events`: feature vectors extracted from cars detected in the video.
- `ffsec_car_objects`: feature vectors extracted from car images uploaded to the card index.
- `ffsec_car_clusters`: centroids of car clusters.
- `ffsec_face_events`: feature vectors extracted from faces detected in the video.
- `ffsec_face_objects`: feature vectors extracted from face images uploaded to the card index.
- `ffsec_face_clusters`: centroids of face clusters.
- `ffsec_user_face`: feature vectors extracted from the FindFace Multi users' photos for face-based authentication.

2.9.5 Backup Options

To backup the feature vector database, you need the `findface-storage-api-dump` utility. It can be launched with the following options:

Note: You can find the detailed information on the `findface-storage-api-dump` usage in *Back Up and Recover FindFace Multi and Its Data*.

```
findface-storage-api-dump --help

...
Command line flags:
  -cache string
            Cache type: inmemory, redis or memcache (default "memcache")
  -cache-inmemory-size int
            Maximum number of items in ARC cache (default 16384)
  -cache-memcache-dns-cache-timeout duration
            DNS cache timeout (default 1m0s)
  -cache-memcache-nodes value
            Comma-separated list of memcache shards (default 127.0.0.1:11211)
  -cache-memcache-timeout duration
            Specifies read/write timeout (default 100ms)
  -cache-redis-db int
            Database to be selected after connecting to the server.
  -cache-redis-network string
            Network type, either tcp or unix (default "tcp")
  -cache-redis-nodes value
            Array of Host:Port addresses (default localhost:6379)
  -cache-redis-password string
            Optional password. Must match the password specified in the requirepass␣
↪server configuration option.
```

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```
  -cache-redis-timeout duration
            Specifies dial/read/write timeout (default 5s)
  -config string
            Path to config file
  -config-template
            Output config template and exit
  -continue-on-errors
            Continue on errors instead of exiting
  -cpu-profile string
            Enable CPU profile and set output file
  -debug
            Enable debug logging
  -extraction-api-extraction-api string
            Extraction API address (default "http://127.0.0.1:18666")
  -extraction-api-keepalive duration
            keep-alive connection timeout (default 24h0m0s)
  -extraction-api-max-idle-conns-per-host int
            max idle keep-alive connections per host (default 20)
  -extraction-api-timeouts-connect duration
            extraction-api-timeouts-connect (default 5s)
  -extraction-api-timeouts-idle-connection duration
            extraction-api-timeouts-idle-connection (default 10s)
  -extraction-api-timeouts-overall duration
            extraction-api-timeouts-overall (default 35s)
  -extraction-api-timeouts-response-header duration
            extraction-api-timeouts-response-header (default 30s)
  -extraction-api-trace
            Enable HTTP tracing (extremely verbose, slows everything down considerably)
  -help
            Print help information
  -limits-allow-return-facen
            Allow returning raw feature vectors to detect responses if ?return_
↪facen=true (v2) or ?return_emben=true (v3)
  -limits-body-image-length int
            Maximum length of image supplied in request body (default 33554432)
  -limits-deny-networks string
            Comma-separated list of subnets that are not allowed to fetch from (default
↪"127.0.0.0/8,192.168.0.0/16,10.0.0.0/8,::1/128,fe00::/8")
  -limits-url-length int
            Maximum supported url length in bytes (default 4096)
  -listen string
            IP:port to listen on (default ":18411")
  -normalized-storage-enabled
            Enables normalize saving (default true)
  -normalized-storage-s3-access-key string
            Access key for the object storage
  -normalized-storage-s3-bucket-name string
            S3 storage bucket name
  -normalized-storage-s3-endpoint string
            S3 compatible object storage endpoint
  -normalized-storage-s3-operation-timeout int
            Storage operations (Get,Put,Delete) timeout in seconds (default 30)
```

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```
  -normalized-storage-s3-public-url string
            Storage public url
  -normalized-storage-s3-region string
            Storage region
  -normalized-storage-s3-secret-access-key string
            Secret key for the object storage
  -normalized-storage-s3-secure
            If 'true' API requests will be secure (HTTPS), and insecure (HTTP)␣
↪otherwise (default true)
  -normalized-storage-webdav-keepalive duration
            keep-alive connection timeout (default 24h0m0s)
  -normalized-storage-webdav-max-idle-conns-per-host int
            max idle keep-alive connections per host (default 20)
  -normalized-storage-webdav-timeouts-connect duration
            normalized-storage-webdav-timeouts-connect (default 5s)
  -normalized-storage-webdav-timeouts-idle-connection duration
            normalized-storage-webdav-timeouts-idle-connection (default 10s)
  -normalized-storage-webdav-timeouts-overall duration
            normalized-storage-webdav-timeouts-overall (default 35s)
  -normalized-storage-webdav-timeouts-response-header duration
            normalized-storage-webdav-timeouts-response-header (default 30s)
  -normalized-storage-webdav-trace
            Enable HTTP tracing (extremely verbose, slows everything down considerably)
  -normalized-storage-webdav-upload-url string
            webdav storage for normalized, disable normalized if empty string (default
↪"http://127.0.0.1:3333/uploads/")
  -normalized_storage string
            Normalized storage type: webdav, s3 (default "webdav")
  -objects value
            Supported object types (default face,body,car)
  -output-dir string
            Output directory (default ".")
  -storage-api-cooldown duration
            Cooldown timeout after communication error (default 2s)
  -storage-api-galleries-read-slave-first
            Prefer slaves over master for get/list galleries requests
  -storage-api-keepalive duration
            keep-alive connection timeout (default 24h0m0s)
  -storage-api-max-idle-conns-per-host int
            max idle keep-alive connections per host (default 20)
  -storage-api-max-slave-attempts int
            Give up after trying to read from max_slave_attempts slaves (default 2)
  -storage-api-read-slave-first
            Prefer slaves over master for requests
  -storage-api-read-slave-only
            Ignore master on read requests. If true: ReadSlaveFirst will be ignored
  -storage-api-timeouts-connect duration
            storage-api-timeouts-connect (default 5s)
  -storage-api-timeouts-idle-connection duration
            storage-api-timeouts-idle-connection (default 10s)
  -storage-api-timeouts-overall duration
            storage-api-timeouts-overall (default 35s)
```

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```
  -storage-api-timeouts-response-header duration
           storage-api-timeouts-response-header (default 30s)
  -storage-api-trace
           Enable HTTP tracing (extremely verbose, slows everything down considerably)

...
```

2.9.6 Restore Options

To restore the feature vector database from a backup, you need the `findface-storage-api-restore` utility. It can be launched with the following options:

Note: You can find the detailed information on the `findface-storage-api-restore` usage in *Back Up and Recover FindFace Multi and Its Data*.

```
findface-storage-api-restore --help

...
Command line flags:
  -cache string
        Cache type: inmemory, redis or memcache (default "memcache")
  -cache-inmemory-size int
        Maximum number of items in ARC cache (default 16384)
  -cache-memcache-dns-cache-timeout duration
        DNS cache timeout (default 1m0s)
  -cache-memcache-nodes value
        Comma-separated list of memcache shards (default 127.0.0.1:11211)
  -cache-memcache-timeout duration
        Specifies read/write timeout (default 100ms)
  -cache-redis-db int
        Database to be selected after connecting to the server.
  -cache-redis-network string
        Network type, either tcp or unix (default "tcp")
  -cache-redis-nodes value
        Array of Host:Port addresses (default localhost:6379)
  -cache-redis-password string
        Optional password. Must match the password specified in the requirepass server␣
↪configuration option.
  -cache-redis-timeout duration
        Specifies dial/read/write timeout (default 5s)
  -config string
        Path to config file
  -config-template
        Output config template and exit
  -cpu-profile string
        Enable CPU profile and set output file
  -debug
        Enable debug logging
  -dont-create-gallery
```

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```
      Don't create gallery, fail if doesn't exist
 -extraction-api-extraction-api string
      Extraction API address (default "http://127.0.0.1:18666")
 -extraction-api-keepalive duration
      keep-alive connection timeout (default 24h0m0s)
 -extraction-api-max-idle-conns-per-host int
      max idle keep-alive connections per host (default 20)
 -extraction-api-timeouts-connect duration
      extraction-api-timeouts-connect (default 5s)
 -extraction-api-timeouts-idle-connection duration
      extraction-api-timeouts-idle-connection (default 10s)
 -extraction-api-timeouts-overall duration
      extraction-api-timeouts-overall (default 35s)
 -extraction-api-timeouts-response-header duration
      extraction-api-timeouts-response-header (default 30s)
 -extraction-api-trace
      Enable HTTP tracing (extremely verbose, slows everything down considerably)
 -help
      Print help information
 -limits-allow-return-facen
      Allow returning raw feature vectors to detect responses if ?return_facen=true␣
↪(v2) or ?return_emben=true (v3)
 -limits-body-image-length int
      Maximum length of image supplied in request body (default 33554432)
 -limits-deny-networks string
      Comma-separated list of subnets that are not allowed to fetch from (default "127.
↪0.0.0/8,192.168.0.0/16,10.0.0.0/8,::1/128,fe00::/8")
 -limits-url-length int
      Maximum supported url length in bytes (default 4096)
 -listen string
      IP:port to listen on (default ":18411")
 -normalized-storage-enabled
      Enables normalize saving (default true)
 -normalized-storage-s3-access-key string
      Access key for the object storage
 -normalized-storage-s3-bucket-name string
      S3 storage bucket name
 -normalized-storage-s3-endpoint string
      S3 compatible object storage endpoint
 -normalized-storage-s3-operation-timeout int
      Storage operations (Get,Put,Delete) timeout in seconds (default 30)
 -normalized-storage-s3-public-url string
      Storage public url
 -normalized-storage-s3-region string
      Storage region
 -normalized-storage-s3-secret-access-key string
      Secret key for the object storage
 -normalized-storage-s3-secure
      If 'true' API requests will be secure (HTTPS), and insecure (HTTP) otherwise␣
↪(default true)
 -normalized-storage-webdav-keepalive duration
      keep-alive connection timeout (default 24h0m0s)
```

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```
  -normalized-storage-webdav-max-idle-conns-per-host int
        max idle keep-alive connections per host (default 20)
  -normalized-storage-webdav-timeouts-connect duration
        normalized-storage-webdav-timeouts-connect (default 5s)
  -normalized-storage-webdav-timeouts-idle-connection duration
        normalized-storage-webdav-timeouts-idle-connection (default 10s)
  -normalized-storage-webdav-timeouts-overall duration
        normalized-storage-webdav-timeouts-overall (default 35s)
  -normalized-storage-webdav-timeouts-response-header duration
        normalized-storage-webdav-timeouts-response-header (default 30s)
  -normalized-storage-webdav-trace
        Enable HTTP tracing (extremely verbose, slows everything down considerably)
  -normalized-storage-webdav-upload-url string
        webdav storage for normalized, disable normalized if empty string (default
↪"http://127.0.0.1:3333/uploads/")
  -normalized_storage string
        Normalized storage type: webdav, s3 (default "webdav")
  -objects value
        Supported object types (default face,body,car)
  -rename string
        Ignore dump header and use this string as gallery name
  -storage-api-cooldown duration
        Cooldown timeout after communication error (default 2s)
  -storage-api-galleries-read-slave-first
        Prefer slaves over master for get/list galleries requests
  -storage-api-keepalive duration
        keep-alive connection timeout (default 24h0m0s)
  -storage-api-max-idle-conns-per-host int
        max idle keep-alive connections per host (default 20)
  -storage-api-max-slave-attempts int
        Give up after trying to read from max_slave_attempts slaves (default 2)
  -storage-api-read-slave-first
        Prefer slaves over master for requests
  -storage-api-read-slave-only
        Ignore master on read requests. If true: ReadSlaveFirst will be ignored
  -storage-api-timeouts-connect duration
        storage-api-timeouts-connect (default 5s)
  -storage-api-timeouts-idle-connection duration
        storage-api-timeouts-idle-connection (default 10s)
  -storage-api-timeouts-overall duration
        storage-api-timeouts-overall (default 35s)
  -storage-api-timeouts-response-header duration
        storage-api-timeouts-response-header (default 30s)
  -storage-api-trace
        Enable HTTP tracing (extremely verbose, slows everything down considerably)
...
```

2.9.7 Direct API Requests to Tarantool

You can use HTTP API to extract object data (faces, bodies, cars) directly from the Tarantool Database.

Note: In the current implementation, Tarantool operates objects as faces. For example, to add an object, send `POST /:ver/faces/add/:name`.

In this section:

General Information

API requests to Tarantool are to be sent to `http://<tarantool_host_ip:port>`.

Tip: The port for API requests can be found in the `FindFace.start` section of the Tarantool configuration file `/etc/tarantool/instances.available/*.lua`:

```
cat /etc/tarantool/instances.available/*.lua

##8101:
FindFace.start("127.0.0.1", 8101)
```

Note: In the case of the standalone deployment, you can access Tarantool by default only locally (127.0.0.1). If you want to access Tarantool remotely, *alter* the Tarantool configuration file (`/etc/tarantool/instances.available/*.lua`).

API requests to Tarantool may contain the following parameters in path segments:

- `:ver`: API version (v2 at the moment).
- `:name`: gallery name.

By default, there are the following galleries in the Tarantool database:

- `ffsec_body_events`: feature vectors extracted from bodies detected in the video.

- `ffsec_body_objects`: feature vectors extracted from body images uploaded to the card index.
- `ffsec_body_clusters`: centroids of body clusters.
- `ffsec_car_events`: feature vectors extracted from cars detected in the video.
- `ffsec_car_objects`: feature vectors extracted from car images uploaded to the card index.
- `ffsec_car_clusters`: centroids of car clusters.
- `ffsec_face_events`: feature vectors extracted from faces detected in the video.
- `ffsec_face_objects`: feature vectors extracted from face images uploaded to the card index.
- `ffsec_face_clusters`: centroids of face clusters.
- `ffsec_user_face`: feature vectors extracted from the FindFace Multi users' photos for face-based authentication.

Tip: To list gallery names on a shard, type in the following command in the address bar of your browser:

```
http://<tarantool_host_ip:shard_port>/stat/list/1/99
```

The same command on the console is as such:

```
curl <tarantool_host_ip:shard_port>/stat/list/1/99 \| jq
```

You can also list gallery names by using a direct request to Tarantool:

```
echo 'box.space.galleries:select()' | tarantoolctl connect <tarantool_host_ip:shard_port>
```

Note that if there is a large number of shards in the system, chances are that a randomly taken shard does not contain all the existing galleries. In this case, just list galleries on several shards.

Add Object

```
POST /:ver/faces/add/:name
```

Parameters in body:

JSON-encoded array of objects with the following fields:

- `"id"`: object id in the gallery, uint64_t,
- `"facen"`: raw feature vector, base64,
- `"meta"`: object metadata, dictionary.

Returns:

- HTTP 200 and empty body on success.
- HTTP 404 if a gallery with the given name doesn't exist.
- HTTP with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -s 'http://localhost:8101/v2/faces/add/testgal' --data '
[
  {
    "id": 9223372036854776000,
    "facen": "qgI3vZRv/z...NpO9MdHavW1WuT0=",
    "meta": {
"cam_id": "223900",
"person_name": "Mary Ostin",

    }
  }
]
```

Response

```
HTTP/1.1 200 Ok
Content-length: 1234
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive
```

Remove Object

```
POST /v2/faces/delete/:name
```

Parameters in body:

JSON-encoded array of object ids to be removed

Returns:

- HTTP 200 and empty body on success.
- HTTP 404 if an object with the given id is not found in the gallery.
- HTTP with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D -  -s 'http://localhost:8101/v2/faces/delete/testgal' --data '[1, 4, 922, 3]'
```

Response

```
HTTP/1.1 200 Ok
Content-length: 111
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive
```

Object Search

```
POST /v2/faces/search/:name
```

Parameters in body:

JSON-encoded search request with the following fields:

- `limit`: maximum number of objects in the response.
- `sort`: sorting order. Pass one of the following values: `id`: increasing order by id, `-id`: decreasing order by id, `-score`: decreasing order by object similarity (only if you search for objects with similar feature vectors).
- `filter` (filters):
  - `facen`: (optional) search for objects with similar feature vectors. Pass a dictionary with the following fields: `data`: raw feature vector, base64; `score`: range of similarity between objects [threshold similarity; 1], where 1 is 100% match.
  - `id` and `meta/<meta_key>`: search by object id and metastring content. To set this filter, use the following operators:
    - `range`: range of values, only for numbers.
    - `set`: id or metastring must contain at least one value from a given set, for numbers and strings.
    - `subset`: id or metastring must include all values from a given subset, for numbers and strings.
    - `like`: by analogy with `like` in SQL requests: only 'aa%', '%aa', and '%aa%' are supported. Only for strings and set[string]. In the case of set[string], the filter will return result if at least one value meets the filter condition.
    - `ilike`: by analogy with `like` but case-insensitive, only for strings and set[string].

Returns:

- JSON-encoded array with objects on success. The value in the X-search-stat header indicates whether the fast index was used for the search: with_index or without_index.

  Note: Fast index is not used in API v2.

- HTTP with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -s 'http://localhost:8101/v2/testgal/search' --data '
{
        "limit": 2,
    "sort": {
                "score": -1
        },
        "filter": {
                "facen": {
                        "data": "qgI3vZRv/z0BQTk9rcirOyZrNpO9MdHavW1WuT0=",
                        "score": [0.75, 1]
                },
                "id": {
                        "range": [9223372036854000000, 9223372036854999000]
                },
                "meta": {
                        "person_id": {
                                "range": [444, 999]
                        },
                        "cam_id": {
                                "set": ["12767", "8632", "23989"]
                        }
                }
        }
}'
```

Response

```
HTTP/1.1 200 Ok
Content-length: 1234
X-search-stat: without_index
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive

{
  "results": [
    {
      "facen": " qgI3vZRv/z0BQTk9rcirOyZrNpO9MdHavW1WuT0=",
```

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```
      "meta": {
        "timestamp": 0,
        "photo_hash": "",
        "person_id": 777,
        "cam_id": "8632"
      },
      "score": 0.9964,
      "id": 9223372036854776000
    }
  ]
}
```

Edit Object Metadata and Feature Vector

```
POST /v2/faces/update/:name
```

Parameters in body:

JSON-encoded array with objects with the following fields:

- `"id"`: object id, uint64_t.
- `"facen"`: (optional) new feature vector, base64. If omitted or passed as `null`, the relevant field in the database won't be updated.
- `"meta"`: dictionary with metadata to be updated. If some metastring is omitted or passed as `null`, the relevant field in the database won't be updated.

Returns:

- HTTP 200 and dictionary with all object parameters, including not updated, on success.
- HTTP 404 and error description if an object with the given id doesn't exist.
- HTTP with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -s 'http://localhost:8101/v2/faces/update/sandbox' --data '[{"id":1,"facen
↪":null,"meta":{"m:timestamp":1848}}]'
```

Response

```
HTTP/1.1 200 Ok
Content-length: 151
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive

{"meta":{"m:timestamp":1848,"normalized_id":"1_b9pkrf00mjt6h1vmq1kg.png","m:cam_id":
↪"a9f7a973-f07e-469d-a3bd-41ddd510b26f","feat":"{\"score\":0.123}"}, "id":1, ... }
```

List Galleries

```
POST /v2/galleries/list
```

Returns:

JSON-encoded array with galleries with the following fields: `name`: gallery name, `faces`: number of objects in a gallery.

Example

Request

```
curl -D - -s -X POST http://localhost:8101/v2/galleries/list
```

Response

```
HTTP/1.1 200 Ok
Content-length: 42
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive

{
  "results": [
    {
      "name": "testgal",
      "faces": 2
    }
  ]
}
```

Get Gallery Info

```
POST /v2/galleries/get/:name
```

Returns:

- HTTP 200 and dictionary with gallery parameters on success.
- HTTP 404 and error description if a gallery with the given name doesn't exist.
- HTTP with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -s -X POST http://localhost:8101/v2/galleries/get/testgal
```

```
HTTP/1.1 200 Ok
Content-length: 11
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive

{"faces":2}
```

Create Gallery

```
POST /v2/galleries/add/:name
```

Returns:

- HTTP 200 and empty body on success.
- with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -X POST -s 'http://localhost:8101/v2/galleries/add/123'
```

Response

```
HTTP/1.1 200 Ok
Content-length: 111
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive
```

Remove Gallery

```
POST /v2/galleries/delete/:name
```

Returns:

- HTTP 200 and empty on success.
- with a status other than 200 and error description in the body on failure.

Example

Request

```
curl -D - -X POST -s 'http://localhost:8101/v2/galleries/delete/123'
```

Response

```
HTTP/1.1 204 No content
Content-length: 0
Server: Tarantool http (tarantool v1.7.3-673-g23cc4dc)
Connection: keep-alive
```

CHAPTER

THREE

USER'S GUIDE

This chapter describes how to work with the FindFace Multi web interface, including its advanced possibilities, and will be of interest to administrators, analysts, operators, and other users.

3.1 Getting Started

Once you have successfully *deployed and configured* FindFace Multi, it's time to open the *web interface*, and get started. In this chapter, you can find a recommended sequence of steps that will help you harness your system's complete functionality.

In this chapter:

3.1.1 Gear Up for Work

Perform the primary configuration of your system:

1. *Set up* the left side navigation bar.
2. *Choose* the language.

3.1.2 Organize Cameras

1. *Create a new camera group* or use the default one. A camera group is an entity that allows you to group cameras subject to their physical location. For example, cameras at the same entrance to a building can be combined into one camera group.
2. *Add cameras* to the camera group and *check their statuses*.

You may also need:

1. Configure your system to process video from the group of cameras at their physical location. It may come in handy in a distributed architecture. *Learn more*.
2. Consider enabling event deduplication if observation scenes of cameras within the group overlap. This feature allows you to exclude coinciding object recognition events among cameras belonging to the same group. *Learn more*.
3. *Enable video recording for selected cameras* (available with Video Recorder).

3.1.3 Organize Watch Lists and Card Index

1. *Create a new watch list* or use the default one. A watch list is an entity that allows you to classify objects (faces, bodies, cars) by arbitrary criteria, e.g., persona non grata, wanted, VIP, staff, etc.
2. Upload cards and add them in the watch list either *manually*, *in bulk via the web interface*, or use the *console bulk upload* function.

You may also need:

1. *Customize card content*. Create additional fields, tabs, and search filters.
2. *Create relations between cards* to improve your system analytical capacity.

3.1.4 Start Monitoring Objects

By default, FindFace Multi is monitoring only *unmatched objects*. To enable a watch list monitoring, make this list *active*. You can also turn on sound notifications and request manual acknowledgment for the events associated with the list.

You may also need:

1. *Enable automatic clustering of objects of the same origin*: face/body images belonging to the same person, images of the same car.
2. Support laws related to the processing of personal data of individuals (GDPR and similar). *Learn more*.

3.1.5 Organize Video Surveillance

Create a camera layout for essential video surveillance.

You may also need:

1. For advanced video surveillance, enable *Video Recorder*.

3.1.6 Count People and Cars. Measure Distance between People

Set up *counters* to count faces, bodies, and cars on connected cameras. You can also configure counters to measure distance between bodies. The Counters possibilities can apply to a wide range of situations, such as people counting in queues and waiting areas, monitoring public gatherings, crowding prevention, health protocol enforcement, traffic jam detection, and more.

3.1.7 Manage Areas

Create *areas* to monitor the presence of people there, using specific rules and schedules. Possible use cases: long queues prevention at retail outlets, theft prevention at enterprises during non-working hours, hazardous area control, work time tracking.

3.1.8 Analyze People

FindFace Multi provide a set of people-related analytical tools:

1. *Analyze* interactions. Examine a circle of people with whom a person has previously been in contact.
2. View 'know your customer' analytics (KYC). It is analytics on the number of visitors, their gender, average age, most frequently visited zones, and the character of visits (first-timers or returners). *Learn more*.

3.1.9 FindFace Multi in Action

1. *Automatically identify objects (faces, bodies, cars) in live video* and check them against watch lists. Work with the event history by using various filters.
2. Harness the *episodes*. An episode is a set of identification events that feature objects of the same origin (face and body images of the same person and images of the same car) detected within a certain period. As events on the *Events* tab show up in an arbitrary order, a large number of miscellaneous events can make the work challenging and unproductive. With the Episodes, the system uses AI to organize incoming events based on the objects similarity and detection time. This allows for the effortless processing of diverse events, even in large numbers.
3. Search for objects in the database of detected objects and card index. *Learn more*.
4. *Search archived videos* for objects under monitoring.

5. Manually *compare two objects* and verify that they match.
6. *Build* detailed reports on object recognition events, episodes, search events, clusters, counters, cameras, card index, KYC analytics, audit logs, and areas.

3.1.10 Basic Maintenance

1. *Configure* automatic cleanup of events, episodes, full frames, and other old data.
2. Manually *purge* old data.
3. Regularly *backup* the database.
4. *Harness* the FindFace Multi comprehensive and searchable audit logs to enhance your system protection.

3.1.11 Go Further

1. Set up *webhooks* to automatically send notifications about specific events, episodes, counter records, and areas to a given URL. In this case, when such an event occurs, FindFace Multi will send an HTTP request to the URL configured for the webhook. You can use webhooks for various purposes, for example, to notify a user about a particular event, invoke required behavior on a target website, and solve security tasks such as automated access control. *Learn more*.
2. Harness the FindFace Multi functions through *HTTP API*.
3. Check out the list of our *partner integrations*.
4. Integrate an *edge device*.

See also:

- *User Management and System Security*
- *Camera Management and Video Recording*
- *Set Up Object Monitoring and Card Index*
- *Object Identification in Offline Videos*
- *Face, Body, Car Counters. Distance Measurement*
- *Face, Body, Car Clusters*
- *People-Related Analytics*
- *Advanced Functionality Setup*
- *Maintenance and Troubleshooting*

3.2 Web Interface Basics

Use the web interface to interact with FindFace Multi. To open the web interface, enter its basic address in the address bar of your browser, and log in.

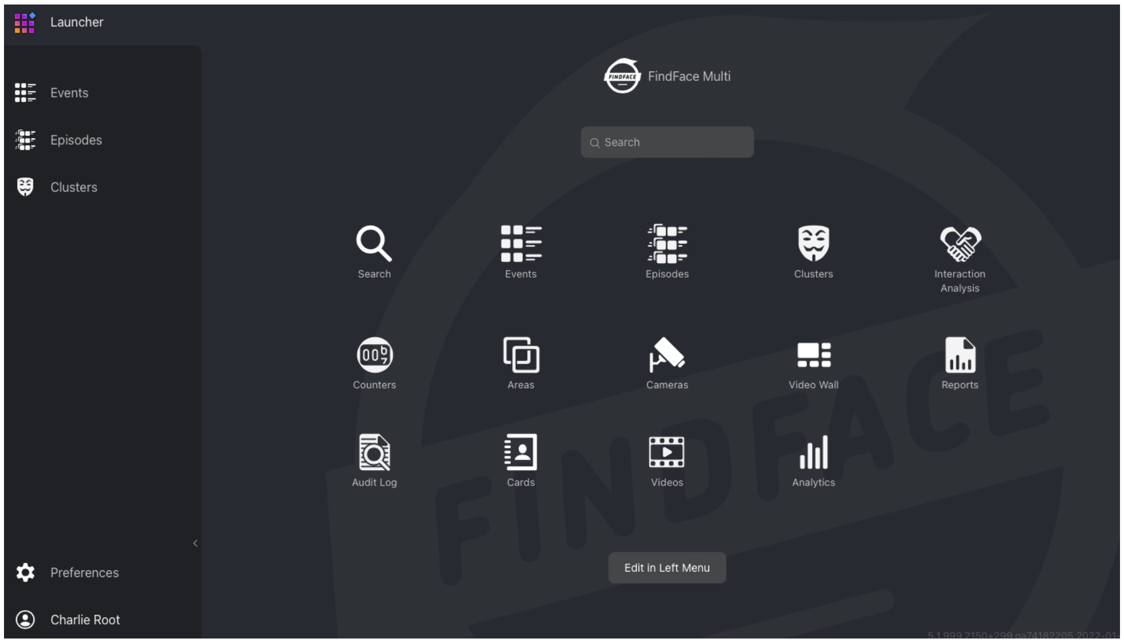
Note: The basic address is set during *deployment*.

Important: To log in for the first time, use the admin account created during *deployment*. To create more users, refer to *User Management*.

Tip: Take your system security up a notch with *face-based authentication*.

3.2.1 Navigation

By default, there are only two items in the left side navigation bar: *Events* and *Episodes*. Use *Launcher* to get access to the other FindFace Multi tabs.

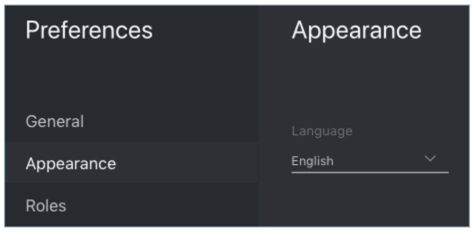


Through *Launcher*, you can also make your favorite tabs permanently available from the navigation bar. Do the following:

1. Click *Edit in Left Menu*.
2. Check and uncheck navigation items, subject to your needs.
3. Click *Finish Editing*.

3.2.2 Web Interface Language

You can change the system language on the *Preferences* -> *Appearance* tab.



Note: By default, only English and Russian languages are available in the web interface. Other languages are provided by request (support@ntechlab.com) and added to the system via the `/etc/findface-security/config.py` configuration file.

See also:

Add Custom Language

3.3 Camera Management and Video Recording

To configure video-based object monitoring, add cameras to FindFace Multi, grouping them subject to their location.

Note: Privileges to create camera groups and cameras are managed in user's permissions (see *User Management*).

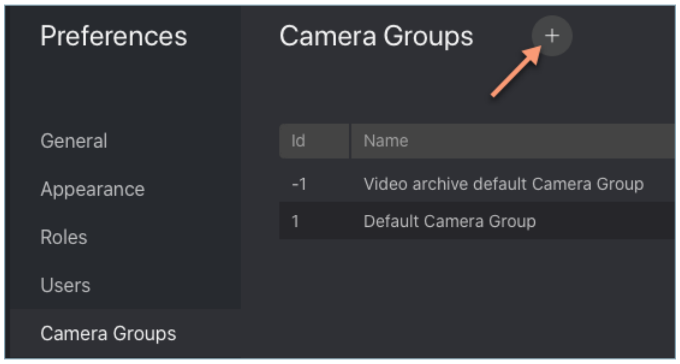
In this chapter:

3.3.1 Create Camera Group

Tip: A default preconfigured camera group is available in the system.

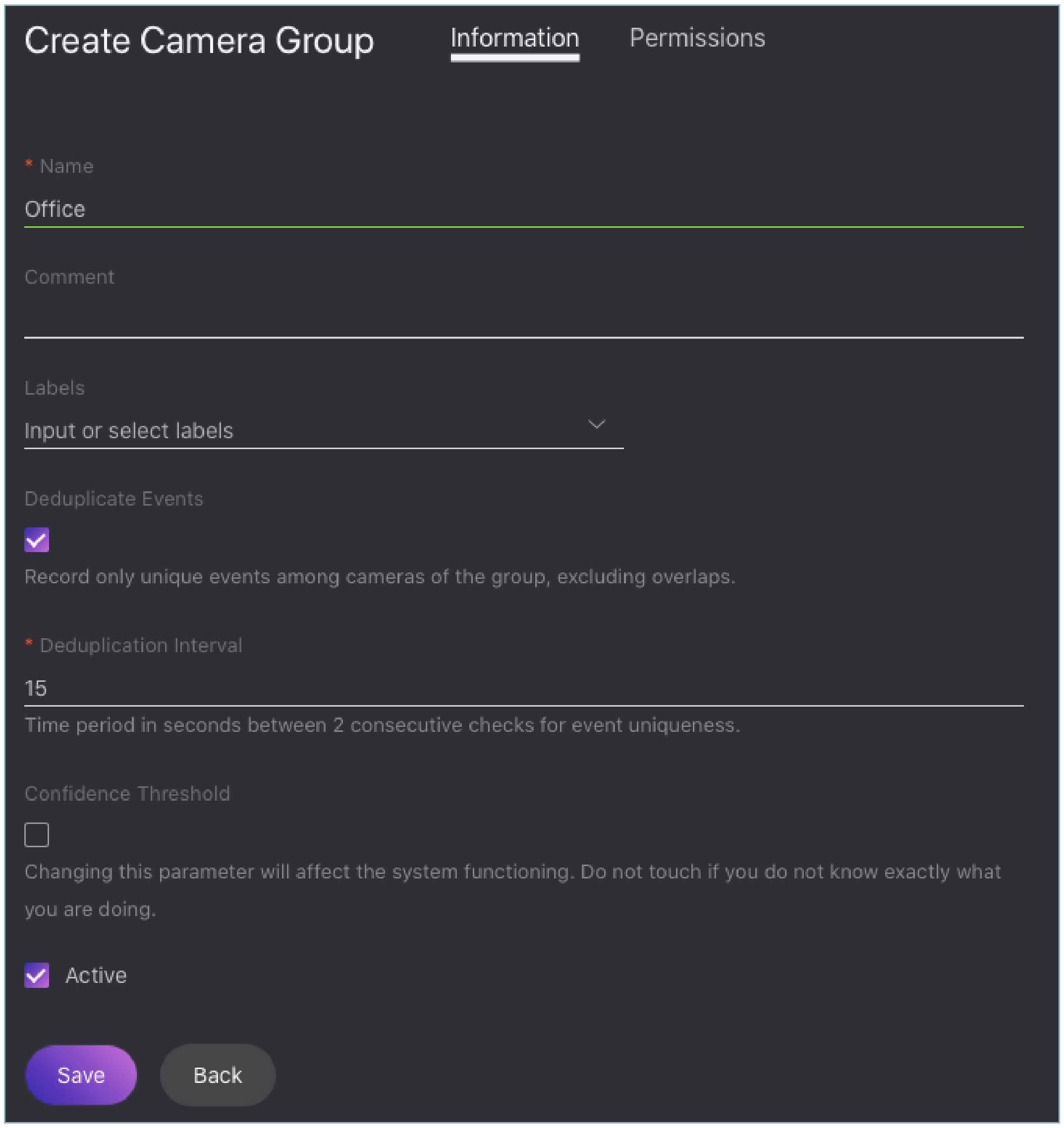
To create a group of cameras, do the following:

1. Navigate to the *Preferences* tab. Click *Camera Groups*.
2. Click +.



Id	Name
-1	Video archive default Camera Group
1	Default Camera Group

3. On the *Information* tab, specify the group name. Add a comment if needed.



Create Camera Group

Information | Permissions

* Name

Office

Comment

Labels

Input or select labels

Deduplicate Events

☑ Record only unique events among cameras of the group, excluding overlaps.

* Deduplication Interval

15

Time period in seconds between 2 consecutive checks for event uniqueness.

Confidence Threshold

☐ Changing this parameter will affect the system functioning. Do not touch if you do not know exactly what you are doing.

☑ Active

Save | Back

4. If you want to allocate a certain `findface-video-worker` instance to process video streams from the group, create or select one or several allocation labels.

   Note: To complete the allocation, list the labels in the `/etc/findface-video-worker-gpu.ini` (`/etc/findface-video-worker-cpu.ini`) configuration file. See *Allocate findface-video-worker to Camera Group* for details.

5. If you want to deduplicate events from cameras that belong to the same group, i. e. exclude coinciding events, check *Deduplicate Events* and specify the deduplication interval (interval between 2 consecutive checks for event uniqueness).

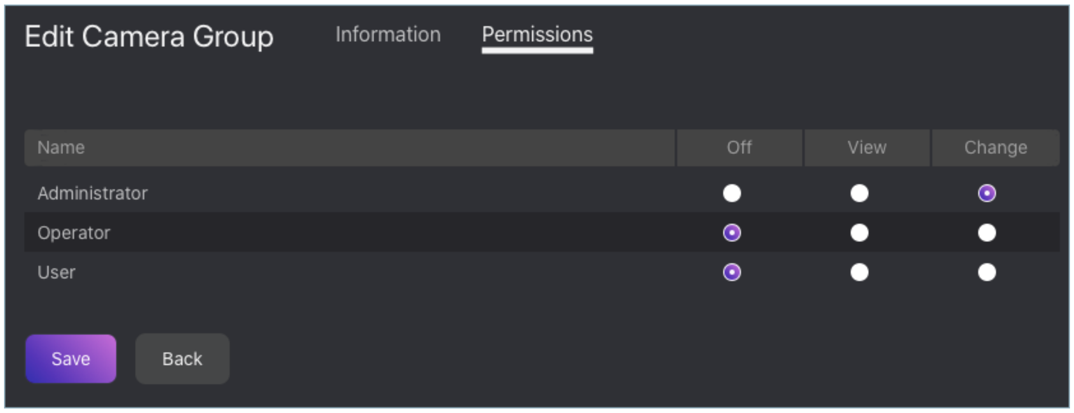
   Warning: Use deduplication with extreme caution. If cameras within a group observe different scenes, some objects may be skipped. See *Deduplicate Events* for details.

6. By default, video from all camera groups is processed using the *generic confidence threshold*. To set an individual

threshold for the camera group, check *Confidence Threshold* and specify the threshold value.

Important: The default generic confidence threshold is optimal for the majority of recognition cases. We do not recommend changing it on your own. Be sure to consult with our technical experts prior (support@ntechlab.com).

7. Check *Active*.
8. Click *Save*.
9. On the *Permissions* tab, assign privileges on the camera group, specifying which user roles are allowed to change/view the camera group settings.



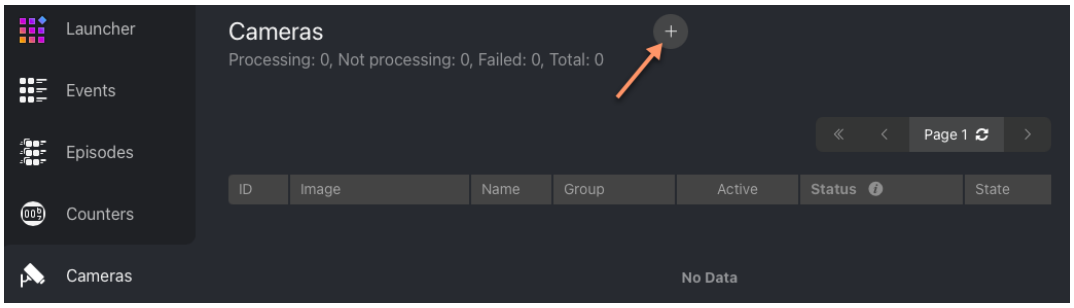
Name	Off	View	Change
Administrator	○	○	●
Operator	●	○	○
User	●	○	○

10. Click *Save*.

3.3.2 Add Camera

To add a camera, do the following:

1. Navigate to the *Cameras* tab.
2. Click +.

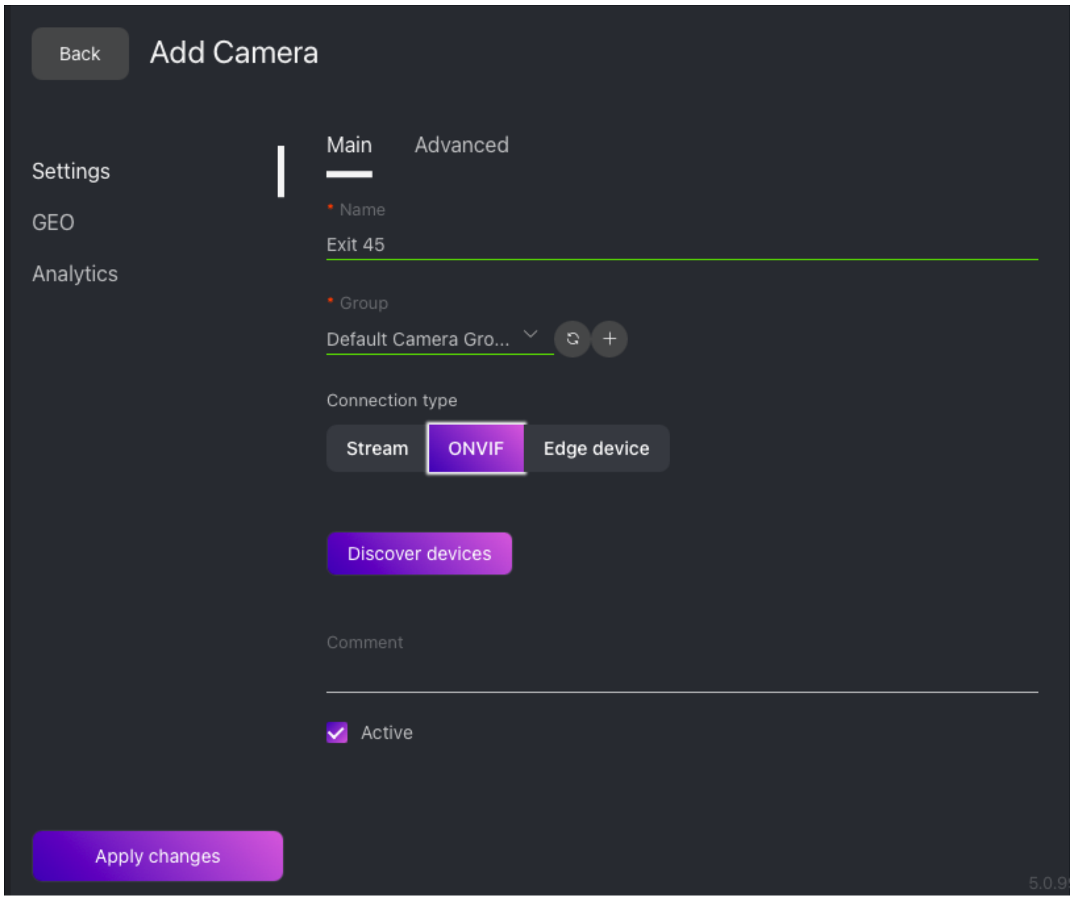


Processing: 0, Not processing: 0, Failed: 0, Total: 0

ID	Image	Name	Group	Active	Status	State

No Data

3. On the *Settings* -> *Main* tab, enter the general camera information:

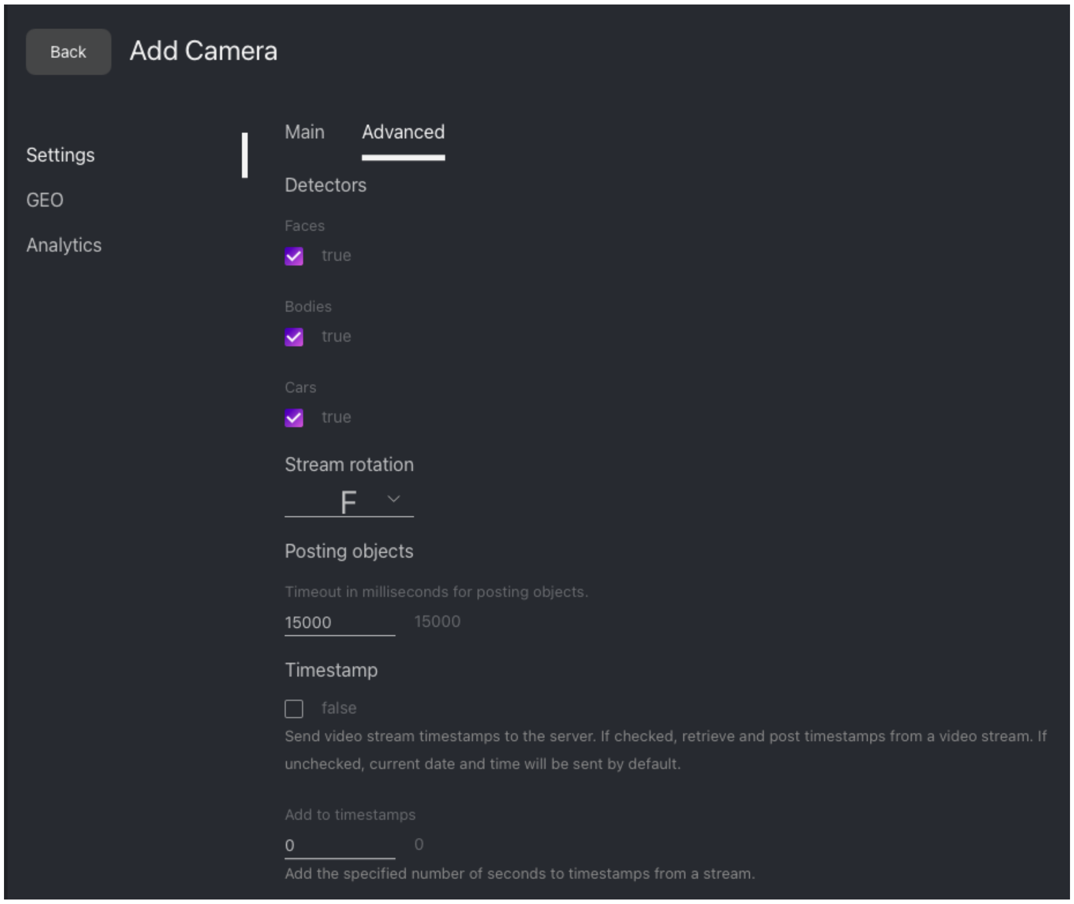


- Specify the camera name.
- Add the camera to a camera group.
- Specify the camera URL (*Stream*). If the camera is *ONVIF*, select it from the list of detected devices to automatically load available settings and streams.

Note: A camera object can also be used for integrating an edge device. *Learn more*.

- If necessary, add a comment.
- Check *Active*.

4. On the *Settings* -> *Advanced* tab, fine-tune the camera:



Detectors

Faces
✓ true

Bodies
✓ true

Cars
✓ true

Stream rotation
F

Posting objects

Timeout in milliseconds for posting objects.
15000 15000

Timestamp
false
Send video stream timestamps to the server. If checked, retrieve and post timestamps from a video stream. If unchecked, current date and time will be sent by default.

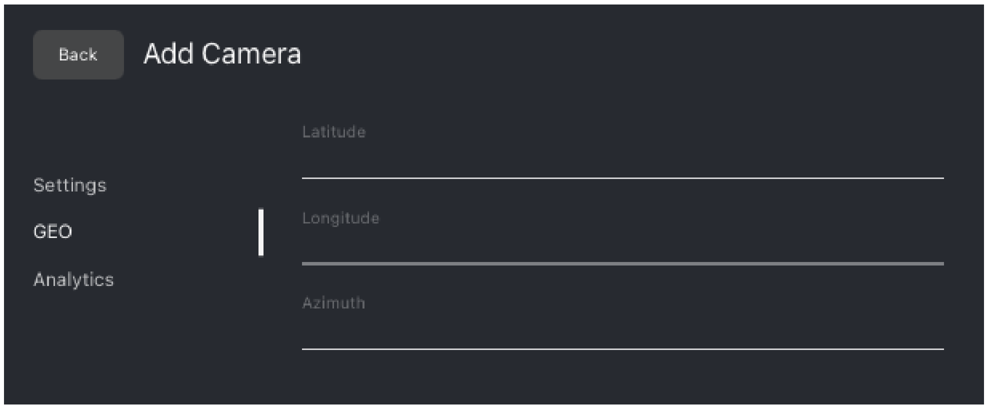
Add to timestamps
0 0
Add the specified number of seconds to timestamps from a stream.

- Check detectors that you want to enable on this camera: faces, bodies, cars.
- If needed, change the video orientation.

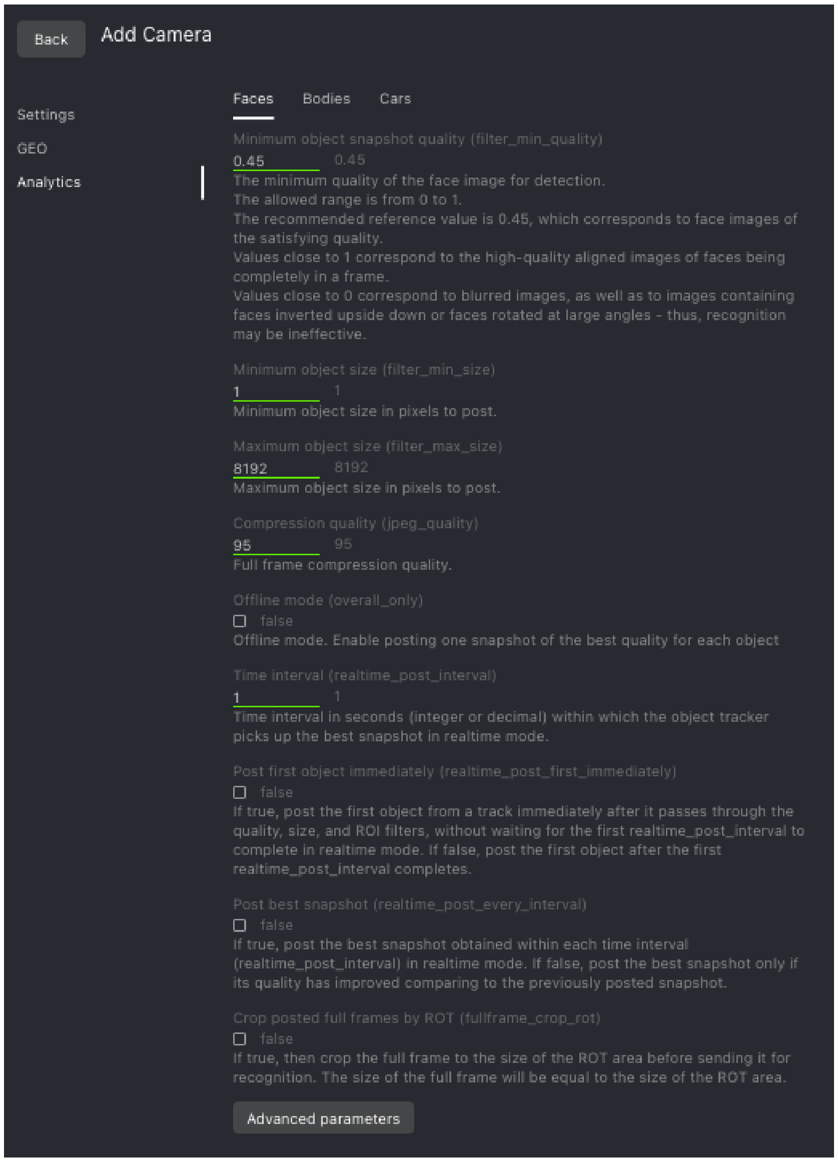
Important: Be aware that the `findface-security` server rotates the video using post-processing tools. It can negatively affect performance. Rotate the video via the camera functionality wherever possible.

- *Timeout in ms*: Specify the timeout in milliseconds for posting detected objects.
- *Retrieve timestamps from stream*: Check to retrieve and post timestamps from the video stream. Uncheck the option to post the current date and time.
- *Add to timestamps*: Add the specified number of seconds to timestamps from the stream.
- *FFMPEG format*: Pass FFMPEG format (mxg, flv, etc.) if it cannot be detected automatically.
- *FFMPEG parameters*: FFMPEG options for the video stream in the key-value format, for example, [“rtsp_transpotr=tcp”, “ss=00:20:00”].
- *Imotion threshold*: Minimum motion intensity to be detected by the motion detector.
- *Verify SSL*: Check to enable verification of the server SSL certificate when the object tracker posts objects to the server over https. Uncheck the option if you use a self-signed certificate.

5. (Optional) On the *GEO* tab, specify the camera geographical location.



6. On the *Analytics* tab, specify settings for each object type detector.



Minimum object snapshot quality (filter_min_quality)
0.45 0.45
The minimum quality of the face image for detection.
The allowed range is from 0 to 1.
The recommended reference value is 0.45, which corresponds to face images of the satisfying quality.
Values close to 1 correspond to the high-quality aligned images of faces being completely in a frame.
Values close to 0 correspond to blurred images, as well as to images containing faces inverted upside down or faces rotated at large angles - thus, recognition may be ineffective.

Minimum object size (filter_min_size)
1 1
Minimum object size in pixels to post.

Maximum object size (filter_max_size)
8192 8192
Maximum object size in pixels to post.

Compression quality (jpeg_quality)
95 95
Full frame compression quality.

Offline mode (overall_only)
☐ false
Offline mode. Enable posting one snapshot of the best quality for each object

Time interval (realtime_post_interval)
1 1
Time interval in seconds (integer or decimal) within which the object tracker picks up the best snapshot in realtime mode.

Post first object immediately (realtime_post_first_immediately)
☐ false
If true, post the first object from a track immediately after it passes through the quality, size, and ROI filters, without waiting for the first realtime_post_interval to complete in realtime mode. If false, post the first object after the first realtime_post_interval completes.

Post best snapshot (realtime_post_every_interval)
☐ false
If true, post the best snapshot obtained within each time interval (realtime_post_interval) in realtime mode. If false, post the best snapshot only if its quality has improved comparing to the previously posted snapshot.

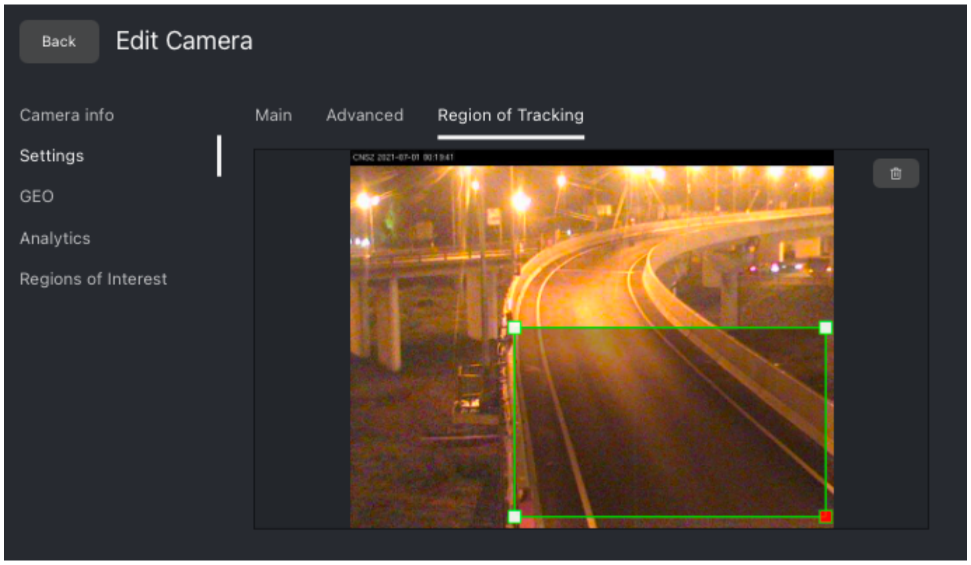
Crop posted full frames by ROT (fullframe_crop_rot)
☐ false
If true, then crop the full frame to the size of the ROT area before sending it for recognition. The size of the full frame will be equal to the size of the ROT area.

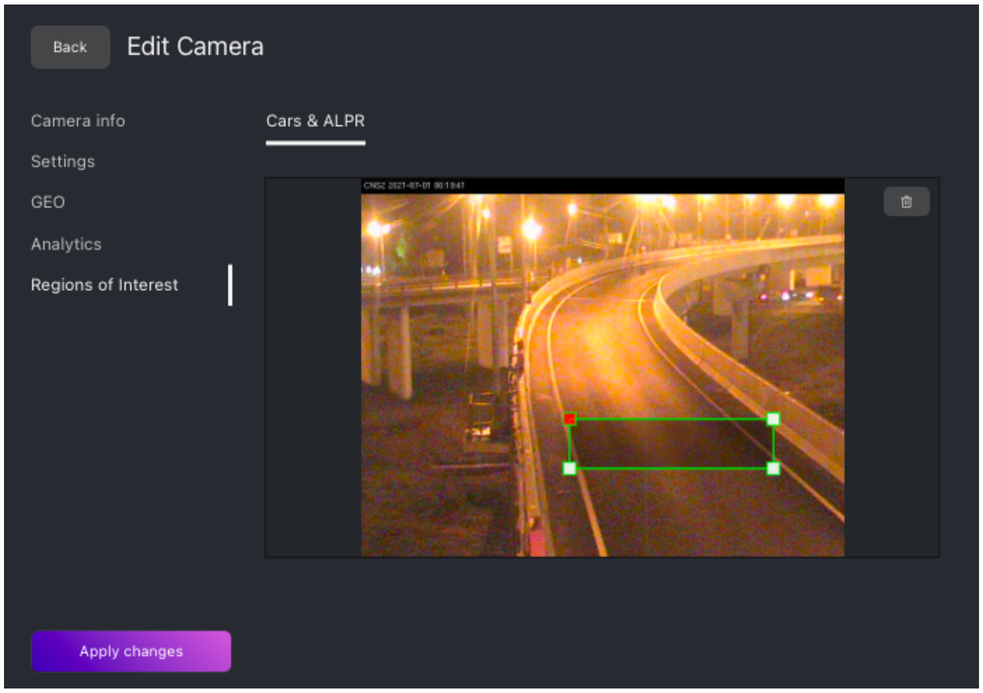
Advanced parameters

- *Minimum object snapshot quality*: Minimum quality of an object image to detect. Do not change the default value without consulting with our technical experts (support@ntechlab.com).

- *Minimum object size*: Minimum object size in pixels to post.
- *Maximum object size*: Maximum object size in pixels to post.
- *Compression quality*: Full frame compression quality.
- *Offline mode*: Offline mode. Enable posting one snapshot of the best quality per entire track for each object.
- *Time interval*: Time interval in seconds (integer or decimal) within which the object tracker picks up the best snapshot in the real-time mode.
- *Post first object immediately*: Check to post the first object snapshot from a track immediately after it passes through the quality, size, and ROI filters, without waiting for the first `Time interval` to complete. The way the subsequent snapshots are posted will depend on the `Post best snapshot` value. Uncheck the option to post the first object snapshot only after the first `Time interval` completes.
- *Post best snapshot*: Check to post the best snapshot obtained within each `Time interval` in the real-time mode, regardless of its quality. Uncheck the option to post the best snapshot only if its quality has improved compared to the previously posted snapshot.

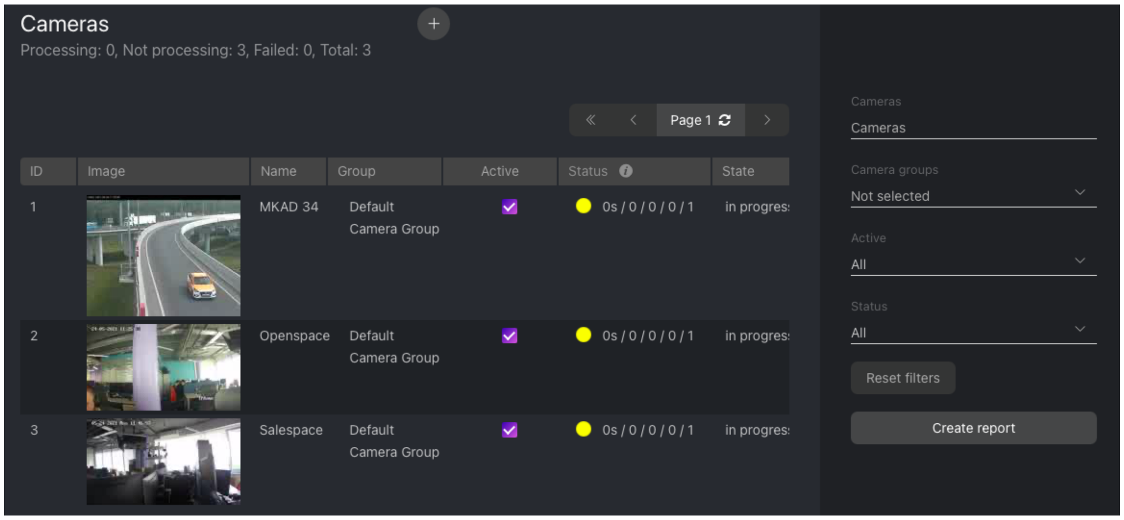
7. Click *Apply changes*.
8. Specify the region of tracking within the camera field (*General* -> *Region of Tracking*) and detection zones (*Regions of Interest*) for each object type detector if necessary. Click *Apply changes*.





3.3.3 Monitor Camera Operation

To monitor the operation of cameras, navigate to the *Cameras* tab.



Cameras

Processing: 0, Not processing: 3, Failed: 0, Total: 3

ID	Image	Name	Group	Active	Status	State
1		MKAD 34	Default Camera Group	✓	● 0s / 0 / 0 / 0 / 1	in progres
2		Openspace	Default Camera Group	✓	● 0s / 0 / 0 / 0 / 1	in progres
3		Salespace	Default Camera Group	✓	● 0s / 0 / 0 / 0 / 1	in progres

Cameras: Cameras

Camera groups: Not selected

Active: All

Status: All

Camera statuses:

- Green: the video stream is being processed without errors.
- Yellow: the video stream is being processed for less than 30 seconds, or one or more errors occurred when posting an object.
- Red: the video stream cannot be processed.
- Grey: camera disabled.

Tip: You can configure the yellow and red statuses based on the portion of dropped frames and failed object postings. To do so, modify the following parameters in the `/etc/findface-security/config.py` configuration file:

```
sudo vi /etc/findface-security/config.py

FFSECURITY = {
    ...
    # max camera frames_dropped percent
    'MAX_CAMERA_DROPPED_FRAMES': {'yellow': 0.1, 'red': 0.3},
    # max camera objects_failed percent
    'MAX_CAMERA_FAILED_FACES': {'yellow': 0.1, 'red': 0.3},
    ...
}
```

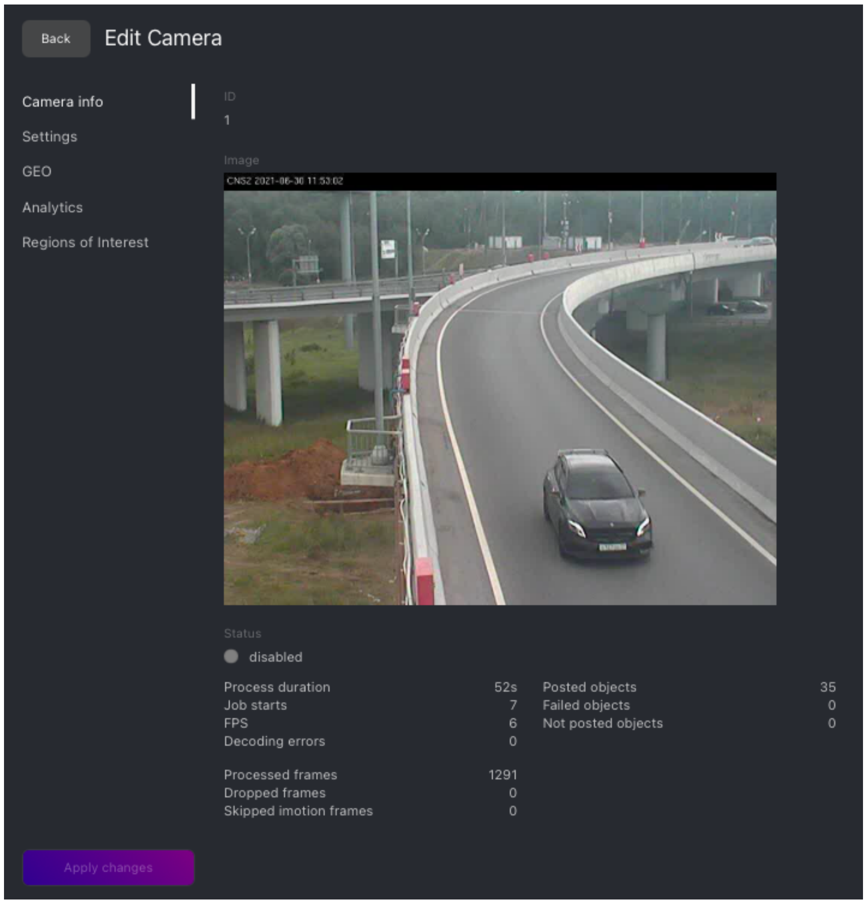
Each created camera is associated with a so called job, a video processing task that contains configuration settings and stream data and is assigned to `findface-video-worker`. This task can be restarted.

To restart a job, click ⟳ in the *Action* column. In this case, the number of errors will be reset to `0`.

With a large number of cameras in the system, use the following filters:

- *Camera groups*,
- *Active*,
- *Status*.

For each camera, you will be provided with complete statistics such as current session duration, the number of successfully posted objects, the number of objects processed with errors after the last job restart, the number of frame drops, and other data. To consult these data, click the camera and go to the *Camera Info* tab.



ID
1

Image

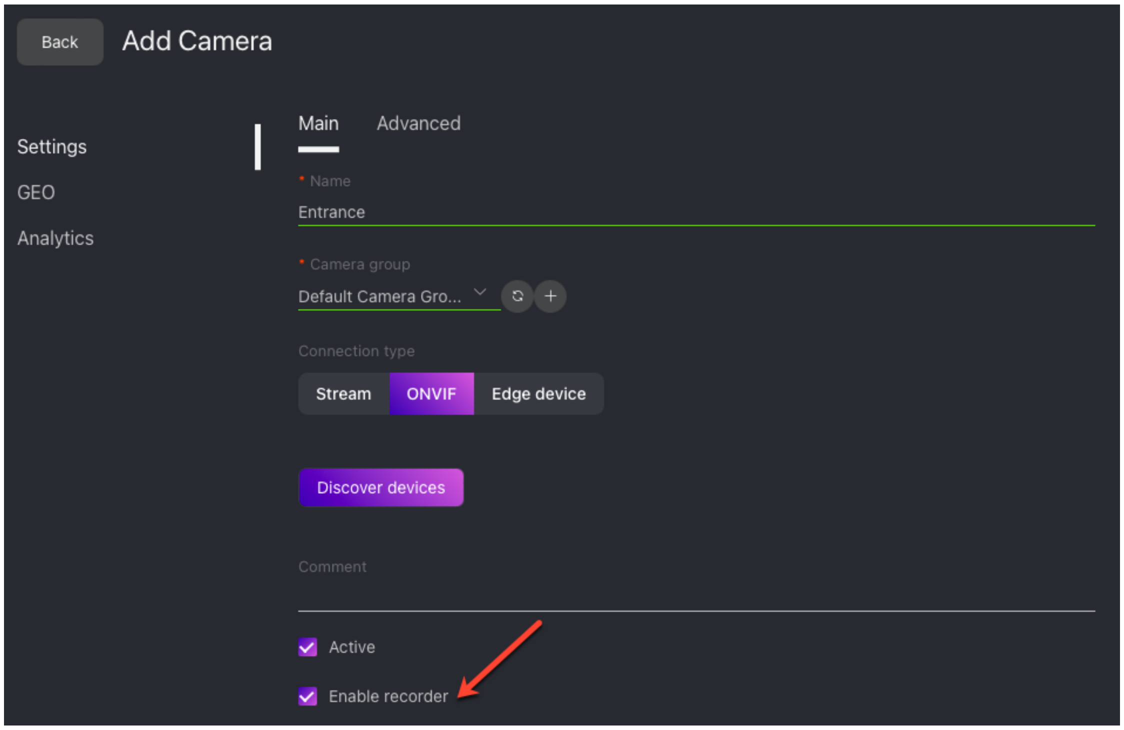
Status
disabled

```
Process duration          52s    Posted objects       35
Job starts                  7    Failed objects        0
FPS                         6    Not posted objects    0
Decoding errors             0

Processed frames         1291
Dropped frames              0
Skipped imotion frames      0
```

3.3.4 Video Recorder

Enable Video Recording

If Video Recorder is *deployed* and *configured*, you will see the *Enable recording* checkbox appear in the main settings of cameras. Check it to enable recording video chunks from a camera and sending them over to Video Recorder for further processing.



* Name: Entrance

* Camera group: Default Camera Gro...

Connection type: ONVIF

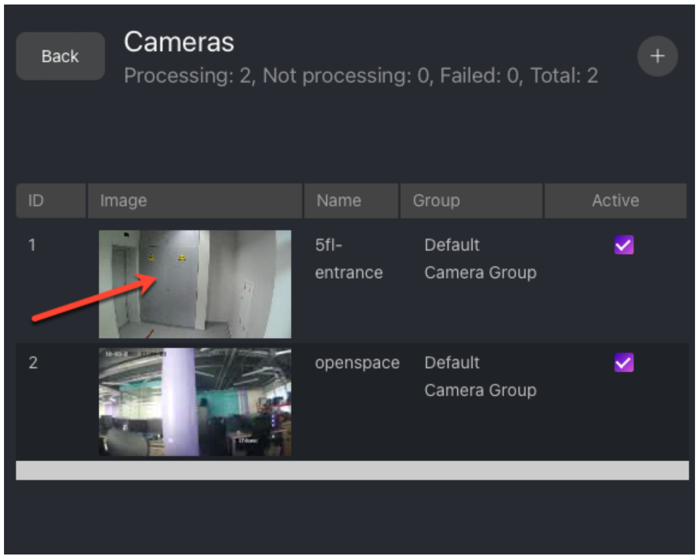
Comment:

☑ Active

☑ Enable recorder

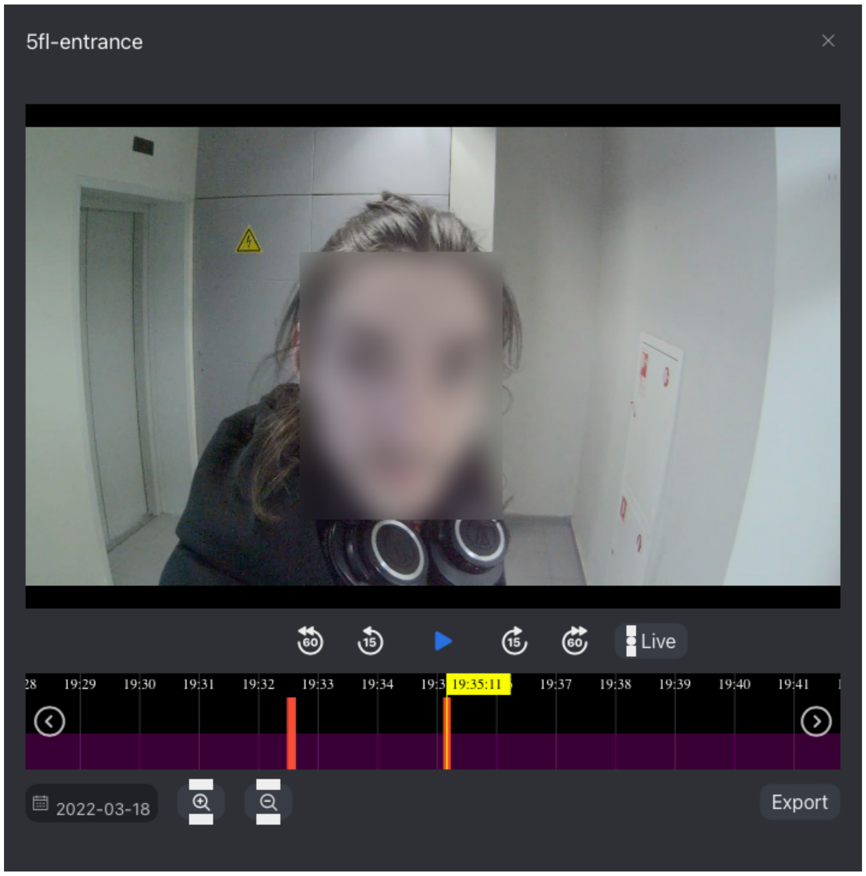
View Camera Video in Video Player

Under *specific settings*, clicking on camera preview opens up not a static frame, but a video player, streaming live video from the camera.



Processing: 2, Not processing: 0, Failed: 0, Total: 2

ID	Image	Name	Group	Active
1		5fl-entrance	Default Camera Group	✓
2		openspace	Default Camera Group	✓



The video player has a highly intuitive design. It provides the following possibilities:

1. Stream live video from the camera.
2. Watch video chunks recorded from the camera. They will be marked in purple on the timeline. To quickly switch from archived video to the camera live stream, click the *Live* button.
3. Visual indicating of moments corresponding to face or car events (if enabled) as colorful markers on the timeline. The unmatched events are marked in pink, while the matched ones are light green.

   Note: This feature is optional and must be pre-configured. See *Configure Video Recorder*.

   Important: The time on the timeline is displayed in the spectator's time zone. For example, if an event happened at 2 p.m. in Abu Dhabi, its marker would be at 12 p.m. for a spectator in Paris.

4. Navigate to the past and future over the timeline, with the possibility of zooming it in and out.

   Tip: You can navigate along the timeline by using the < / > buttons, or by moving the cursor along the timeline with the right mouse button held down.

   Tip: To zoom in and out, use the + / - buttons, or the mouse wheel.

5. Export selected clips.

See also:

- *Allocate findface-video-worker to Camera Group*
- *Deduplicate Events*
- *Video Object Detection: findface-video-manager and findface-video-worker*
- *Deploy Video Recorder Step-by-Step*
- *Configure Video Recorder*
- *Video Player in Event Notification*

3.4 Set Up Object Monitoring and Card Index

FindFace Multi provides video monitoring of the following objects:

- human face
- human body (silhouette)
- car/vehicle

Object monitoring is implemented using a set of default and custom watch lists, e.g., wanted, VIP, etc., and a card index. You can create as many custom watch lists as necessary.

The card index contains two types of cards:

- person card: aggregates data about a person, such as photos of their face and body, their name, and associated files.
- car card: contains car-related data, such as car photos and license plate number information.

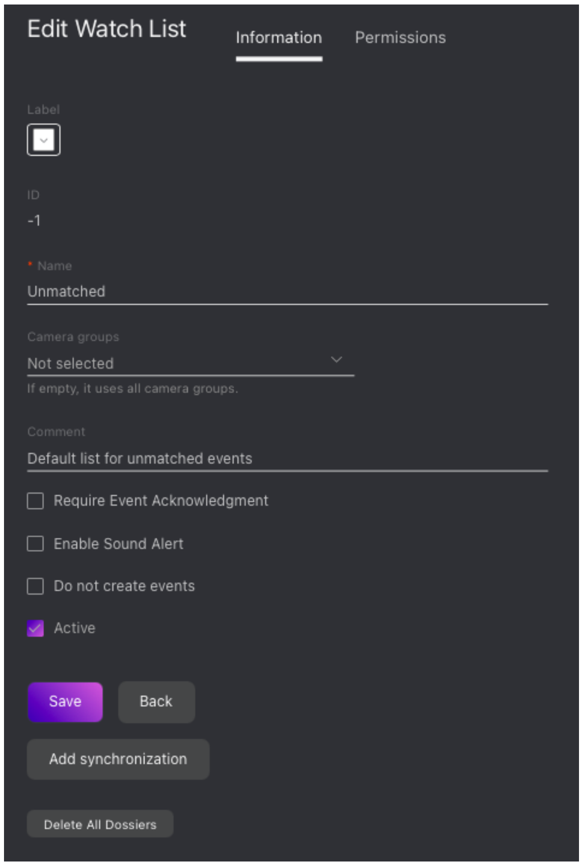
Each card is allocated to one or several watch lists. To put a person/car on video monitoring, you need to make a relevant watch list active.

To create cards in bulk, use the *batch photo upload* functionality.

In this section:

3.4.1 Monitoring Unmatched Objects

FindFace Multi features a special pre-configured watch list used for monitoring only unmatched objects (objects that do not match any card). This watch list cannot be removed from the system. To edit its settings, navigate to the *Preferences* tab. Click *Watch Lists* and then click *Unmatched* in the table.



Label

ID
-1

* Name
Unmatched

Camera groups
Not selected
If empty, it uses all camera groups.

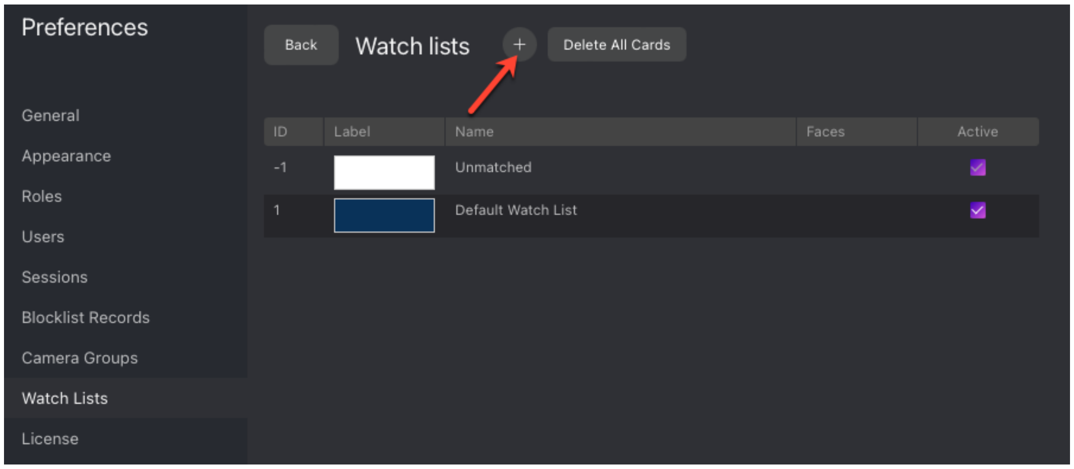
Comment
Default list for unmatched events

- [ ] Require Event Acknowledgment
- [ ] Enable Sound Alert
- [ ] Do not create events
- [x] Active

3.4.2 Create Watch List

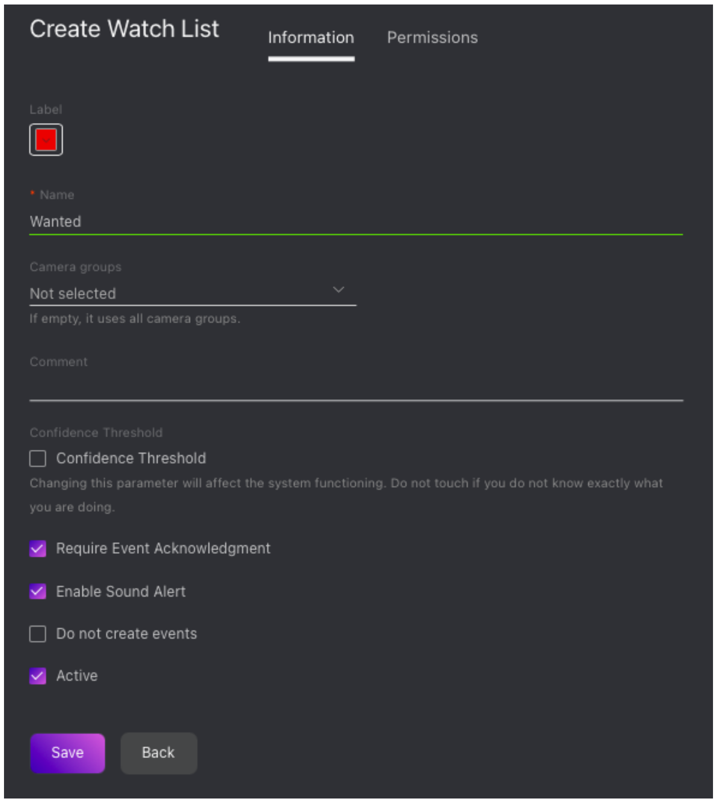
You can create a custom watch list. Do the following:

1. Navigate to the *Preferences* tab. Click *Watch Lists*.
2. Click +.



ID	Label	Name	Faces	Active
-1	⬜	Unmatched		✓
1	🟦	Default Watch List		✓

3. From the *Label* palette, select a color which will be shown in event notifications for this list. Keep in mind that the right color makes for a quicker response of the person on duty.



Label
🟥

* Name
Wanted

Camera groups
Not selected
If empty, it uses all camera groups.

Comment

Confidence Threshold
☐ Confidence Threshold
Changing this parameter will affect the system functioning. Do not touch if you do not know exactly what you are doing.

☑ Require Event Acknowledgment

☑ Enable Sound Alert

☐ Do not create events

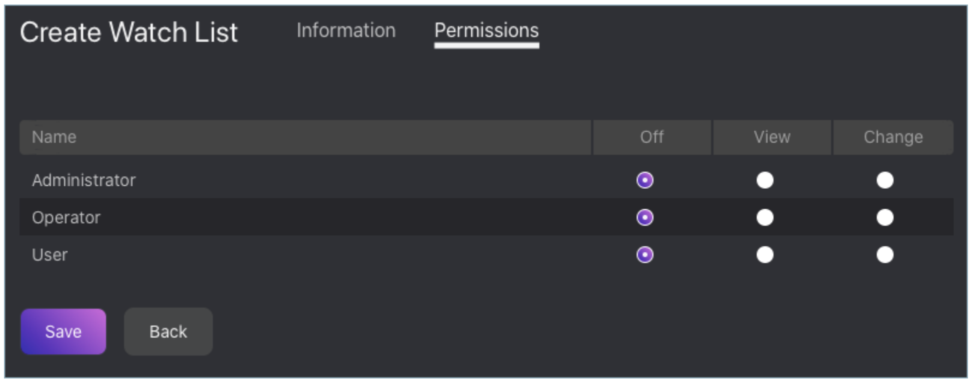
☑ Active

4. Specify the watch list name. Add a comment if needed.
5. Select a camera group(s) that will be used to monitor the watch list. If no groups specified, the watch list will be monitored by all active cameras in the system.
6. Check *Require acknowledgment* if it is mandatory that events associated with the list be manually acknowledged.
7. Check *Enable sound alert* to turn on sound notifications for the list if needed.

8. By default, all watch lists in the system are applied the *generic confidence threshold*. To set an individual threshold for the watch list, check *Confidence Threshold* and specify the threshold value.

   Important: The default generic confidence threshold is optimal for the majority of recognition cases. We do not recommend changing it on your own. Be sure to consult with our technical experts prior (support@ntechlab.com).

9. Check *Active*.
10. Click *Save*.
11. On the *Permissions* tab, assign privileges on the watch list, specifying which user roles are allowed to change/view the watch list settings.



Name	Off	View	Change
Administrator	●	○	○
Operator	●	○	○
User	●	○	○

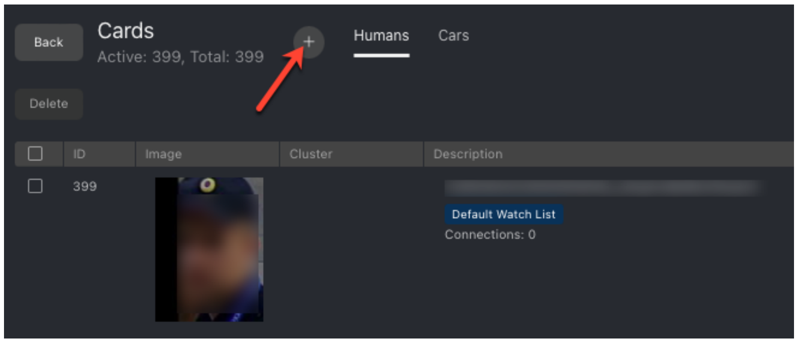
12. Click *Save*.

3.4.3 Create Person Card

To create a person card manually, do the following:

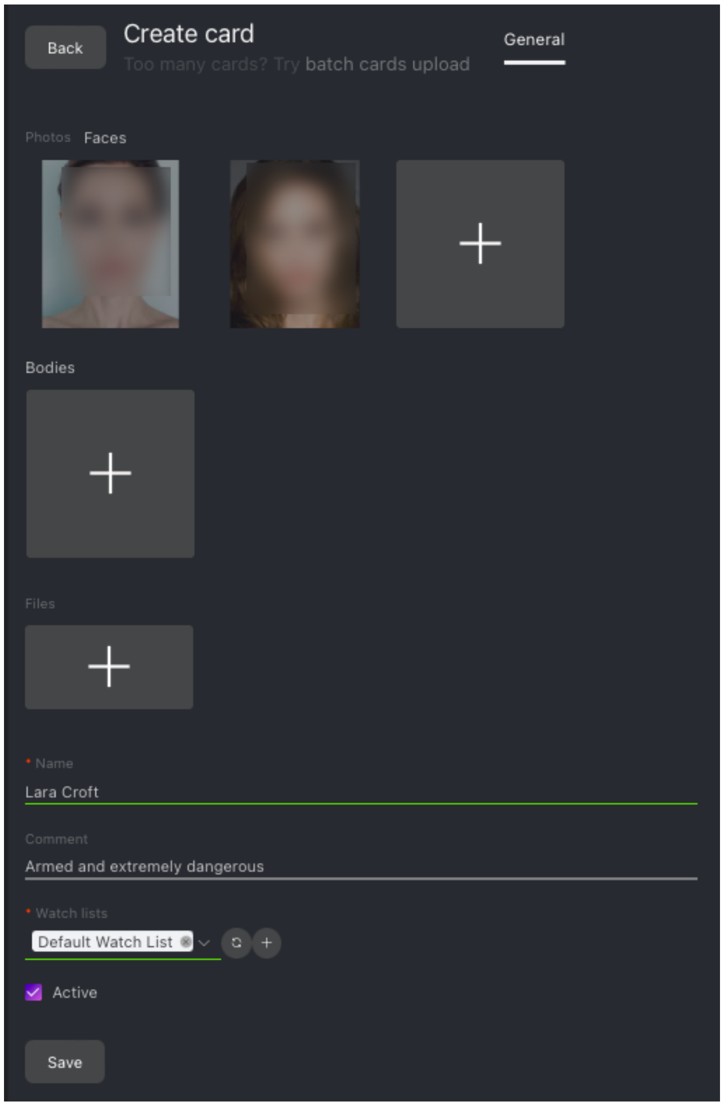
Important: To be able to attach body images to a person card, you must enable the *body detection* functionality.

1. Navigate to the *Cards* tab.
2. Click *Humans*.
3. Click +.



4. Attach images of the person's face/body. Supported formats: WEBP, JPG, BMP, PNG.

Important: A face/body in the images must be close to a frontal position. Distance between pupils in the face image: 60 px. Images that do not meet the requirements will be rejected with a detailed error description.



Name: Lara Croft

Comment: Armed and extremely dangerous

Watch lists: Default Watch List

Active: ✓

5. Attach related files.
6. Specify the card name. If necessary, add a comment.
7. From the *Watch lists* drop-down menu, select a watch list for the card (or several watch lists, one by one).
8. Check *Active*. If a card is inactive, it is excluded from the monitoring.
9. Click *Save*.

Note: If a similar card already exists in the card index, you will be given the following options:

- add objects from the new card to the already existing one and cancel the new card creation

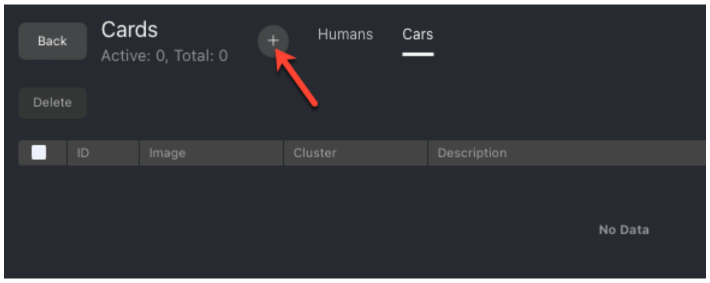
- create the new card anyway
- cancel creation

3.4.4 Create Car Card

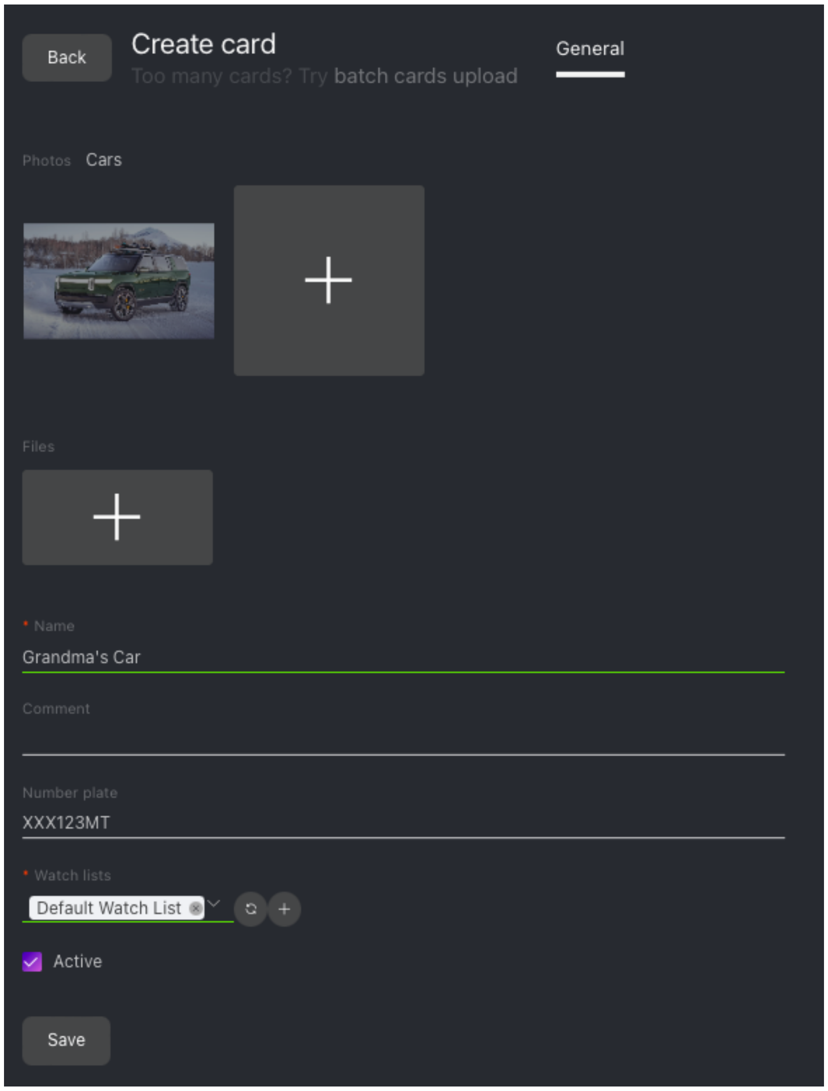
Important: For car cards to be available for creation, you must enable the *car detection* functionality.

To create a car card manually, do the following:

1. Navigate to the *Cards* tab.
2. Click *Cars*.
3. Click +.



4. Attach the car images. Supported formats: WEBP, JPG, BMP, PNG.



5. Attach related files.
6. Specify the card name. If necessary, add a comment.
7. Specify the car's license plate number if applicable.
8. From the *Watch lists* drop-down menu, select a watch list for the card (or several lists, one by one) .
9. Check *Active*. If a card is inactive, it is excluded from the monitoring.
10. Click *Save*.

Note: If a similar card already exists in the card index, you will be given the following options:

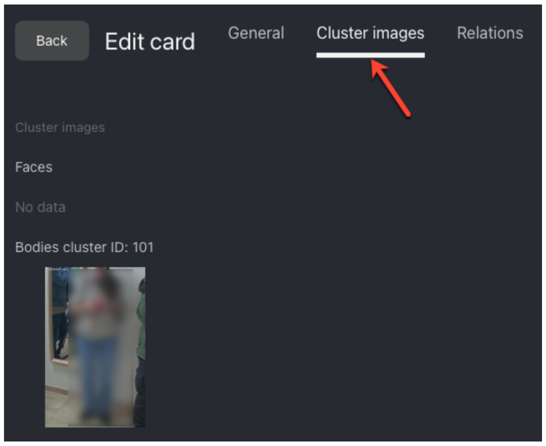
- add objects from the new card to the already existing one and cancel the new card creation
- create the new card anyway
- cancel creation

3.4.5 View Matched Clusters

Important: To be able to view matched clusters, you must *enable clustering* of relevant object types.

In the course of operation, the system may supplement cards with matched *clusters*.

To view a cluster matched with an exact person or car, open the corresponding card and navigate to the *Cluster images* tab.



In a person card, you will see a matched face cluster and a body cluster. A relevant car cluster will be shown in a car card.

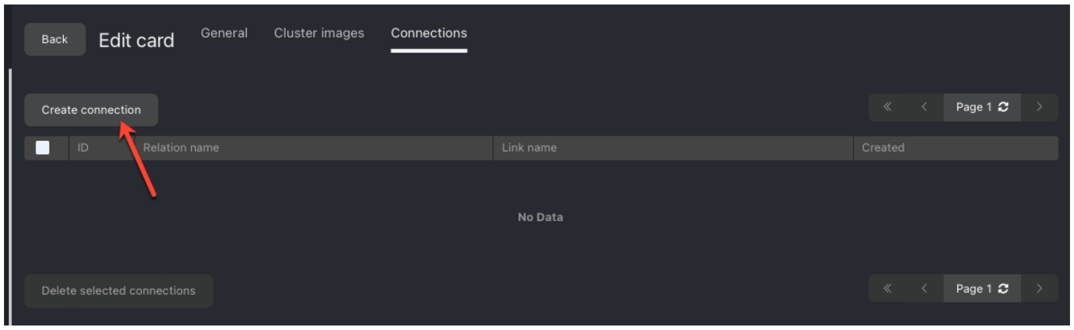
3.4.6 Card Relations

You can set up relations between cards by creating a common category they belong. For example, the `Household` category can include all family members and their vehicles.

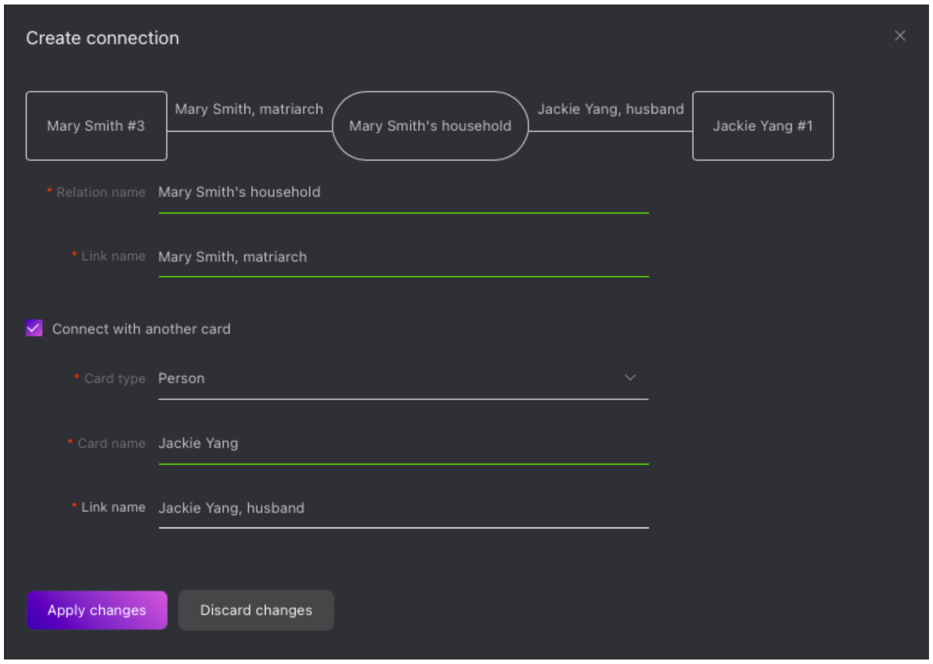
A card can be related to as many categories as needed.

To set up a card-to-category relation, do the following:

1. Open the card for editing by clicking it on the list. Navigate to the *Connections* tab.
2. Click *Create connection*.



3. In the *Relation name* field, specify the category name. If there are already existing matching categories in the system, you will be able to see them and select one of them shortly after you start typing the name.



* Relation name: Mary Smith's household

* Link name: Mary Smith, matriarch

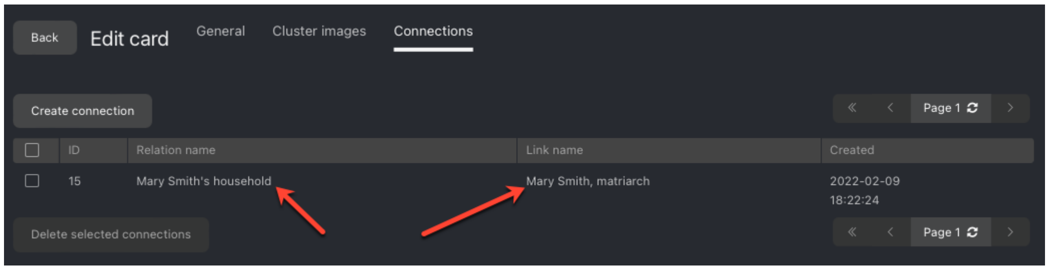
☑ Connect with another card

* Card type: Person

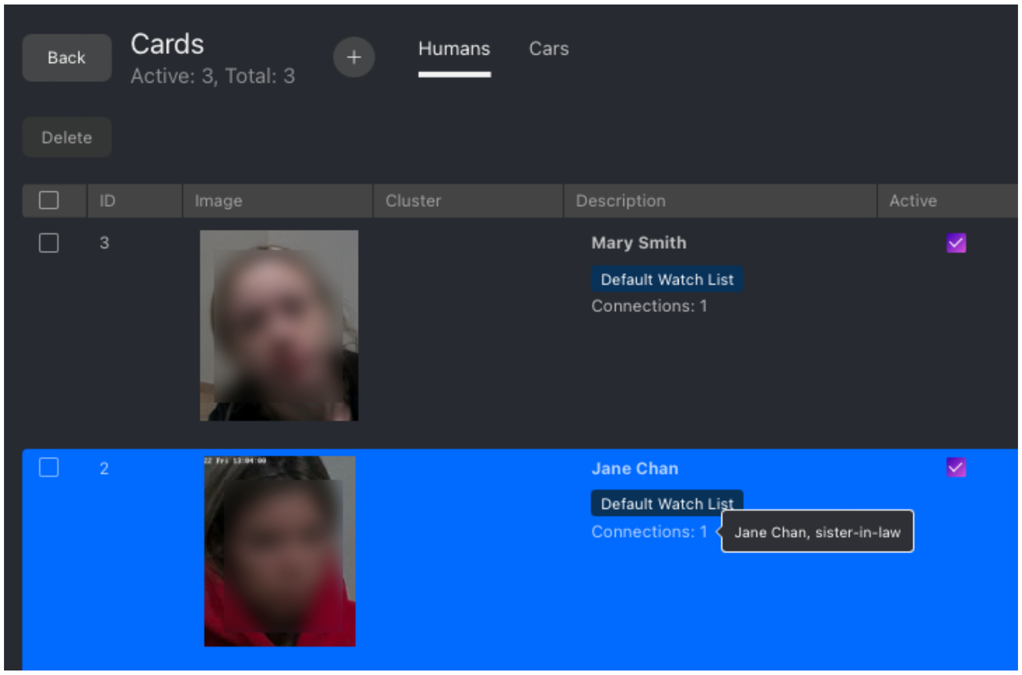
* Card name: Jackie Yang

* Link name: Jackie Yang, husband

4. In the *Link name* field, describe the link between the card and the category.
5. If there is another card related to the same category, you can promptly add it right here. Do the following:
   1. Check *Connect with another card*.
   2. Select the card type: *Person* or *Car*.
   3. Start typing the card name in the same-name field. As a result, the system will automatically suggest cards with relevant names. Select one of them.
   4. In the *Link name* field, describe the link between the card and the category.
6. Click *Save*. The created links will be shown on the *Connections* tab and on the card list.



	ID	Relation name	Link name	Created
☐	15	Mary Smith's household	Mary Smith, matriarch	2022-02-09 18:22:24



Note: If there are several cards related to the same category, repeat this step-by-step instruction with all the cards involved.

3.4.7 Batch Card Upload

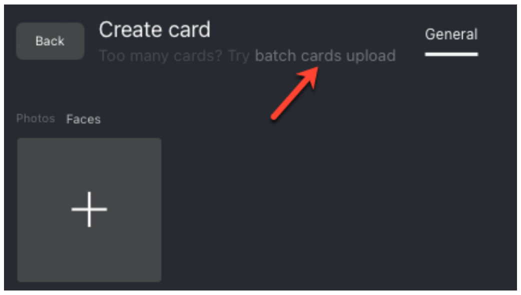
To create cards in bulk, use the batch card upload. Do the following:

Tip: If the number of photos you need to upload exceeds 10,000, use the *console bulk upload*. In the current version, it does not support cars and bodies, only faces.

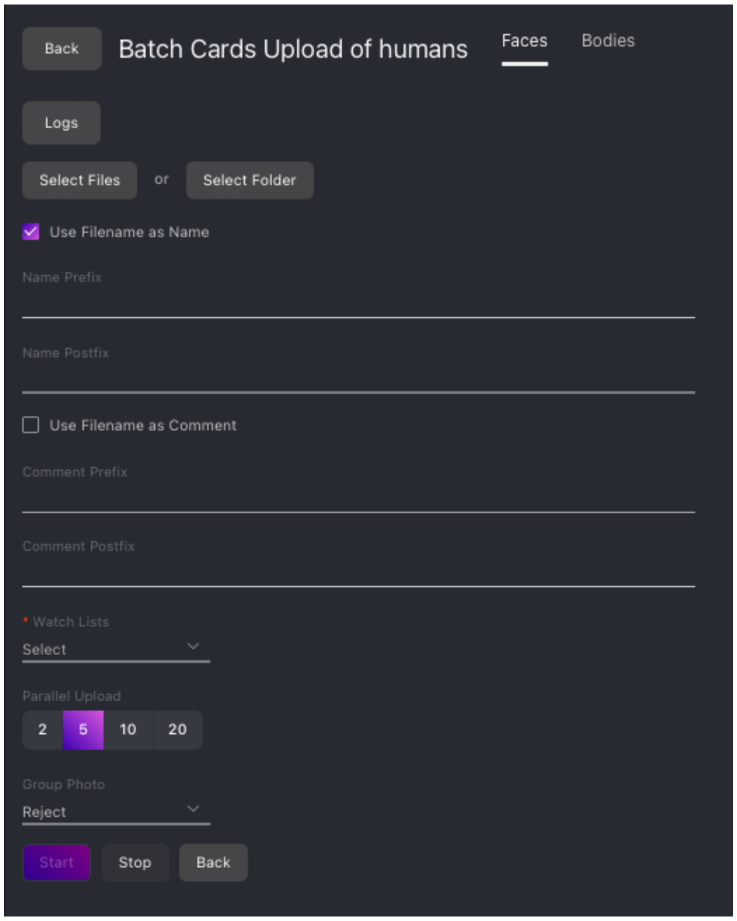
Important: Supported formats: WEBP, JPG, BMP, PNG.

Important: A face/body in the images must be close to a frontal position. Distance between pupils in face images: 60 px. Images that do not meet the requirements will be rejected with a detailed error description.

1. Navigate to the *Cards* tab.
2. Click *Humans* or *Cars*, subject to the card type being uploaded.
3. Click +.
4. Click *Try batch card upload*.



5. For person cards, specify the objects to detect: faces or bodies.
6. Select multiple image files, or a directory.



☑ Use Filename as Name

Name Prefix

Name Postfix

☐ Use Filename as Comment

Comment Prefix

Comment Postfix

* Watch Lists: Select

Parallel Upload: 2 [✓ 5] 10 20

Group Photo: Reject

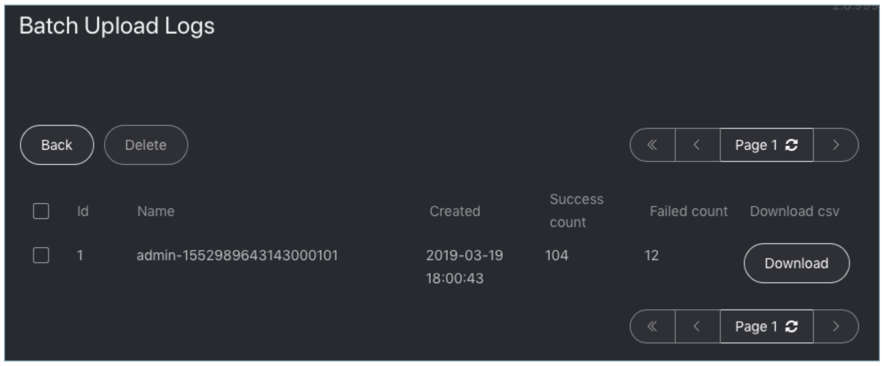
7. You can use image file names as a basis for names and/or comments in cards to be created. Select the necessary option(s). Then configure the automatic name/comment generation rule by appending a custom prefix and/or postfix to the file name.

Tip: To avoid merging the 3 words into one, use underscore or another symbol in the prefix and postfix.

8. From the *Watch lists* drop-down menu, select a classification list for the cards.

9. Use the *Parallel Upload* option to specify the number of photo upload streams. The more streams you use, the faster it takes to complete the upload, however it requires more resources as well.
10. From the *Group Photo* drop-down menu, select the system behavior upon detecting several objects in a photo: reject the photo, upload the biggest object, or upload all objects.
11. Click *Start* to launch the photo upload.

Important: To view the batch photo upload log, click *Logs*. You can then download the log in the `.csv` format if needed.


Batch Upload Logs

	Id	Name	Created	Success count	Failed count	Download csv
☐	1	admin-1552989643143000101	2019-03-19 18:00:43	104	12	Download

3.4.8 Filter Cards

You can find all cards created in FindFace Multi on the *Cards* tab. Use the following filters to filter them out:

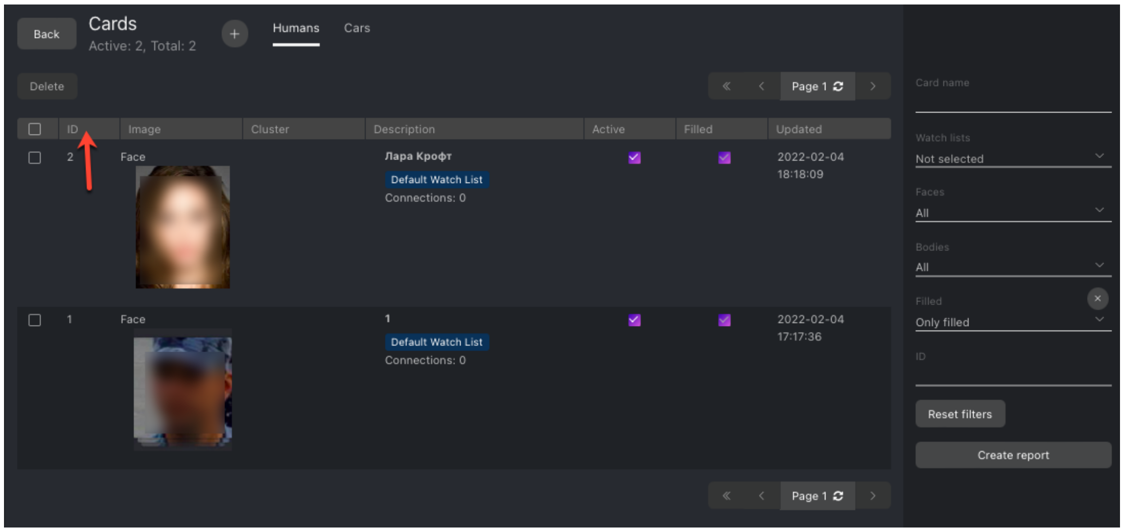
On the *Humans* tab (people cards):

- *Card name*: filter cards by name.
- *Watch lists*: display cards included into selected watch lists.
- *Faces*: filter cards by presence of a face image in a card attachment.
- *Bodies*: filter cards by presence of a body image in a card attachment.
- *Filled*: display cards subject to whether they are auto-generated (not filled) or completed (filled) cards. See *Auto-Generated and Completed Cards* for a detailed explanation.
- *ID*: display a card with a given ID.

On the *Cars* tab (car cards):

- *Card name*: filter cards by name.
- *License plate*: filter cards by license plate number.
- *Watch lists*: display cards included into selected watch lists.
- *Cars*: filter cards by presence of a car image in a card attachment.
- *Filled*: display cards subject to whether they are auto-generated (not filled) or completed (filled) cards.
- *ID*: display a card with a given ID.

You can sort out cards in the list by *ID*.

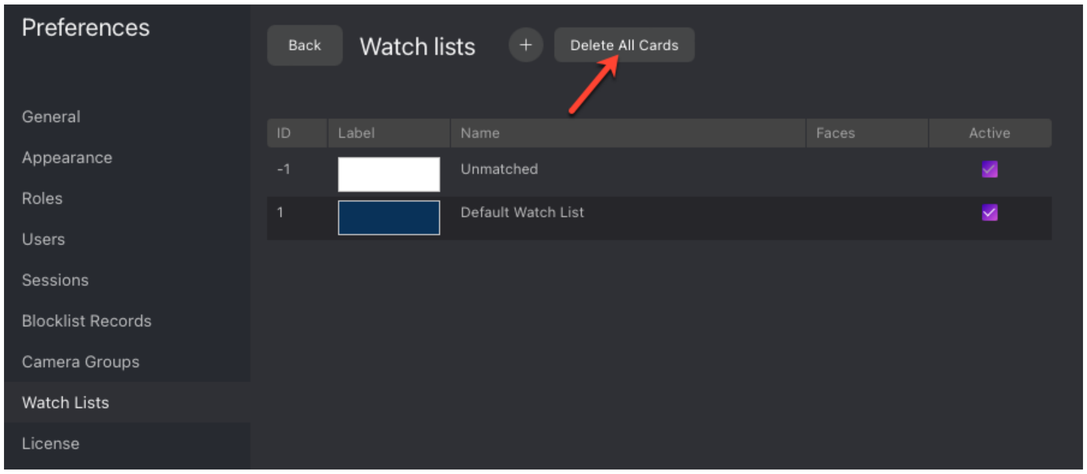


ID	Image	Cluster	Description	Active	Filled	Updated
2	Face		Лара Крофт Default Watch List Connections: 0	✓	✓	2022-02-04 18:18:09
1	Face		1 Default Watch List Connections: 0	✓	✓	2022-02-04 17:17:36

Card name:
Watch lists: Not selected
Faces: All
Bodies: All
Filled: Only filled
ID:

3.4.9 Purge Card Index

You can purge the entire card index in one click. To do so, navigate to the *Preferences* tab. Click *Watch Lists*. Click *Delete All Cards*.



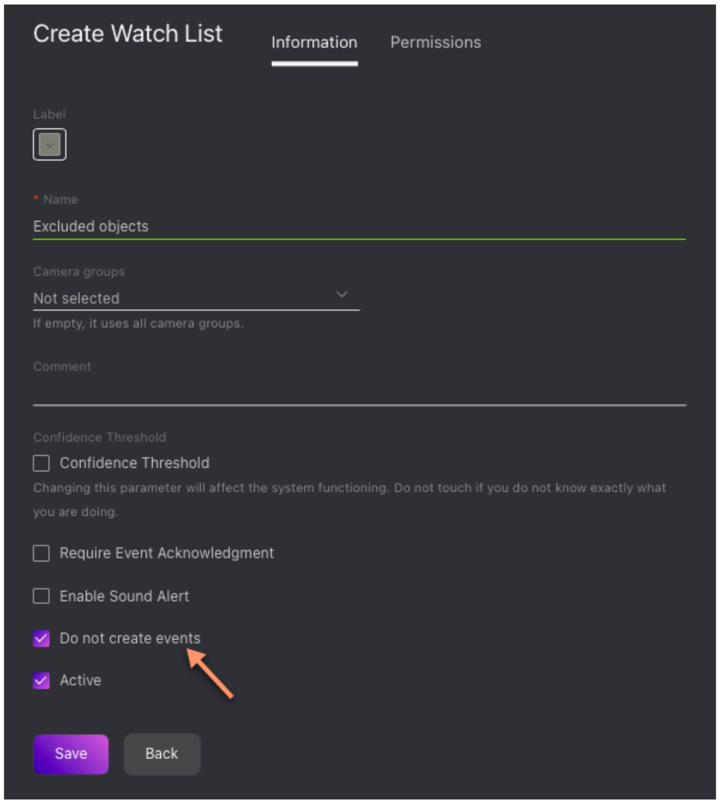
ID	Label	Name	Faces	Active
-1	⬜	Unmatched		✓
1	🟦	Default Watch List		✓

3.4.10 Disable Event Creation for Specific Objects

Sometimes, it is necessary to omit certain objects during monitoring. One of the most common cases is the objects in advertisement media located in the camera field. Being detected continuously by your system, they can easily overflow the event feed and the database.

To prevent this from happening, do the following:

1. *Create a watch list* that will store the objects excluded from detection. In its settings, check *Do not create events*.


Create Watch List

Information | Permissions

Label

* Name: Excluded objects

Camera groups: Not selected

If empty, it uses all camera groups.

Comment

Confidence Threshold

☐ Confidence Threshold

Changing this parameter will affect the system functioning. Do not touch if you do not know exactly what you are doing.

☐ Require Event Acknowledgment

☐ Enable Sound Alert

☑ Do not create events

☑ Active

2. For each excluded object, create a card and add it to the watch list.

3.4.11 Auto-Generated and Completed Cards

Subject to the way a card is created, there are auto-generated (“auto”) cards and completed cards.

Auto cards

Auto cards are created automatically by the system for clusters that have no matches in the card index.

Note: By default, the creation of auto cards is disabled. To enable it, set `'CREATE_AUTO_CARDS': True` at `/etc/findface-security/config.py` and restart `findface-security`.

```
sudo vi /etc/findface-security/config.py

# create auto cards for unmatched clusters
'CREATE_AUTO_CARDS': True,
```

```
sudo systemctl restart findface-security.service
```

There are no uploaded images on the *General* tab in the auto cards, so such cards are also called blank.

The following filters do not apply to the blank cards:

- *Faces -> Only with faces*

- *Bodies -> Only with bodies*
- *Cars -> Only with cars*

Completed cards

Unlike auto cards, completed cards have uploaded images of a person's face and body or a car image.

To separate auto cards and completed cards in the card index, use the *Filled* filter.

To turn an auto card into a completed card, upload the same object's image to it and modify the card name.

3.5 Face, Body, Car Counters. Distance Measurement

Important: To be able to count human bodies (silhouettes) or cars, you first have to enable *body detection* or *car detection*.

FindFace Multi allows you to count faces, bodies and cars on connected cameras. This functionality can apply to a wide range of situations, such as people counting in queues and waiting areas, monitoring public gatherings, crowding prevention, traffic jam detection, and more.

The counting method is based on time slices, which means that the system counts faces, bodies and cars in static screenshots taken with a given `count interval`.

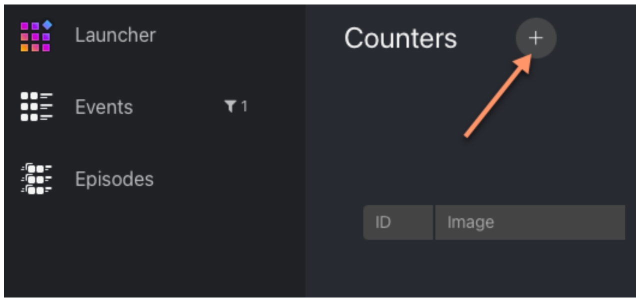
You can opt for counting faces/bodies/cars either on each camera independently, or collectively on all selected cameras.

In this section:

3.5.1 Create Counter

To set up a counter, do the following:

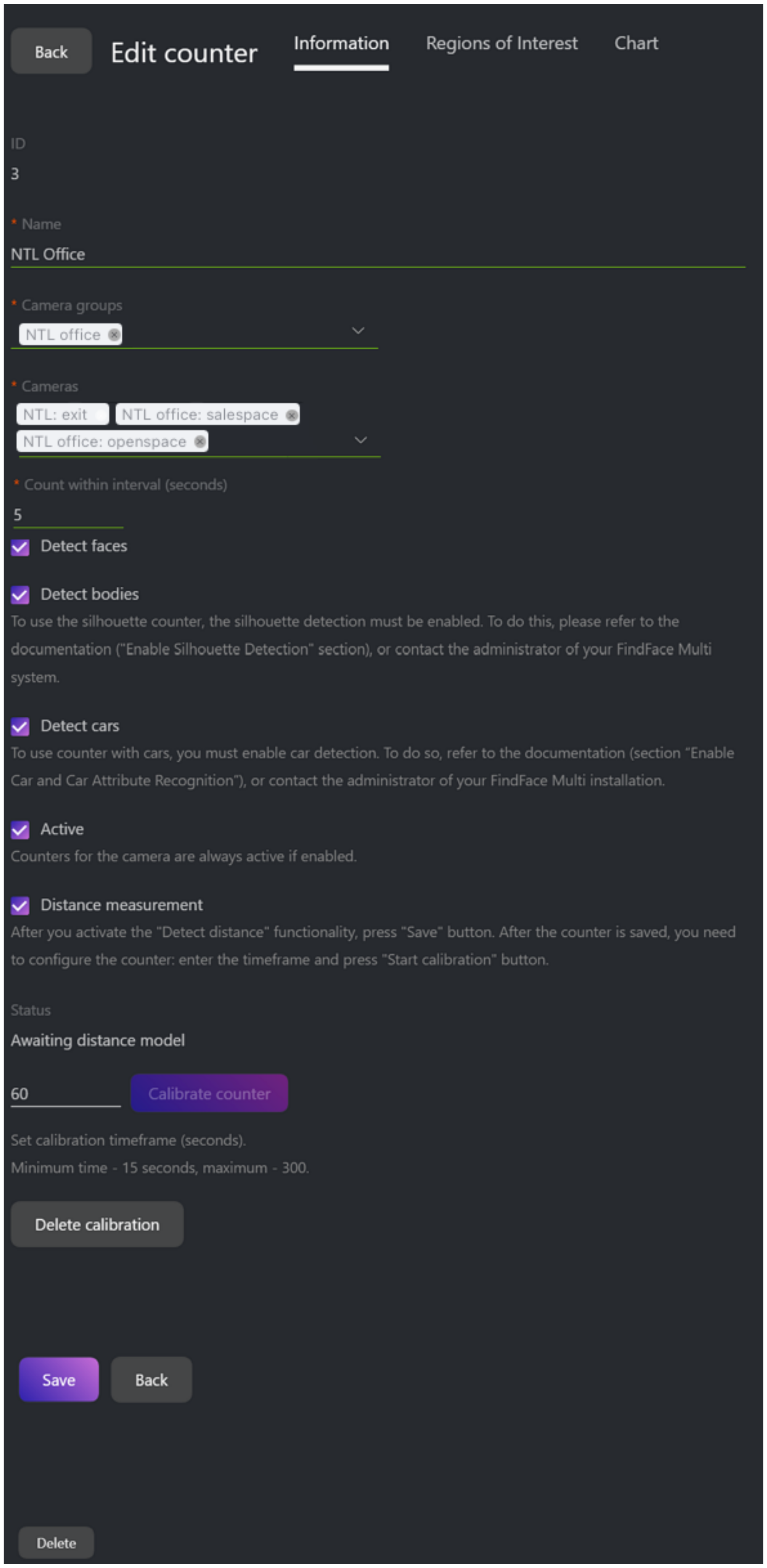
1. Navigate to the *Counters* tab.
2. Click +.



3. Specify the counter name.
4. Select one or several camera groups for counting.

Tip: By default, counting will apply to all cameras within the groups. If necessary, you can disable counting on specific cameras.

5. Specify the interval in seconds between two consecutive screenshots used for counting.
6. Check *Detect Faces* to count faces.
7. Check *Detect Bodies* to count bodies. Body detection has to be *enabled*.
8. Check *Detect Cars* to count cars. Car detection has to be *enabled*.
9. Check *Distance measurement* to count the distance between bodies. This option becomes available only if *Detect Bodies* box is checked.
10. Make sure that the counter is *Active*.
11. Click *Save*.



ID

3

* Name

NTL Office

* Camera groups

NTL office

* Cameras

NTL: exit
NTL office: salespace
NTL office: openspace

* Count within interval (seconds)

5

✓ Detect faces

✓ Detect bodies

To use the silhouette counter, the silhouette detection must be enabled. To do this, please refer to the documentation ("Enable Silhouette Detection" section), or contact the administrator of your FindFace Multi system.

✓ Detect cars

To use counter with cars, you must enable car detection. To do so, refer to the documentation (section "Enable Car and Car Attribute Recognition"), or contact the administrator of your FindFace Multi installation.

✓ Active

Counters for the camera are always active if enabled.

✓ Distance measurement

After you activate the "Detect distance" functionality, press "Save" button. After the counter is saved, you need to configure the counter: enter the timeframe and press "Start calibration" button.

Status

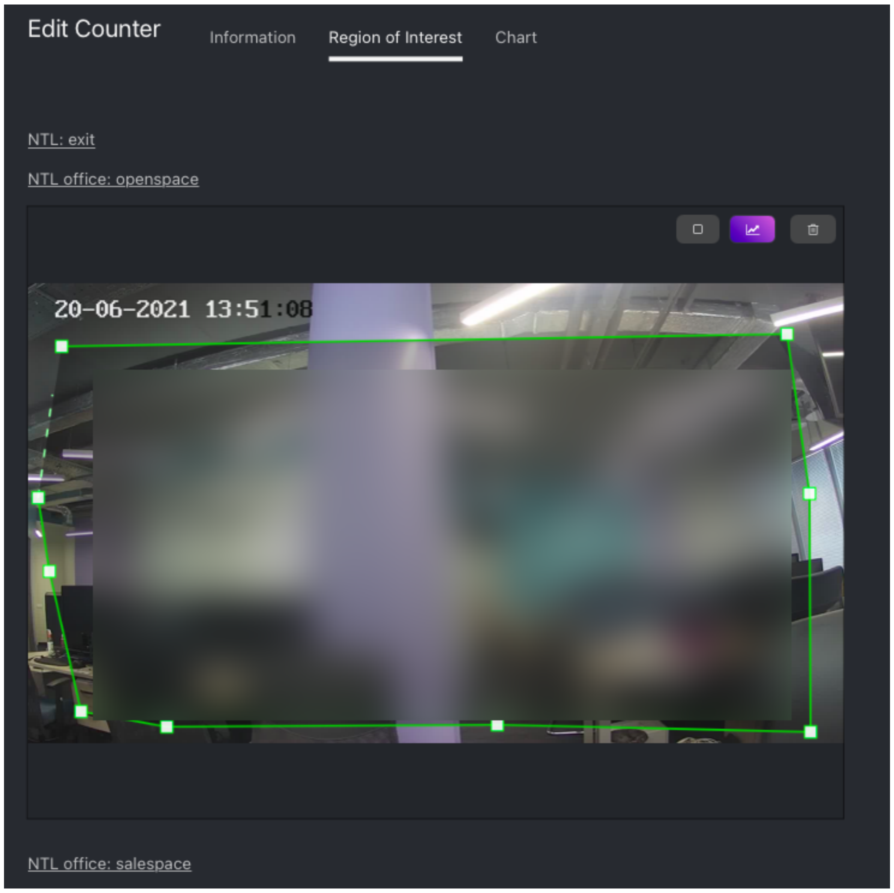
Awaiting distance model

60

Set calibration timeframe (seconds).

Minimum time - 15 seconds, maximum - 300.

12. (Optional) Navigate to the *Region of Interest* tab to specify the face/body/car tracking region within the camera(s) field.



3.5.2 Calibrate Counter for Distance Measurement

If *Distance measurement* is enabled, you should perform the counter calibration.

For counter calibration:

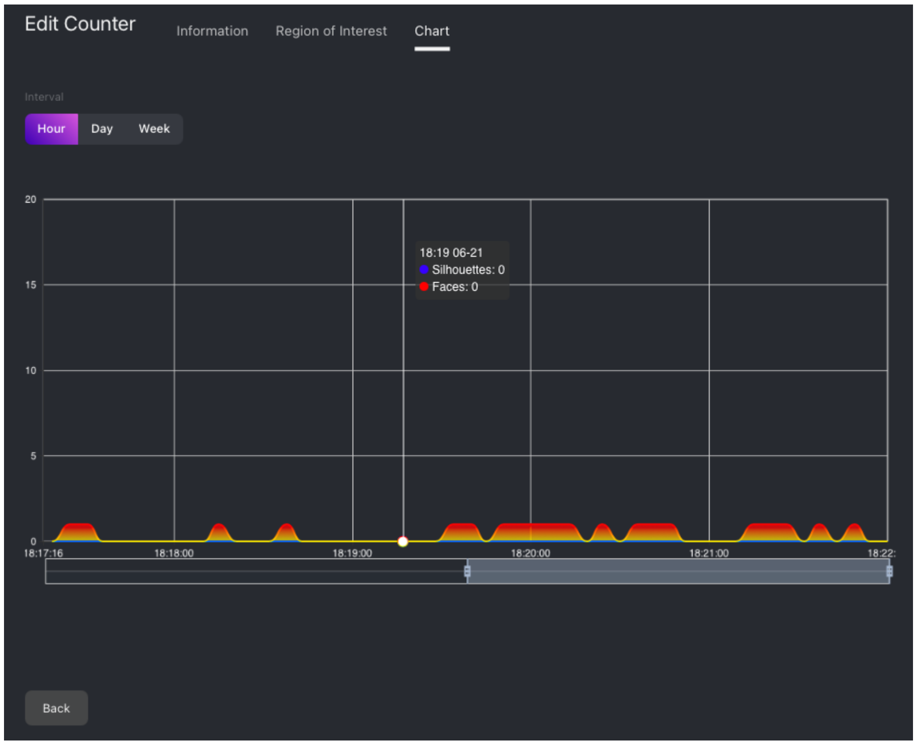
1. Ask a person to stand before the selected camera in full height.
2. Ask a person to walk through the area visible by the camera, along which the distances will be calculated. To achieve the best quality, the person must walk on a flat surface.
3. Enter the counter calibration timeframe (from 15s to 300s) and click *Calibrate counter*.

If you need to calibrate the counter for several cameras, perform steps 1-3 for each camera selected in the *Cameras* field.

If you are unsatisfied by the result, click *Delete calibration* and perform the calibration once more.

3.5.3 Counter Chart

To see the counter chart for the last hour, 24 hours, or week, navigate to the *Chart* tab in the counter settings.



3.5.4 Monitor Counter Operation

To monitor the operation of counters, navigate to the *Counters* tab.

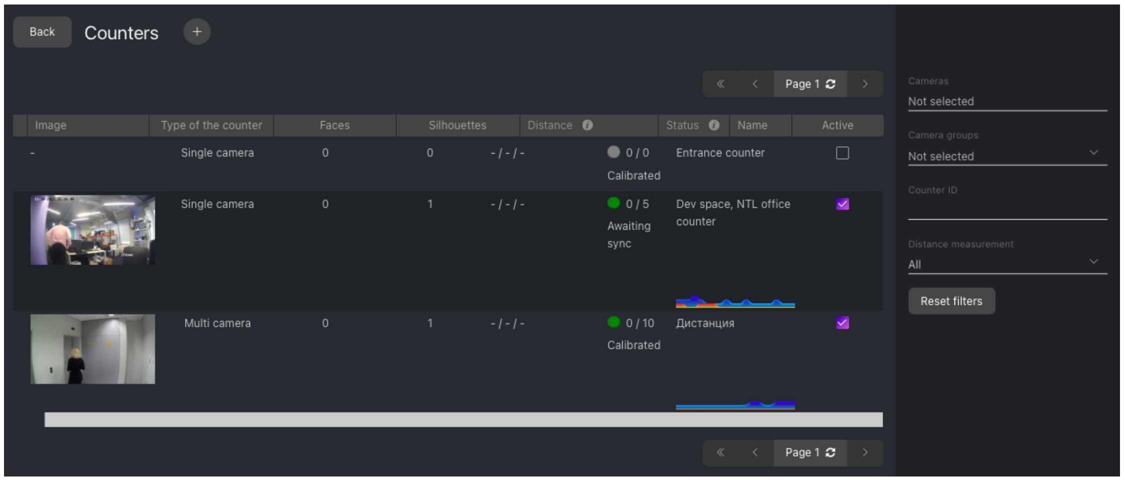


Image	Type of the counter	Faces	Silhouettes	Distance	Status	Name	Active
-	Single camera	0	0	- / - / -	0 / 0 Calibrated	Entrance counter	☐
	Single camera	0	1	- / - / -	● 0 / 5 Awaiting sync	Dev space, NTL office counter	✓
	Multi camera	0	1	- / - / -	● 0 / 10 Calibrated	Дистанция	✓

Cameras: Not selected
Camera groups: Not selected
Counter ID:
Distance measurement: All
Reset filters

Counter statuses:

- Green: the counter is running without errors, or the number of errors doesn't pass the acceptable threshold.
- Yellow: the number of errors exceeds the threshold.
- Red: the number of errors is critical.

- Grey: the counter disabled.

Tip: You can configure the yellow and red statuses based on the portion of failed counter records and change the time window duration between two consecutive checks of the counter health status. To do so, modify the following parameters in the `/etc/findface-security/config.py` configuration file:

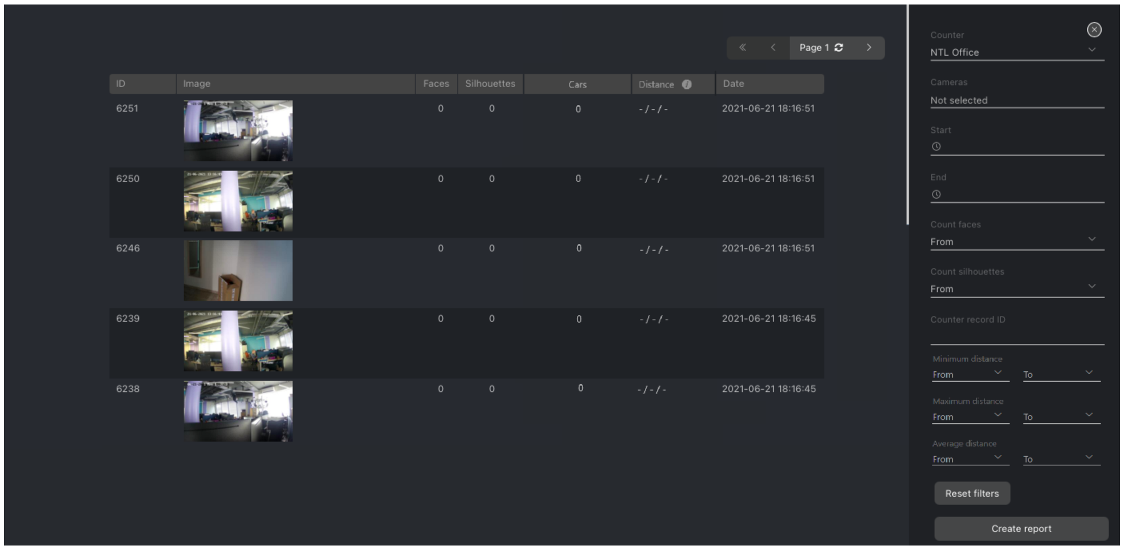
```
sudo vi /etc/findface-security/config.py

FFSECURITY = {
    ...
    # Counter health status config:
    # max percent of camera records with errors
    'MAX_COUNTER_ERROR_RECORDS': {'yellow': 0.3, 'red': 0.5},
    # time window for computing health status (in seconds)
    'COUNTER_HEALTH_STATUS_TIME_WINDOW': 30,
    ...
}
```

3.5.5 Work with Counter Records

Static screenshots taken by a counter, with the number of faces, bodies and cars in them, are saved as counter records. If you have enabled the distance measurement, each record will also contain a minimum, average, and maximum detected distance in meters.

If the counter is running with errors, the system will be creating blank records with an error message.

To see the counter records, navigate to the *Counters* tab. Click on any column for the counter, except `ID` (leads to the counter settings).



ID	Image	Faces	Silhouettes	Cars	Distance	Date
6251		0	0	0	- / - / -	2021-06-21 18:16:51
6250		0	0	0	- / - / -	2021-06-21 18:16:51
6246		0	0	0	- / - / -	2021-06-21 18:16:51
6239		0	0	0	- / - / -	2021-06-21 18:16:45
6238		0	0	0	- / - / -	2021-06-21 18:16:45

Counter: NTL Office
Cameras: Not selected
Start:
End:
Count faces: From
Count silhouettes: From
Counter record ID:
Minimum distance: From To
Maximum distance: From To
Average distance: From To

You can scale the screenshots by clicking on them. If distanse measurement is enabled, the screenshot will contain boxes around bodies and the distance between them.

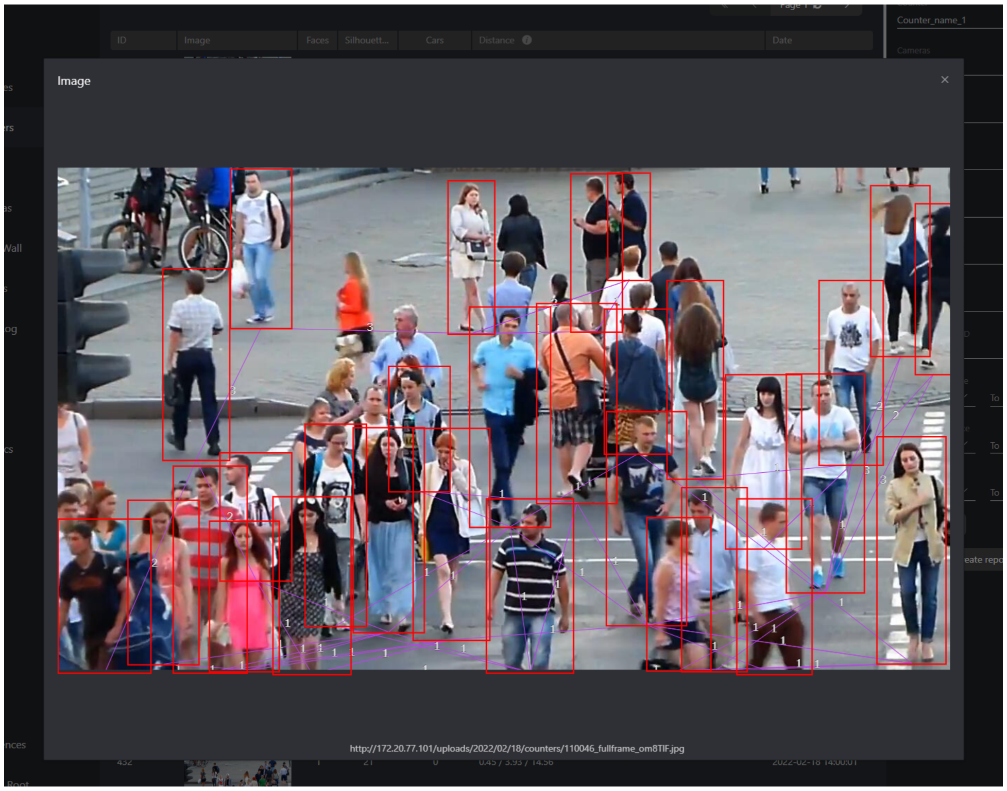


Image
http://172.20.77.101/uploads/2022/02/18/counters/110046_fullframe_om8TIF.jpg

To work with counter records, use the following filters:

- Counter
- Cameras
- Camera groups
- Time
- Number of faces in record
- Number of bodies in record
- Number of cars in record
- Record id
- Minimum distance
- Maximum distance
- Average distance

3.5.6 Set Webhook for Counter

To take it up a notch, *configure a webhook* for counter records with a specific number of faces, bodies and cars.

See also:

- *Enable Body and Body Attribute Recognition*
- *Enable Car and Car Attribute Recognition*
- *Webhooks*

3.5.7 Configure Counters

To configure counters, open the `/etc/findface-security/config.py` configuration file and modify the following parameters:

- `COUNTERS_DEDUP_OPTIONS`: a set of options that help avoid object duplication in multi-camera counters, i.e., the situation when the same object is counted on several cameras at the same time, leading to the overly increased counting result. Two options are available for each object type (`face`, `body`, `car`): `enabled` - enables object deduplication, `threshold` - defines the minimum level of similarity between objects for the system to consider them duplicates.
- `COUNTERS_SAVE_FULLFRAME` determines saving options of full frames in counters: `always`, `detect` - only save if faces, bodies or cars have been detected, `never`.
- `COUNTERS_FULLFRAME_JPEG_QUALITY`: JPEG quality of full frames,
- `COUNTERS_THUMBNAIL_JPEG_QUALITY`: JPEG quality of thumbnails.
- `COUNTERS_ROI_INTERSECTION_THRESHOLD`: required percentage of the rectangle around the object (a.k.a. `bbox`) intersection with the region of interest defined for the counter.

```
sudo vi /etc/findface-security/config.py

# deduplicate objects on multi-camera counters
 'COUNTERS_DEDUP_OPTIONS': {
     'face': {
         'enabled': False,
         'threshold': 0.723,  # model: [kiwi_320]
     },
     'body': {
         'enabled': False,
         'threshold': 0.65,  # model: [andariel]
     },
     'car': {
         'enabled': False,
         'threshold': 0.65,  # model: [alonso]
     },
},
# counters full frame saving options:
# `always` - save always
# `detect` - save only if faces or bodies have been detected
# `never` - never save full frames
'COUNTERS_SAVE_FULLFRAME': 'always',
'COUNTERS_FULLFRAME_JPEG_QUALITY': 75,
'COUNTERS_THUMBNAIL_JPEG_QUALITY': 75,
```

(continues on next page)

(continued from previous page)

```
# required percentage of bbox intersection with ROI
'COUNTERS_ROI_INTERSECTION_THRESHOLD': 0.75,
...
```

Be sure to restart the `findface-security` service after making changes.

```
sudo systemctl restart findface-security.service
```

3.6 Area Management

Important: To be able to use the Areas functionality, you first have to enable *body detection*.

FindFace Multi allows you to monitor the presence of people on cameras in given areas, using rules and schedules. Once the system detects that the situation in an area fits the rule, it creates a so-called area activation.

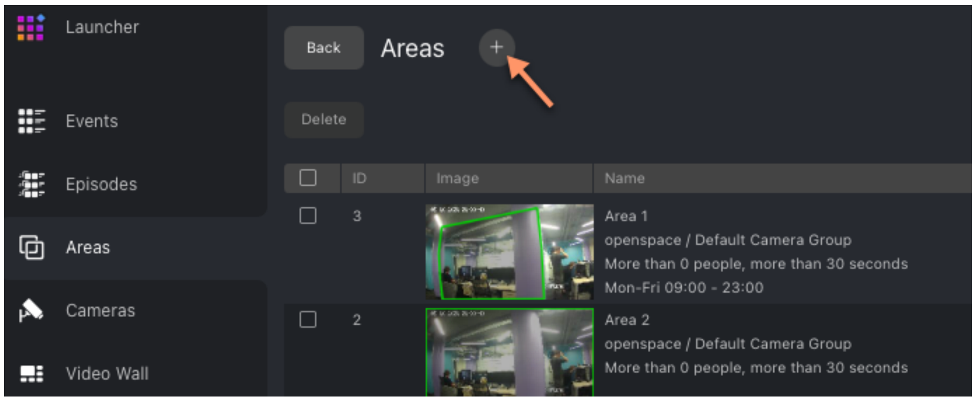
The Areas functionality is an excellent tool for solving such problems as long queues prevention at retail outlets, theft prevention at enterprises during non-working hours, hazardous area control, work time tracking, and many others.

In this section:

3.6.1 Create Area

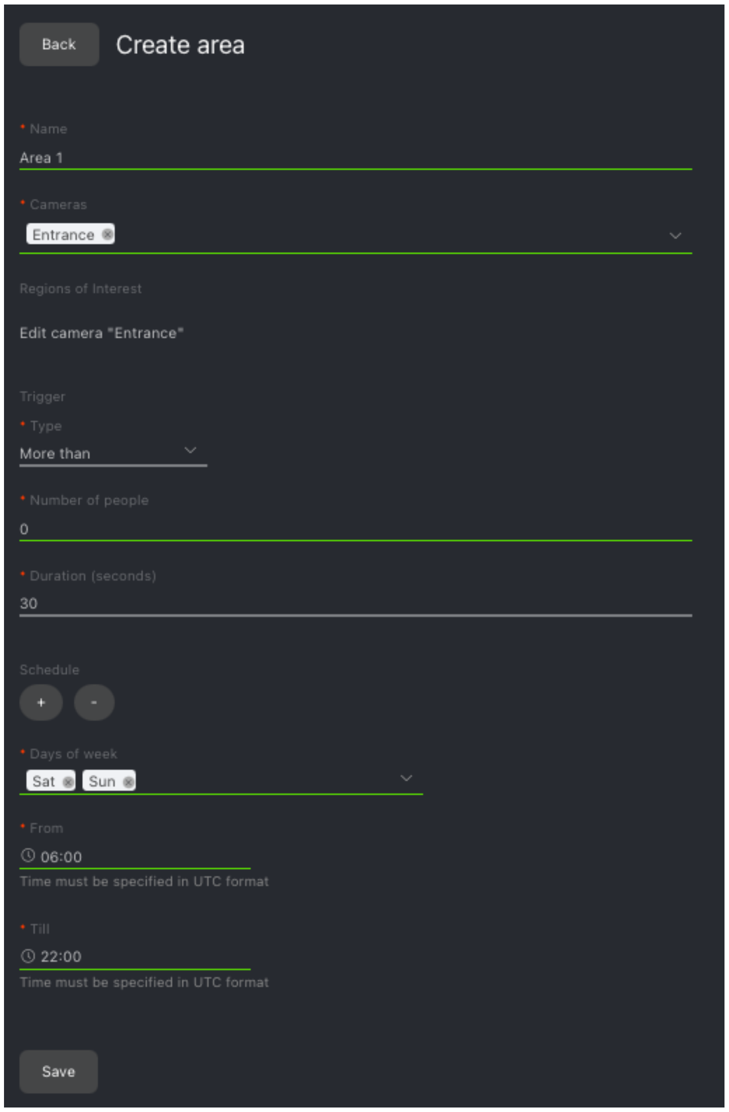
To create an area, do the following:

1. Navigate to the *Areas* tab.
2. Click +.



	ID	Image	Name
☐	3		Area 1 openspace / Default Camera Group More than 0 people, more than 30 seconds Mon-Fri 09:00 - 23:00
☐	2		Area 2 openspace / Default Camera Group More than 0 people, more than 30 seconds

3. Specify the area name.



Name: Area 1

Cameras: Entrance

Regions of Interest

Edit camera "Entrance"

Trigger

Type: More than

Number of people: 0

Duration (seconds): 30

Schedule

Days of week: Sat, Sun

From: 06:00

Time must be specified in UTC format

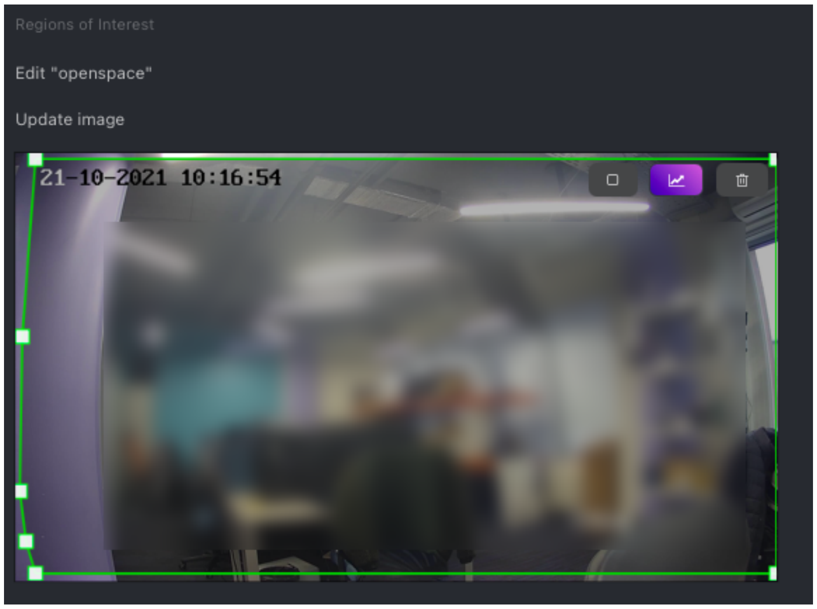
Till: 22:00

Time must be specified in UTC format

4. Select one or several cameras to monitor the area.

Tip: You can create multiple areas on the same camera to monitor the physical area using different rules and schedules.

5. Specify the region of interest within the camera(s) field.



Note: Use the following buttons:

- ▢: draw a rectangular region
- ⤢: draw a polygonal region point by point
- 🗑: delete the drawn region

6. Configure the area activation trigger (rule):

   - *Less than*: the area will be activated if the number of people has been less than the threshold value during the specified period.
   - *More than*: the area will be activated if the number of people has been more than the threshold value during the specified period.
   - *Number of people*: threshold number of people.
   - *Duration*: minimum period of trigger duration in seconds to activate the area. During this period, the number of people must remain less/more than the threshold value.

   Note: For example, the rule `More than 5 Duration 30` applied to a cashier desk results in the area activation if more than five customers have waited longer than 30 seconds in line.

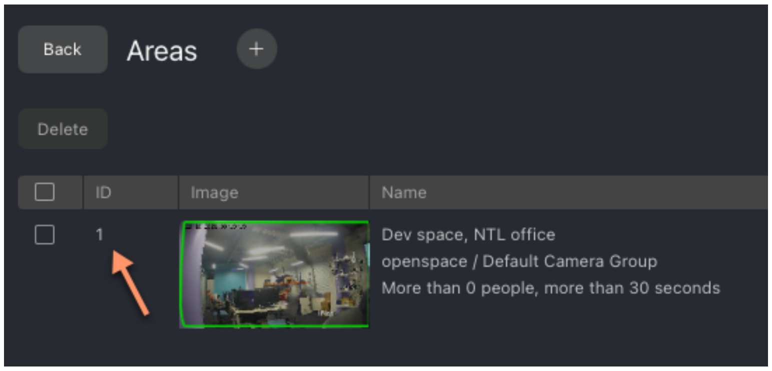
   - *Schedule*: create one or several monitoring schedules. Specify the day(s) of the week and the period during which the area will be under monitoring. If no schedule is specified, the area will be permanently monitored.

   Note: If a situation in the area continues to fit the activation rule after the scheduled monitoring period, the area will remain activated until this situation is over.

7. Click *Save*.

3.6.2 Edit Area

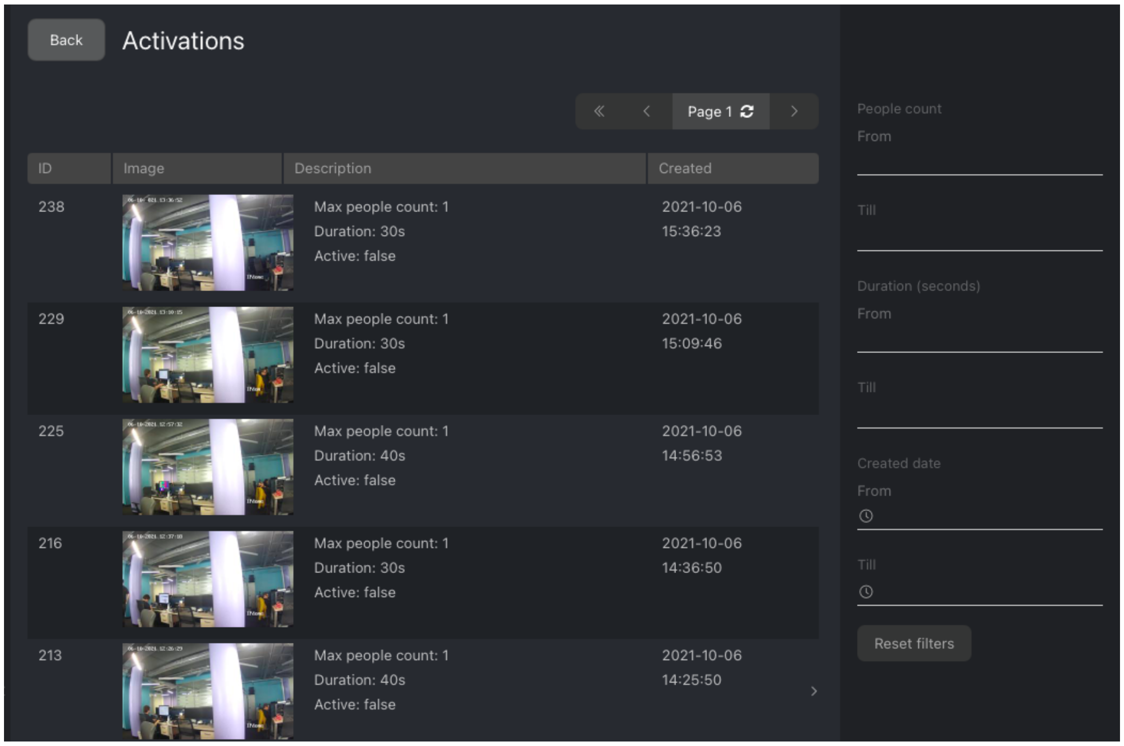
To open area settings for editing, click on the *ID* column in the area list.



	ID	Image	Name
☐	1		Dev space, NTL office openspace / Default Camera Group More than 0 people, more than 30 seconds

3.6.3 Work with Area Activations

Once the situation in an area matches the triggering rule, the system creates an area activation. To see the list of area activations, navigate to the *Areas* tab. There, click on any column for the area, except its ID (leads to the area settings).



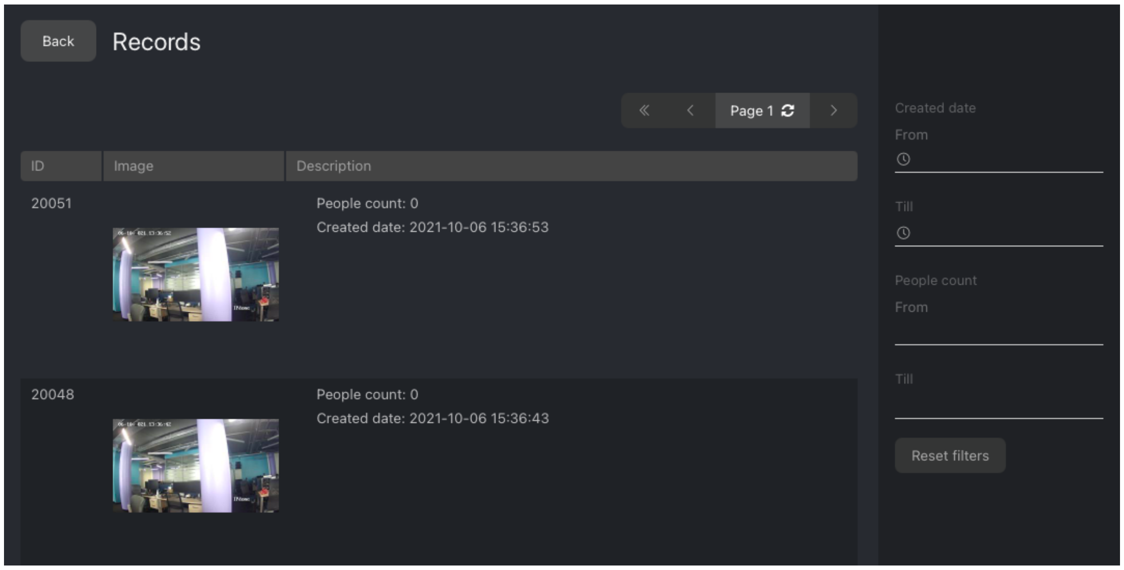
ID	Image	Description	Created
238		Max people count: 1 Duration: 30s Active: false	2021-10-06 15:36:23
229		Max people count: 1 Duration: 30s Active: false	2021-10-06 15:09:46
225		Max people count: 1 Duration: 40s Active: false	2021-10-06 14:56:53
216		Max people count: 1 Duration: 30s Active: false	2021-10-06 14:36:50
213		Max people count: 1 Duration: 40s Active: false	2021-10-06 14:25:50

Apply the following filters to the activation list if needed:

- The number of people detected in the area (`from/to`)

- Trigger duration (`from/to`)
- Creation date and time of an activation (`from/till`)

Click an activation to view its records. The records are screenshots from the area-monitoring camera, with the detected number of people and the timestamp.



20051
People count: 0
Created date: 2021-10-06 15:36:53

20048
People count: 0
Created date: 2021-10-06 15:36:43

Note: The records are taken with the 10-second interval throughout the entire trigger duration.

Filter the record list using the following parameters:

- The number of people in the record (`from/to`)
- Record timestamp (`from/till`)

3.6.4 Work Time Reports on Areas

See *Reports*.

3.6.5 Set Webhook for Area

To take it up a notch and automate your work with an area, *configure a webhook*.

3.6.6 Configure Areas

You can configure how screenshots (full frames) that you see in area activation records, and their thumbnails, are saved in the system. You can also enable body deduplication in multi-camera areas, to avoid the situation when the same person is counted on several cameras at the same time. This situation can lead to the overly increased counting result and, as an outcome, to a false area activation/absence of activation.

To configure areas, open the `/etc/findface-security/config.py` configuration file and modify the following parameters:

- AREA_DEDUP_OPTIONS: a set of options that help avoid body duplication in multi-camera areas. Two options are available: enabled - enables body deduplication, threshold - defines the minimum level of similarity between bodies for the system to consider them duplicates.
- AREAS_SAVE_FULLFRAME determines saving options of full frames in activation records: always, never.
- AREAS_THUMBNAIL_JPEG_QUALITY: JPEG quality of thumbnails.
- AREAS_FULLFRAME_JPEG_QUALITY: JPEG quality of full frames.

```
sudo vi /etc/findface-security/config.py

...
# deduplicate objects on multi-camera areas
'AREA_DEDUP_OPTIONS': {
    'enabled': False,
    'threshold': 0.65,  # model: [andariel]
},
# areas full frame saving options:
# `always` - save always
# `never` - never save full frames
'AREAS_SAVE_FULLFRAME': 'always',
'AREAS_THUMBNAIL_JPEG_QUALITY': 75,
'AREAS_FULLFRAME_JPEG_QUALITY': 75,
...
```

Be sure to restart the findface-security service after making changes.

```
sudo systemctl restart findface-security.service
```

3.7 Events and Episodes of Object Recognition

To monitor the real-time object identification in live videos, use the *Events* and *Episodes* tabs. Besides monitoring, both tabs allow you to access the history of identification events.

Tip: Search for objects through the event database and card index on the *Search* tab.

Tip: To perform the object identification in archived videos, see *Object Identification in Offline Videos*.

3.7.1 Work with Events

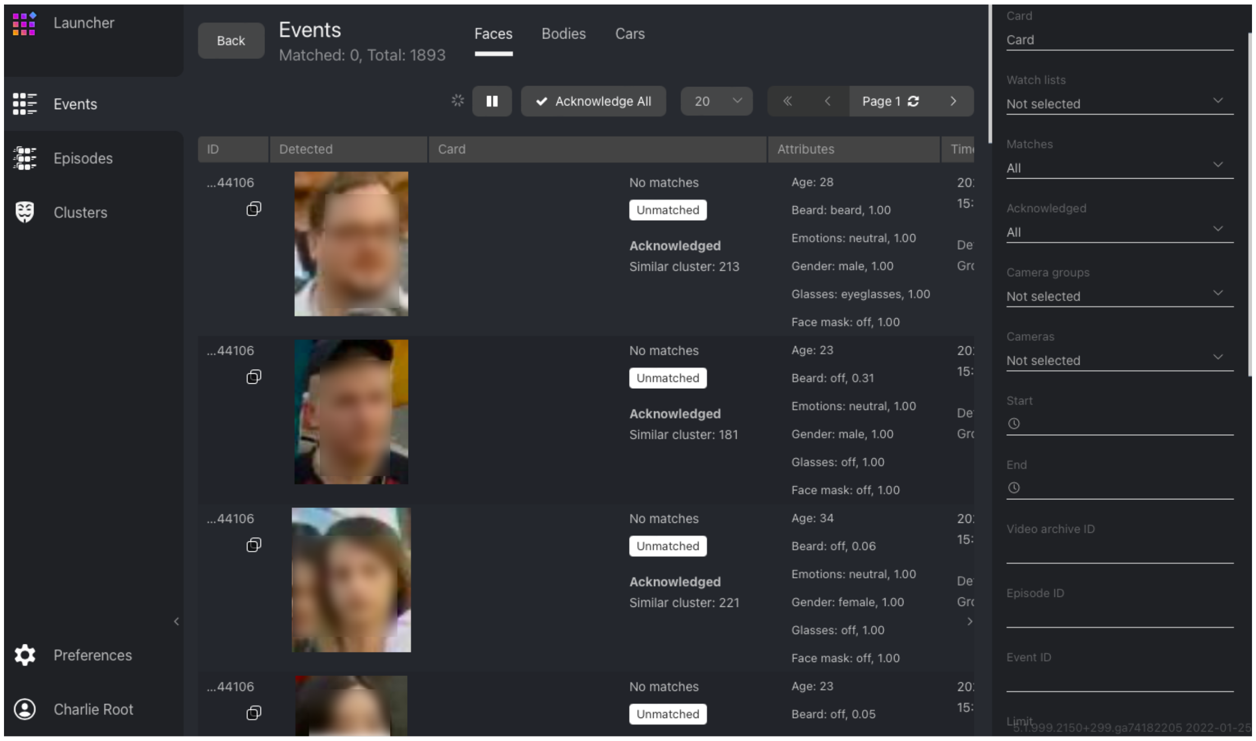
This section is about the *Events* tab.

Important: You can *enable sound notifications* for events related to specific watch lists. In some browsers, the tab with events has to remain in focus to get a sound played. To put a tab in focus, open it, and click anywhere on the page.

In this chapter:

View Events

Once an object is detected, you will see a notification on one of the event lists: *Faces*, *Bodies*, or *Cars*, subject to the object type.



Events
Matched: 0, Total: 1893

ID	Detected	Card	Attributes	Tim
...44106		No matches Unmatched Acknowledged Similar cluster: 213	Age: 28 Beard: beard, 1.00 Emotions: neutral, 1.00 Gender: male, 1.00 Glasses: eyeglasses, 1.00 Face mask: off, 1.00	20: 15: De Gro
...44106		No matches Unmatched Acknowledged Similar cluster: 181	Age: 23 Beard: off, 0.31 Emotions: neutral, 1.00 Gender: male, 1.00 Glasses: off, 1.00 Face mask: off, 1.00	20: 15: De Gro
...44106		No matches Unmatched Acknowledged Similar cluster: 221	Age: 34 Beard: off, 0.06 Emotions: neutral, 1.00 Gender: female, 1.00 Glasses: off, 1.00 Face mask: off, 1.00	20: 15: De Gro
...44106		No matches Unmatched	Age: 23 Beard: off, 0.05	20: 15:

Card: Card
Watch lists: Not selected
Matches: All
Acknowledged: All
Camera groups: Not selected
Cameras: Not selected
Start
End
Video archive ID
Episode ID
Event ID
Limit
5.1.999.2150+299.ga74182205 2022-01-2

A notification can feature different pieces of information, depending on whether a detected object has a match in the card index:

- Match not found: the normalized object image, detection date and time, camera group name.
- Match found: the normalized object image, reference object photo from the related card, name, the similarity between the matched objects, comment from the card, watch list, detection date and time, camera group.

Important: In order to pause the notifications thread, click ⏸ above the list of events.

When working with events, the following filters may come in handy:

Note: Some filters from the list below may be hidden, subject to enabled recognition features.

- *Card*: display events only for a selected card.
- *Watch lists*: display events only for a selected watch list.
- *Matches*: display events only with/without matches, or all events.
- *Acknowledged*: display only acknowledged/unacknowledged events, or all events.
- *Cameras*: display only events from a selected camera.
- *Camera groups*: display only events from a selected group of cameras.
- *Start*, *End*: display only events that occurred within a certain period.
- *Video Archive ID*: display events from the video archive with a given ID.
- *Event ID*: display an event with a given ID.
- *Episode ID*: display events from the episode with a given ID.
- *Limit*: display a given number of most relevant events.

Specific filters for faces

- *Event best shot*: display all events of a track, only events with real-time snapshots, only one event with the best snapshot at the end of a track.
- *Age*: display events with people of a given age.
- *Gender*: display events with people of a given gender.
- *Emotions*: display events with given emotions.
- *Glasses*: filter events by the fact of wearing glasses.
- *Beard*: filter events by the fact of having a beard.
- *Liveness*: filter events by face liveness.
- *Face mask*: filter events by the fact of wearing a face mask.

Specific filters for bodies

- *Headwear*: display only events with a person wearing headgear of a given type: hat/cap, hood/headscarf, none.
- *Upper body clothes*: display only events with a person wearing upper body wear of a given generalized category: long sleeves, short sleeves, no sleeve.
- *Upper clothes type*: display only events with a person wearing upper body wear of a given specific type: jacket, coat, sleeveless vest, sweatshirt, T-shirt, shirt, dress.
- *Upper clothes color*: display only events with a person wearing a top of a given color.
- *Lower body clothes*: display only events with a person wearing lower body wear of a given type: pants, skirt, shorts, obscured.
- *Lower clothes color*: display only events with a person wearing a bottom of a given color.

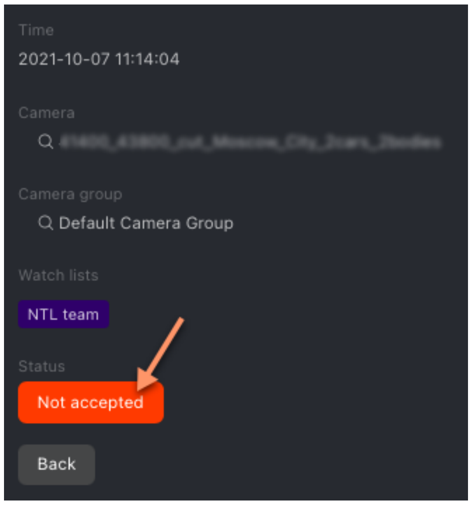
Specific filters for cars

- *Car body style*: display only events with cars of a given body style.
- *Car color*: display only events with cars of a given color.
- *Country of the license plate*: display only events with cars registered in a given country.
- *Number plate*: display an event with a given plate number.
- *Region of the license plate*: display only events with cars registered in a given region.
- *Make*: filter car events by car make.
- *Model*: filter car events by car model.
- *Special vehicle*: display only events with vehicles belonging to a given type: police, ambulance, rescue service, taxi, other.

Event Ticket. Acknowledging Event

In order to navigate to an event ticket from the list of events, click on the recognition result in a notification (*No matches* or the name from the corresponding card).

An event ticket contains the same data as a relevant *notification*. It also allows for acknowledging the event. To do so, click *Not accepted* to change the event acknowledgment status. Click *Save*.


Time
2021-10-07 11:14:04
Camera
[redacted]
Camera group
Default Camera Group
Watch lists
NTL team
Status
Not accepted
Back

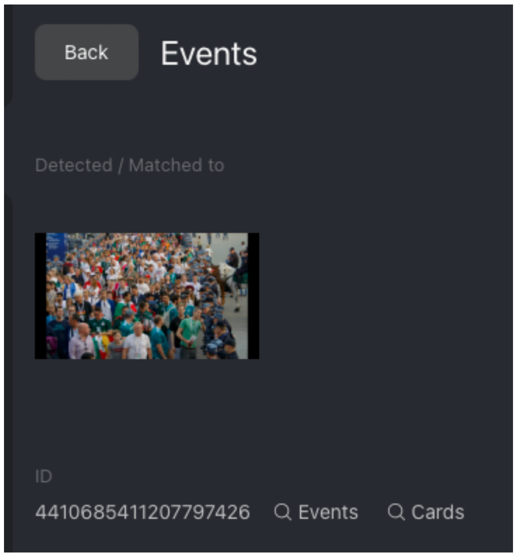
Tip: If a detected object has a match in the card index, you can navigate to the relevant card by clicking on the name in the event ticket.

Tip: In order to acknowledge all events, click ✓ above the list of events.

Note: Event acknowledgment can be automated for selected watch lists.

Event Ticket. Object Search

FindFace Multi allows you to search detected objects through the list of events and card index. To navigate from an event ticket to the search tab, click *Events* or *Cards* respectively.



See also:

- *Search Objects in Databases*

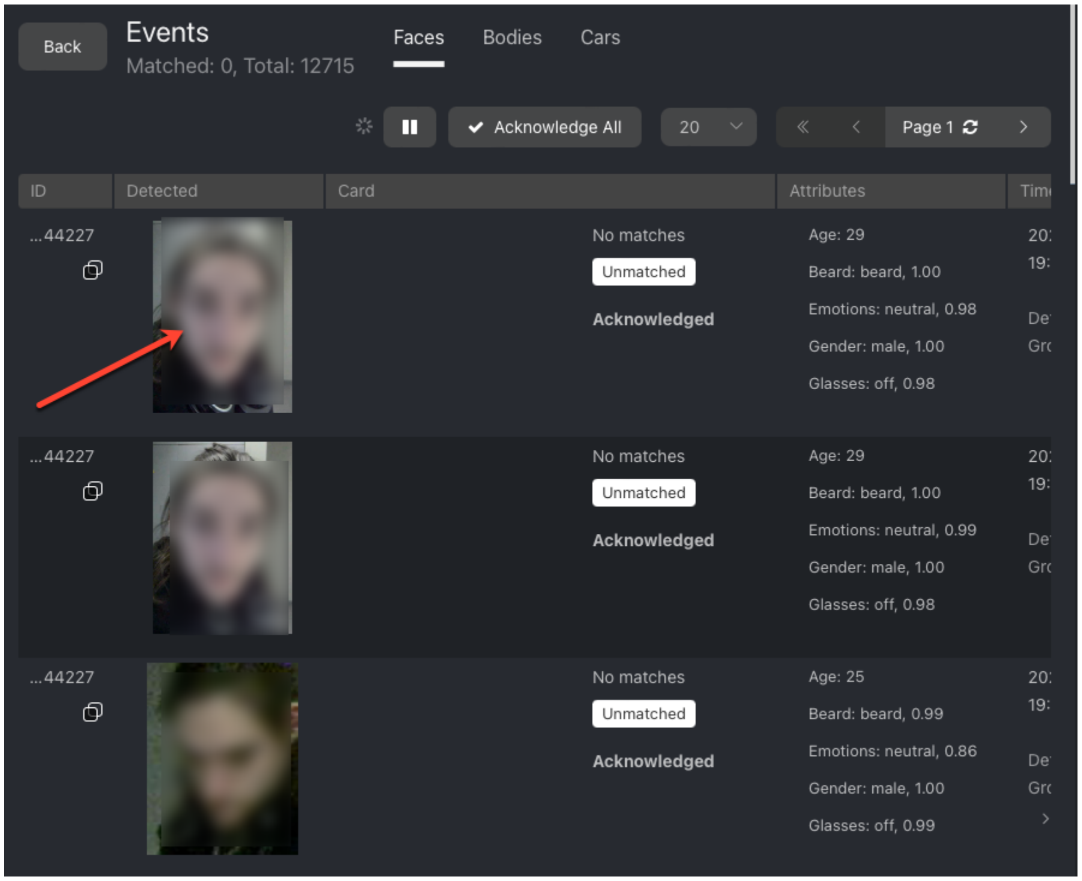
Work Time Reports on Events

See *Reports*.

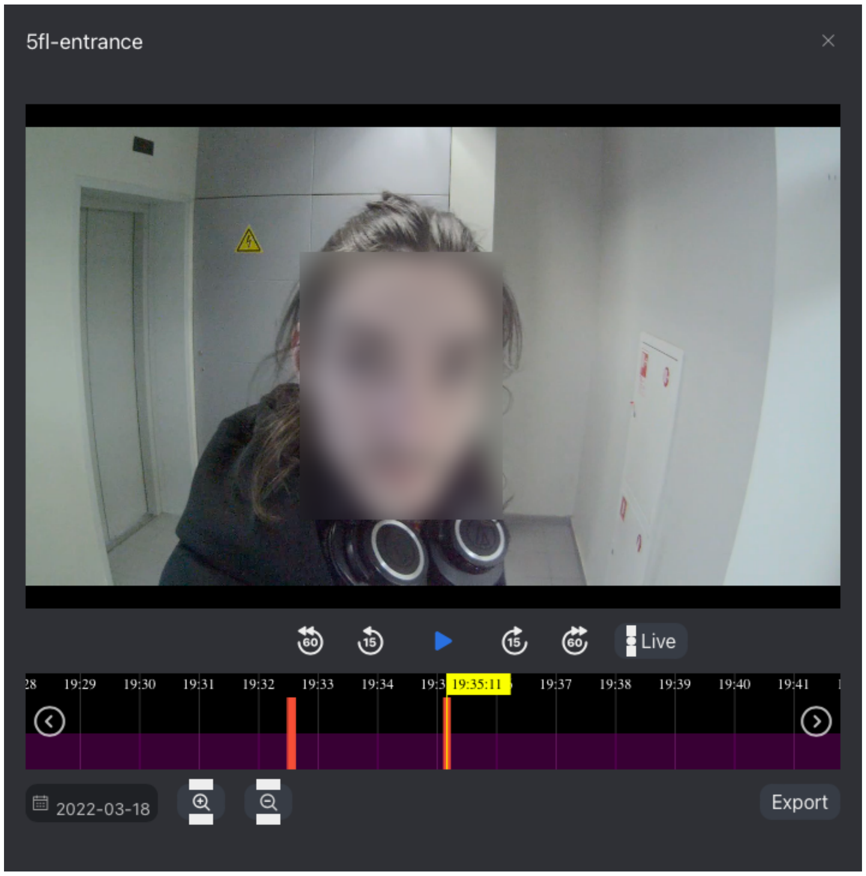
Video Player in Event Notification

Important: Only with *Video Recorder*.

If Video Recorder is *deployed* and properly *configured*, clicking on an event's thumbnail plays the event video in the appeared video player.



ID	Detected	Card	Attributes	Tim
...44227		No matches Unmatched Acknowledged	Age: 29 Beard: beard, 1.00 Emotions: neutral, 0.98 Gender: male, 1.00 Glasses: off, 0.98	20: 19: De Grc
...44227		No matches Unmatched Acknowledged	Age: 29 Beard: beard, 1.00 Emotions: neutral, 0.99 Gender: male, 1.00 Glasses: off, 0.98	20: 19: De Grc
...44227		No matches Unmatched Acknowledged	Age: 25 Beard: beard, 0.99 Emotions: neutral, 0.86 Gender: male, 1.00 Glasses: off, 0.99	20: 19: De Grc



The video player has a highly intuitive design. See *View Camera Video in Video Player* for details.

3.7.2 Organize Events with Episodes

This section is about the *Episodes* tab.

See also:

- *Work with Events*

An episode is a set of identification events that feature objects of the same origin (face and body images of the same person and images of the same car) detected within a specific period. As events on the *Events* tab show up in an arbitrary order, a large number of miscellaneous events can make the work difficult and unproductive. With the episodes, the system uses AI to organize incoming events based on the objects' similarity and detection time. This allows for easy processing of diverse events, even in large numbers.

In this chapter:

About Episodes

There are two stages of an episode lifecycle:

- LIVE: an episode is currently active, with more events to be possibly added.
- Closed: an episode is closed, no events can be added.

Episodes are classified as people episodes and car episodes. People episodes feature face and body images of people, detected within a specific period, while car episodes contain car images.

Grant Rights for Episodes

A user receives a notification of a new episode if they have rights for the first event. Viewing new events in the episode also requires proper rights.

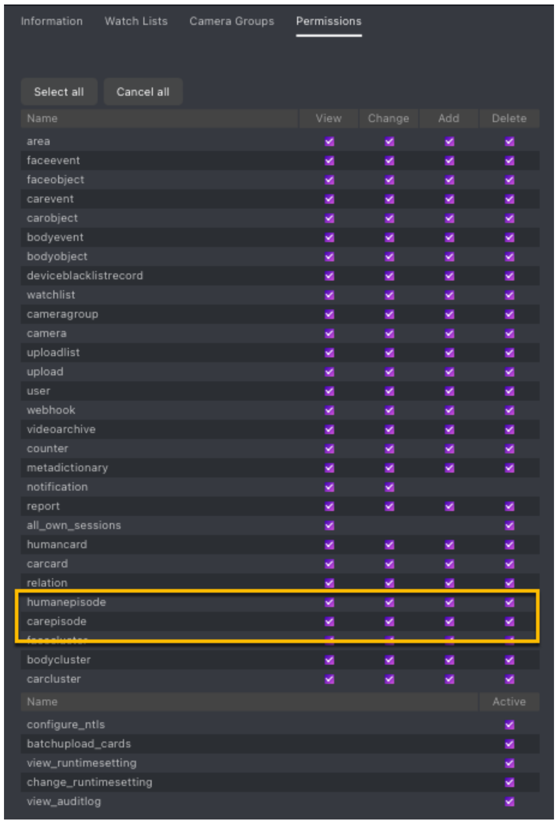
The right for an event consists of the rights for a corresponding camera and watch list.

Note: To see unmatched events, you only need the rights for a camera.

To manage rights of a role for the entire `Episode` entity, open permissions for this role and adjust the following permissions:

- `humanepisode`: people episodes
- `carepisode`: car episodes

Tip: See *User Management*.



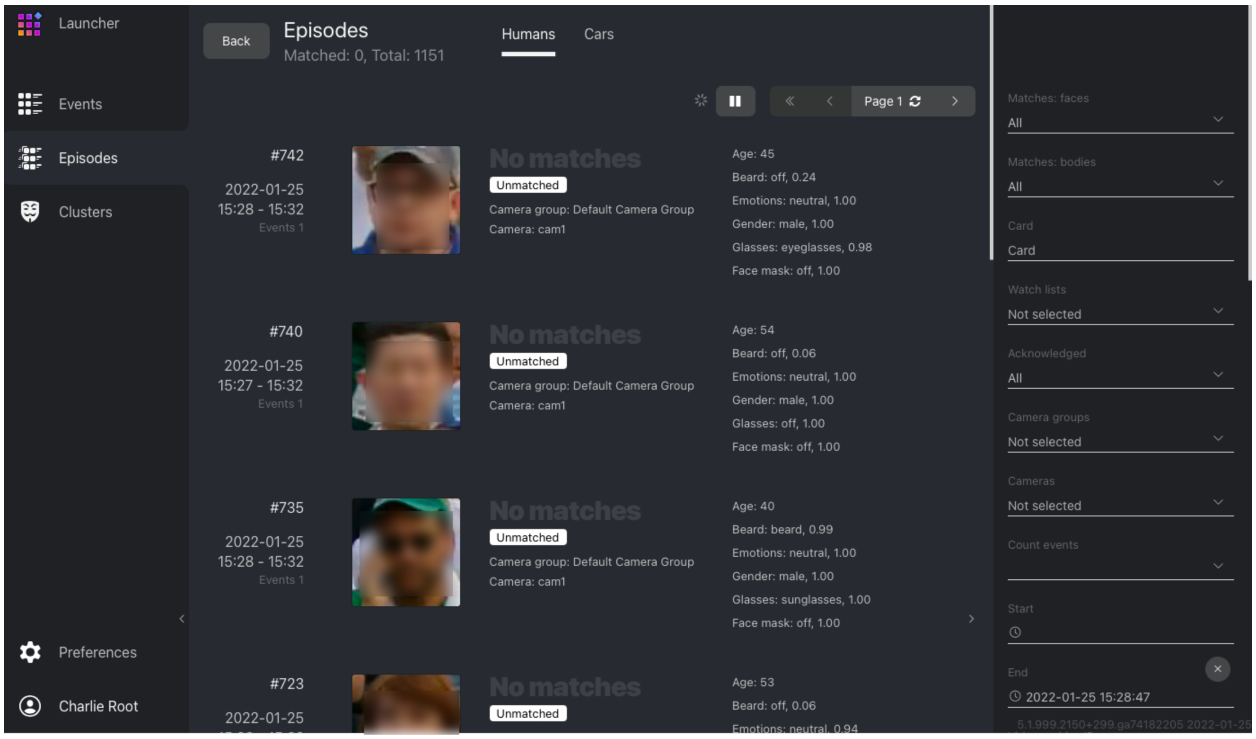
Name	View	Change	Add	Delete
area	✓	✓	✓	✓
faceevent	✓	✓	✓	✓
faceobject	✓	✓	✓	✓
carevent	✓	✓	✓	✓
carobject	✓	✓	✓	✓
bodyevent	✓	✓	✓	✓
bodyobject	✓	✓	✓	✓
deviceblacklistrecord	✓	✓	✓	✓
watchlist	✓	✓	✓	✓
cameragroup	✓	✓	✓	✓
camera	✓	✓	✓	✓
uploadlist	✓	✓	✓	✓
upload	✓	✓	✓	✓
user	✓	✓	✓	✓
webhook	✓	✓	✓	✓
videoarchive	✓	✓	✓	✓
counter	✓	✓	✓	✓
metadictionary	✓	✓	✓	✓
notification	✓	✓		
report	✓	✓	✓	✓
all_own_sessions	✓			✓
humancard	✓	✓	✓	✓
carcard	✓	✓	✓	✓
relation	✓	✓	✓	✓
humanepisode	✓	✓	✓	✓
carepisode	✓	✓	✓	✓
facecluster	✓	✓	✓	✓
bodycluster	✓	✓	✓	✓
carcluster	✓	✓	✓	✓

Name	Active
configure_ntls	✓
batchupload_cards	✓
view_runtimesetting	✓
change_runtimesetting	✓
view_auditlog	✓

View Episodes

You can find the list of episodes with filters and statistics on the *Episodes* tab. Episodes are sorted subject to the object's origin: there are people episodes and car episodes.

Once an object is detected, it is either added to an existing LIVE episode or used as a starting point for a new episode. Each episode is assigned an identifier which can be later used to filter events and episodes.



Episodes
Matched: 0, Total: 1151

#742
2022-01-25
15:28 - 15:32
Events 1
No matches
Unmatched
Camera group: Default Camera Group
Camera: cam1
Age: 45
Beard: off, 0.24
Emotions: neutral, 1.00
Gender: male, 1.00
Glasses: eyeglasses, 0.98
Face mask: off, 1.00

#740
2022-01-25
15:27 - 15:32
Events 1
No matches
Unmatched
Camera group: Default Camera Group
Camera: cam1
Age: 54
Beard: off, 0.06
Emotions: neutral, 1.00
Gender: male, 1.00
Glasses: off, 1.00
Face mask: off, 1.00

#735
2022-01-25
15:28 - 15:32
Events 1
No matches
Unmatched
Camera group: Default Camera Group
Camera: cam1
Age: 40
Beard: beard, 0.99
Emotions: neutral, 1.00
Gender: male, 1.00
Glasses: sunglasses, 1.00
Face mask: off, 1.00

#723
2022-01-25
No matches
Unmatched
Age: 53
Beard: off, 0.06
Emotions: neutral, 0.94

Matches: faces: All
Matches: bodies: All
Card: Card
Watch lists: Not selected
Acknowledged: All
Camera groups: Not selected
Cameras: Not selected
Count events:
Start:
End: 2022-01-25 15:28:47

When working with the episodes, the following default filters may come in handy:

Note: Some filters from the list below may be hidden, subject to enabled recognition features.

- *Card*: display episodes only for a selected card.
- *Watch lists*: display episodes only for a selected watch list.
- *Matches*: display episodes only with/without matches, or all episodes.
- *Acknowledged*: display only acknowledged/unacknowledged episodes, or all episodes.
- *Cameras*: display only episodes from a selected camera.
- *Camera groups*: display only episodes from a selected group of cameras.
- *Start*, *End*: display only episodes that occurred within a certain period.
- *Count from*: display only episodes with a given number of events.
- *Video Archive ID*: display episodes related to the video archive with a given ID.
- *Episode ID*: display an episode with a given ID.

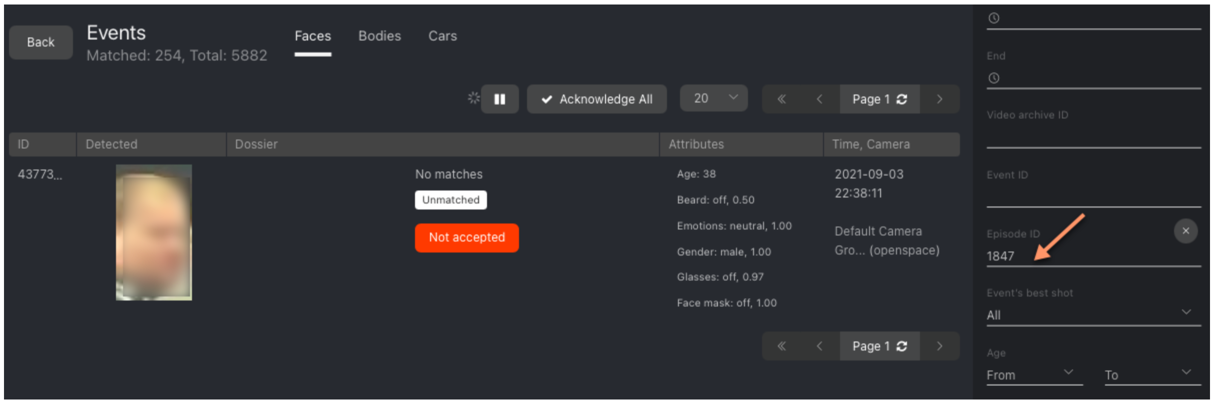
Specific filters for people episodes

- *Age*: display episodes with people of a given age.
- *Gender*: display episodes with people of a given gender.
- *Emotions*: display episodes with given emotions.
- *Glasses*: filter episodes by the fact of wearing glasses.
- *Beard*: filter episodes by the fact of having a beard.
- *Liveness*: filter episodes by face liveness.
- *Face mask*: filter episodes by the fact of wearing a face mask.
- *Headwear*: display only episodes with a person wearing headgear of a given type: hat/cap, hood/headscarf, none.
- *Upper body clothes*: display only episodes with a person wearing upper body wear of a given generalized category: long sleeves, short sleeves, no sleeve.
- *Upper clothes type*: display only episodes with a person wearing upper body wear of a given specific type: jacket, coat, sleeveless vest, sweatshirt, T-shirt, shirt, dress.
- *Upper clothes color*: display only episodes with a person wearing a top of a given color.
- *Lower body clothes*: display only episodes with a person wearing lower body wear of a given type: pants, skirt, shorts, obscured.
- *Lower clothes color*: display only episodes with a person wearing a bottom of a given color.

Specific filters for car episodes

- *Car body style*: display only episodes with cars of a given body style.
- *Car color*: display only episodes with cars of a given color.
- *Country of the license plate*: display only episodes with cars registered in a given country.
- *Number plate*: display an episode with a given plate number.
- *Region of the license plate*: display only episodes with cars registered in a given region.
- *Make*: filter car episodes by car make.
- *Model*: filter car episodes by car model.
- *Special vehicle*: display only episodes with vehicles belonging to a given type: police, ambulance, rescue service, taxi, other.

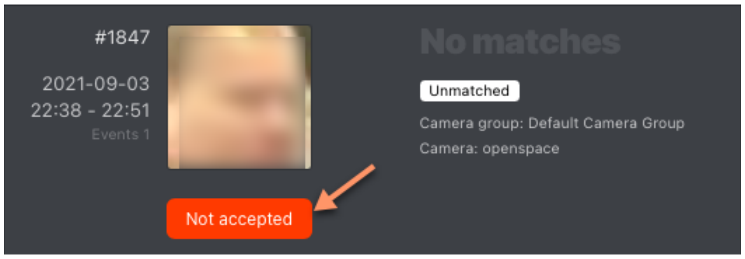
To view episode events, click the episode on the list. You will be redirected to the *Events* tab with the corresponding episode ID set in the *Episode* filter:



Work with the *Events* tab as described in *Work with Events*.

Event and Episode Acknowledging

To acknowledge an entire episode, click *Not accepted* for this episode on the list. As a result, all events in the episode will be automatically acknowledged, including those that are yet-to-appear (in the case of a LIVE episode).



An episode is also automatically acknowledged after acknowledging all its events one by one.

Filter Events by Episode ID

To display events by episode ID, either use the *id* filter on the *Episodes* tab or the *Episode ID* filter on the *Events* tab.

Episode Settings

To configure the episodes, use the `/etc/findface-security/config.py` configuration file. Find the following parameters in the `FFSECURITY` section:

- `FACE_EPISODES_THRESHOLD`, `BODY_EPISODES_THRESHOLD`, `CAR_EPISODES_THRESHOLD`: Similarity thresholds that the system are using when searching for recent events in order to construct an episode. The default values are set to the optimum. If necessary, you can change them. Be sure to consult with our technical experts prior (support@ntechlab.com).
- `FACE_EPISODE_SEARCH_INTERVAL`, `BODY_EPISODE_SEARCH_INTERVAL`, `CAR_EPISODE_SEARCH_INTERVAL`: The period preceding an event, for which the system searches the feature vector database for already existing events with similar objects. If no such event is found, the system creates a new episode. Otherwise, it sorts out the 100 most recent similar objects and picks up the most relevant event from a LIVE episode.
- `EPISODE_MAX_DURATION`: The maximum episode duration in seconds. After this time, an episode automatically closes.
- `EPISODE_EVENT_TIMEOUT`: The maximum time in seconds since the last event has been added to an episode. After this time, an episode automatically closes.

- EPISODE_KEEP_ONLY_BEST_EVENT: When closing an episode, delete all events in it, except the one with the best object. Use this option to save disk space.

```
sudo vi /etc/findface-security/config.py

...

FFSECURITY = {
      ...
      # episodes specific matching threshold that is used to join faces in an episode
      'FACE_EPISODES_THRESHOLD': 0.688,  # FAR = 1.00E-06  # model: [kiwi_320]
      'BODY_EPISODES_THRESHOLD': 0.61,  # model: [andariel]
      'CAR_EPISODES_THRESHOLD': 0.61,  # model: [alonso]
      ...
      'EPISODE_KEEP_ONLY_BEST_EVENT': True,
      ...
      # maximum event age in seconds than could be added to an episode.
      'FACE_EPISODE_SEARCH_INTERVAL': 60,
      'BODY_EPISODE_SEARCH_INTERVAL': 60,
      'CAR_EPISODE_SEARCH_INTERVAL': 60,
      # maximum episode duration (episode is closed after)
      'EPISODE_MAX_DURATION': 300,
      # if no new event added to an episode during this timeout, episode will be closed.
      'EPISODE_EVENT_TIMEOUT': 30,
      ...
}

...
```

3.8 Object Identification in Offline Videos

Besides real-time object identification, FindFace Multi allows for offline video processing. This functionality has a wide range of possible applications, among which the most common case is object detection and recognition in archived videos.

In this chapter:

3.8.1 Video File Formats

FindFace Multi supports a wide variety of file formats depending on the acceleration type (CPU or GPU).

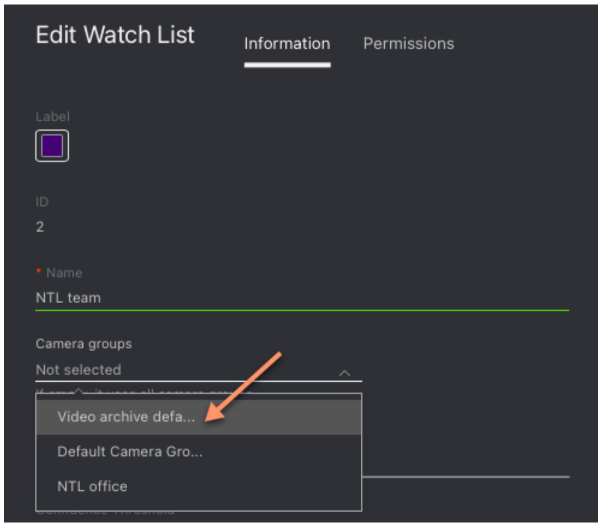
Both CPU- and GPU-accelerated instances support all FFMPEG codecs. In addition to that, the following codecs are supported:

- *CPU-based acceleration*: flv (both as a codec and as a container), h263, h264, h265, mjpeg, vp8, vp9, mpeg1video, mpeg2video, msmpeg4v2, msmpeg4v3
- *GPU-based acceleration*: mjpeg, h264, h265, vp9 and others, depending on the list of codecs supported by the used video card. Apart from that, for GPU-accelerated instances the CPU-based acceleration can be enabled, thus adding flv support, which is not available by default.

3.8.2 Process Video File

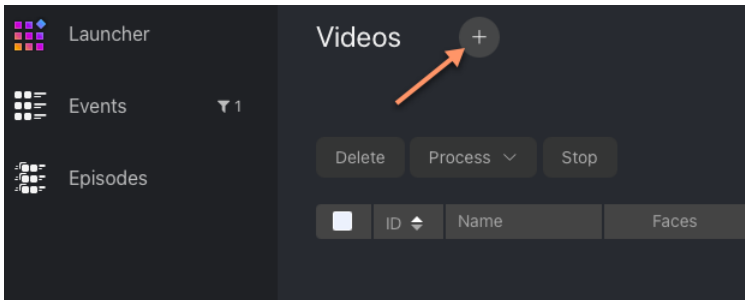
Important: Before the video processing, the following prep work is required:

1. Designate a camera group to which the system will attribute the object recognition events from the video. The `Video archive default camera group` is perfect for this task. You can also create a new camera group with basic settings specifically for this video file.
2. Assign the designated camera group to all *watch lists* you want to monitor when processing the video.

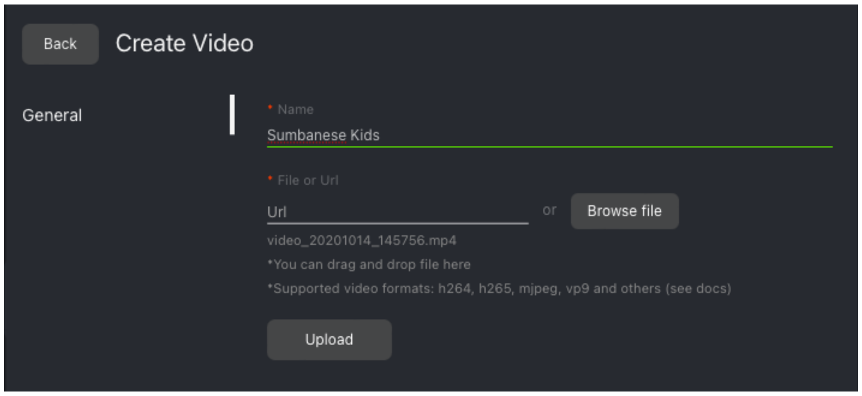


To identify objects in an offline video, do the following:

1. Create a video in FindFace Multi by uploading it from a file or online storage/cloud. To do so, navigate to the *Videos* tab.
2. Click +.

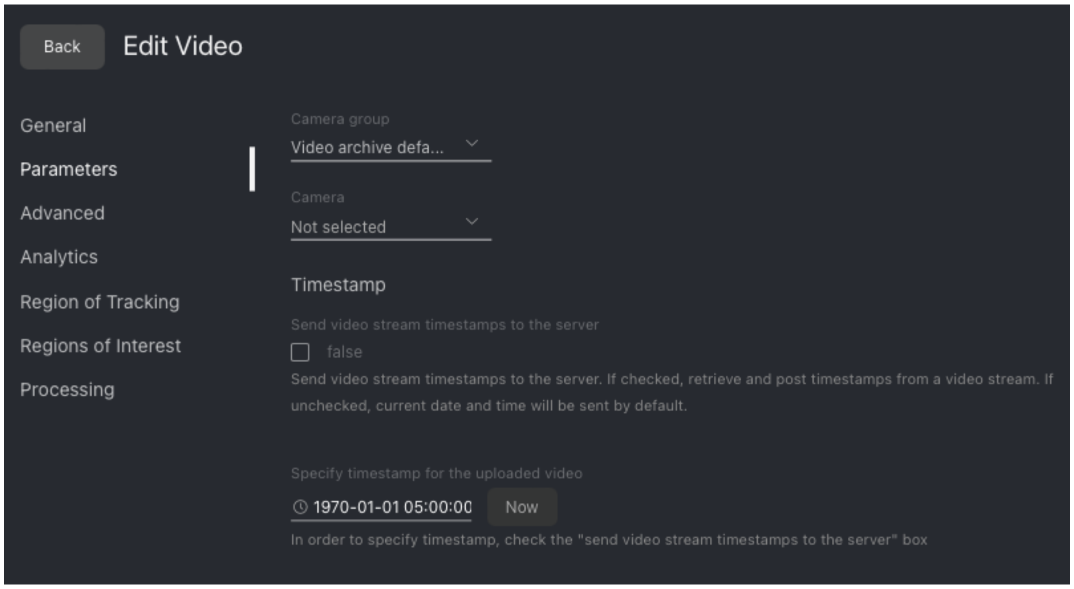


3. Specify the video name.



* Name
Sumbanese Kids
* File or Url
Url or
video_20201014_145756.mp4
*You can drag and drop file here
*Supported video formats: h264, h265, mjpeg, vp9 and others (see docs)

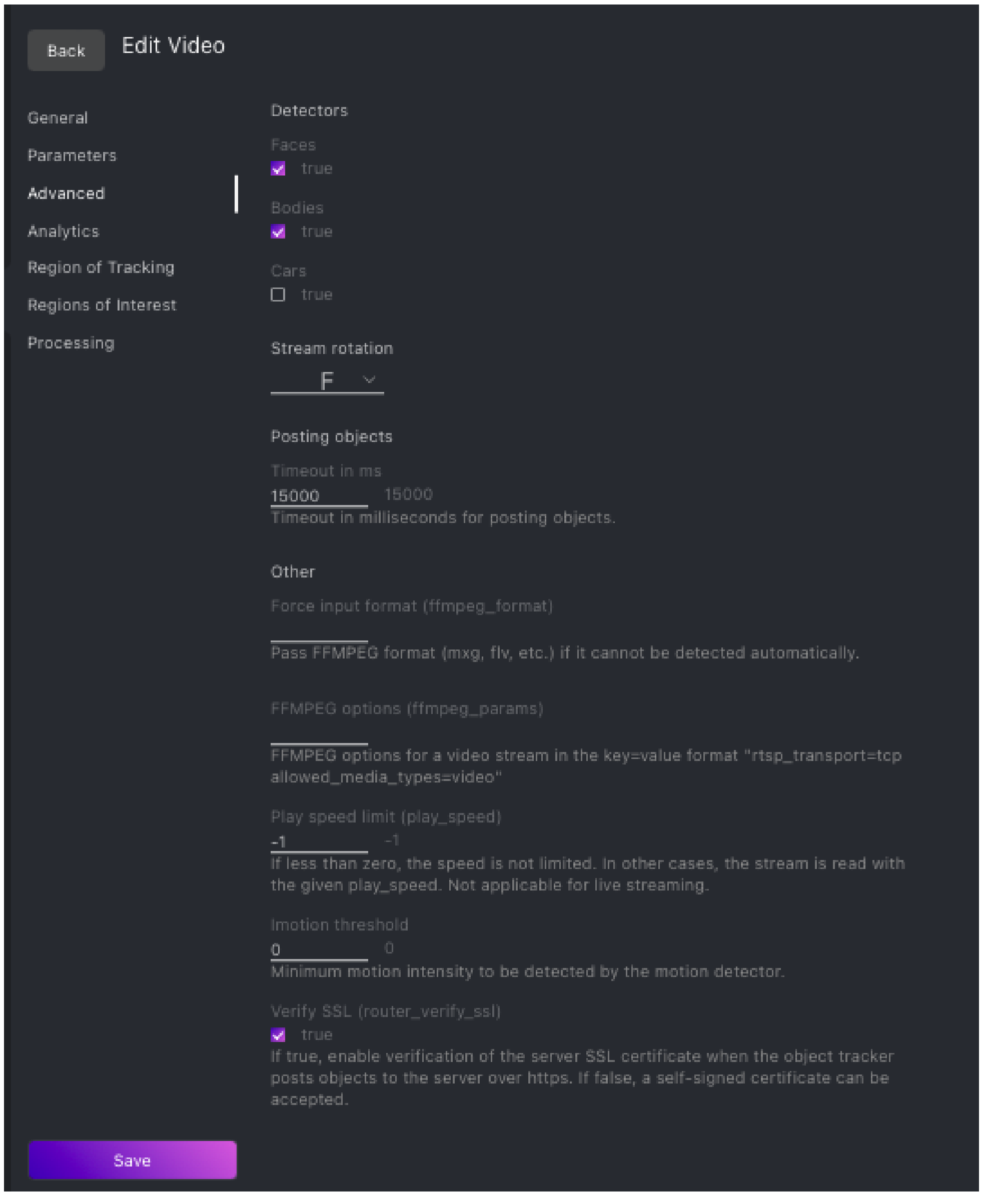
4. Specify a URL in online storage, or select a file.
5. Click *Upload*.
6. After the video is uploaded, navigate to the *Parameters* tab. Specify parameters of video processing:



Camera group
Video archive defa...
Camera
Not selected
Timestamp
Send video stream timestamps to the server
false
Send video stream timestamps to the server. If checked, retrieve and post timestamps from a video stream. If unchecked, current date and time will be sent by default.
Specify timestamp for the uploaded video
1970-01-01 05:00:00
In order to specify timestamp, check the "send video stream timestamps to the server" box

- Indicate the camera group you have designated prior. (Optional) Select a camera within that camera group to tag the object recognition events from this video more precisely.
- Configure the timestamps for object recognition events.

7. On the *Advanced* tab, fine-tune the video processing:



Detectors

Faces
✓ true

Bodies
✓ true

Cars
☐ true

Stream rotation
F

Posting objects

Timeout in ms
15000 15000
Timeout in milliseconds for posting objects.

Other

Force input format (ffmpeg_format)

Pass FFMPEG format (mxg, flv, etc.) if it cannot be detected automatically.

FFMPEG options (ffmpeg_params)

FFMPEG options for a video stream in the key=value format "rtsp_transport=tcp allowed_media_types=video"

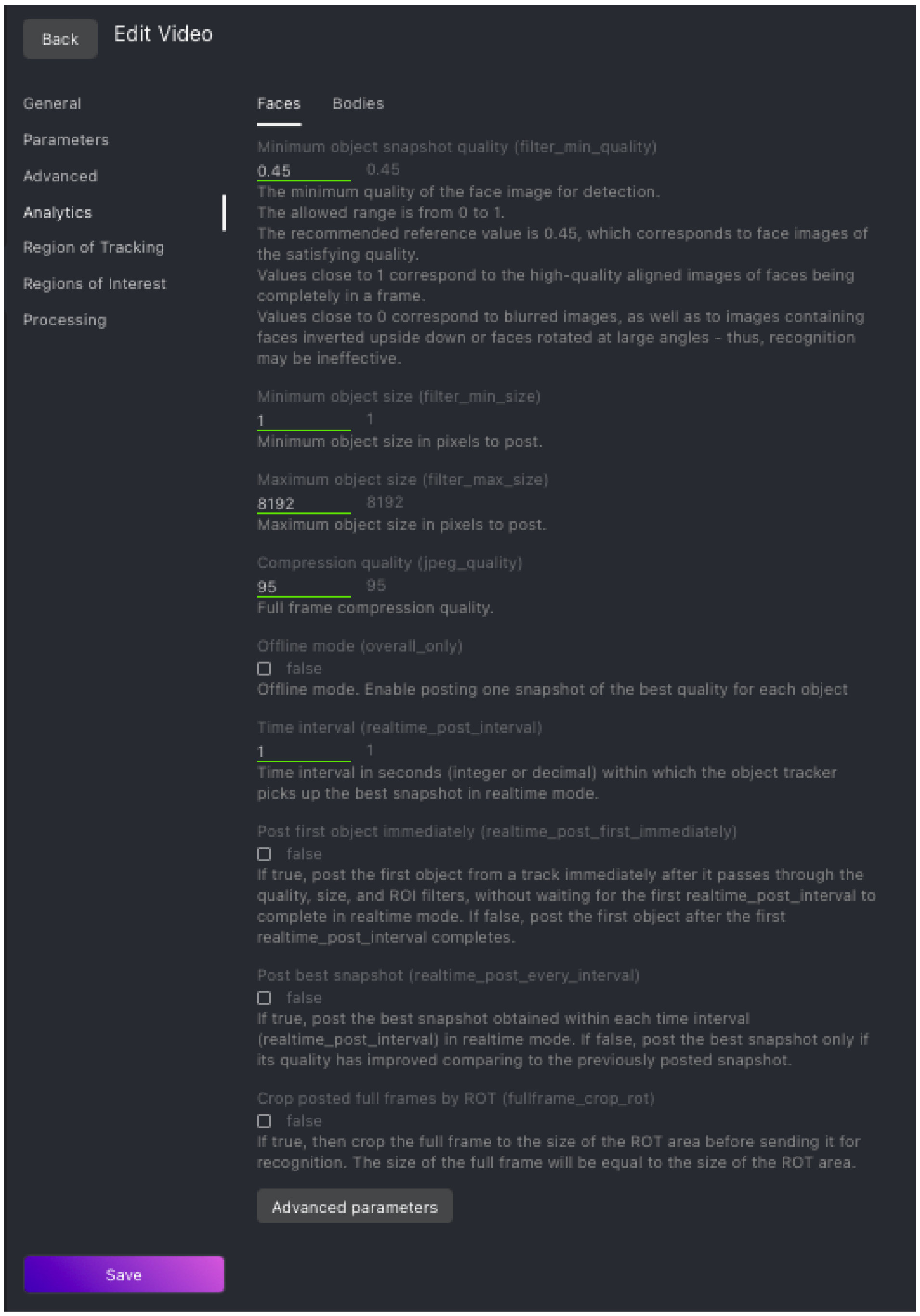
Play speed limit (play_speed)
-1 -1
If less than zero, the speed is not limited. In other cases, the stream is read with the given play_speed. Not applicable for live streaming.

Imotion threshold
0 0
Minimum motion intensity to be detected by the motion detector.

Verify SSL (router_verify_ssl)
✓ true
If true, enable verification of the server SSL certificate when the object tracker posts objects to the server over https. If false, a self-signed certificate can be accepted.

- Check detectors that you want to enable for this video: faces, bodies, cars & ALPR.
- If needed, change the video orientation.
- *Timeout in ms*: Specify the timeout in milliseconds for posting detected objects.
- *FFMPEG format*: Pass FFMPEG format (mxg, flv, etc.) if it cannot be detected automatically.
- *FFMPEG parameters*: FFMPEG options for the video in the key-value format, for example, [“rtsp_transpotr=tcp”, “ss=00:20:00”].
- *Play speed limit*: If less than zero, the speed is not limited. In other cases, the stream is read with the given `play_speed`.
- *Imotion threshold*: Minimum motion intensity to be detected by the motion detector.
- *Verify SSL*: Check to enable verification of the server SSL certificate when the object tracker posts objects to the server over https. Uncheck the option if you use a self-signed certificate.

8. On the *Analytics* tab, specify settings for each object type detector.



Minimum object snapshot quality (filter_min_quality)
0.45 0.45
The minimum quality of the face image for detection.
The allowed range is from 0 to 1.
The recommended reference value is 0.45, which corresponds to face images of the satisfying quality.
Values close to 1 correspond to the high-quality aligned images of faces being completely in a frame.
Values close to 0 correspond to blurred images, as well as to images containing faces inverted upside down or faces rotated at large angles - thus, recognition may be ineffective.

Minimum object size (filter_min_size)
1 1
Minimum object size in pixels to post.

Maximum object size (filter_max_size)
8192 8192
Maximum object size in pixels to post.

Compression quality (jpeg_quality)
95 95
Full frame compression quality.

Offline mode (overall_only)
☐ false
Offline mode. Enable posting one snapshot of the best quality for each object

Time interval (realtime_post_interval)
1 1
Time interval in seconds (integer or decimal) within which the object tracker picks up the best snapshot in realtime mode.

Post first object immediately (realtime_post_first_immediately)
☐ false
If true, post the first object from a track immediately after it passes through the quality, size, and ROI filters, without waiting for the first realtime_post_interval to complete in realtime mode. If false, post the first object after the first realtime_post_interval completes.

Post best snapshot (realtime_post_every_interval)
☐ false
If true, post the best snapshot obtained within each time interval (realtime_post_interval) in realtime mode. If false, post the best snapshot only if its quality has improved comparing to the previously posted snapshot.

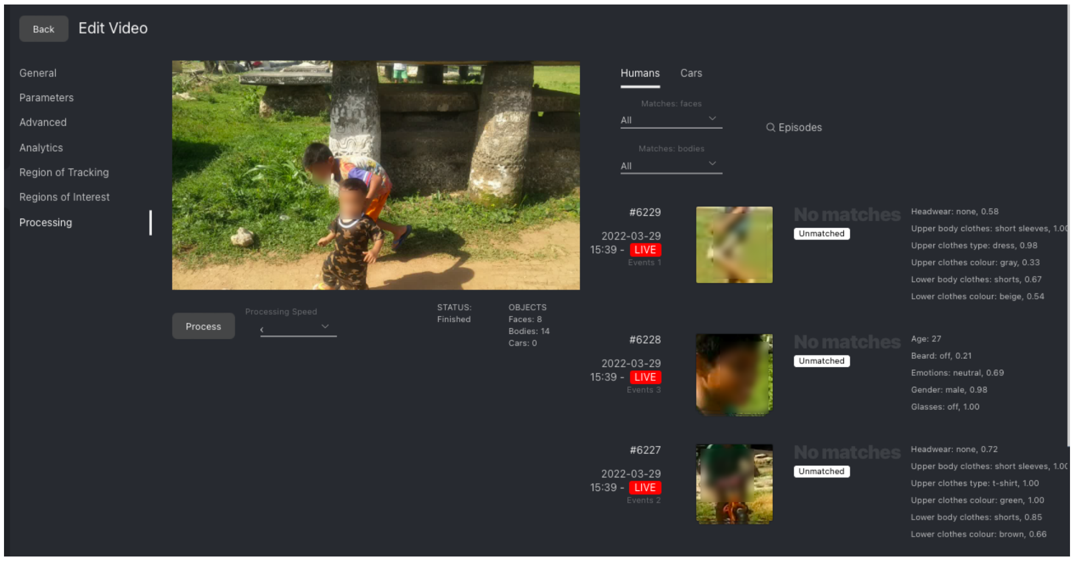
Crop posted full frames by ROT (fullframe_crop_rot)
☐ false
If true, then crop the full frame to the size of the ROT area before sending it for recognition. The size of the full frame will be equal to the size of the ROT area.

- *Minimum object snapshot quality*: Minimum quality of an object snapshot to post. Do not change the default value without consulting with our technical experts (support@ntechlab.com).
- *Minimum object size*: Minimum object size in pixels to post.
- *Maximum object size*: Maximum object size in pixels to post.
- *Compression quality*: Full frame compression quality.
- *Offline mode*: Offline mode. Enable posting one snapshot of the best quality per entire track for each object in addition to the sequence of snapshots taken per track in the real-time mode (enabled by default).
- *Time interval*: Time interval in seconds (integer or decimal) within which the object tracker picks up the

best snapshot in the real-time mode.

- *Post first object immediately*: Check to post the first object from a track immediately after it passes through the quality, size, and ROI filters, without waiting for the first `Time interval` to complete. The way the subsequent snapshots are posted will depend on the `Post best snapshot` value. Uncheck the option only to post the first object after the first `Time interval` completes.
- *Post best snapshot*: Check to post the best snapshot obtained within each `Time interval` in the real-time mode, regardless of its quality. Uncheck the option to post the best snapshot only if its quality has improved compared to the previously posted snapshot.

9. (Optional) On the *Region of Tracking* and *Regions of Interest* tabs, specify the region of tracking within the camera field and detection zones for each object type detector.
10. Navigate to the *Processing* tab. Click *Process* to start object identification.



STATUS: Finished

OBJECTS
Faces: 8
Bodies: 14
Cars: 0

#6229
2022-03-29 15:39 - LIVE
Events 1
No matches
Unmatched
Headwear: none, 0.58
Upper body clothes: short sleeves, 1.0
Upper clothes type: dress, 0.98
Upper clothes colour: gray, 0.33
Lower body clothes: shorts, 0.67
Lower clothes colour: beige, 0.54

#6228
2022-03-29 15:39 - LIVE
Events 3
No matches
Unmatched
Age: 27
Beard: off, 0.21
Emotions: neutral, 0.69
Gender: male, 0.98
Glasses: off, 1.00

#6227
2022-03-29 15:39 - LIVE
Events 2
No matches
Unmatched
Headwear: none, 0.72
Upper body clothes: short sleeves, 1.0
Upper clothes type: t-shirt, 1.00
Upper clothes colour: green, 1.00
Lower body clothes: shorts, 0.85
Lower clothes colour: brown, 0.66

You can view object identification events right here, as well as on the *Events* and *Episodes* tabs by filtering the list of events by the camera group/camera associated with the video.

3.8.3 Configure Offline Video Processing

By default, video files are processed in a queued mode to prevent event drops due to resource overconsumption. You can modify the default number of simultaneously processed video files. To do so, open the `/etc/findface-security/config.py` configuration file and change the `MAX_VIDEO_ARCHIVE_JOBS` parameter. Please contact our experts prior (support@ntechlab.com) to make sure your resources are enough.

```
sudo vi /etc/findface-security/config.py

...

FFSECURITY = {
...
    # maximum concurrent video manager jobs for video archives processing
    'MAX_VIDEO_ARCHIVE_JOBS': 3,
    ...
}
...
```

Be sure to restart the `findface-security` service after making changes.

```
sudo systemctl restart findface-security.service
```

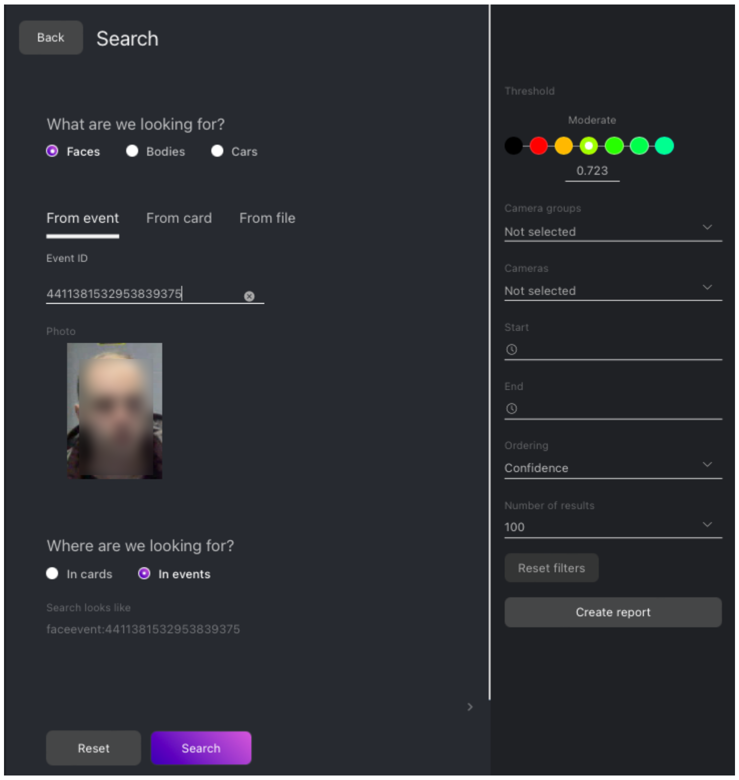
3.9 Search Objects in Databases

FindFace Multi allows you to search for objects in the following databases:

- Database of detected objects: the *Events* tab.
- Card index: the *Cards* tab.

To find an object in a database, do the following:

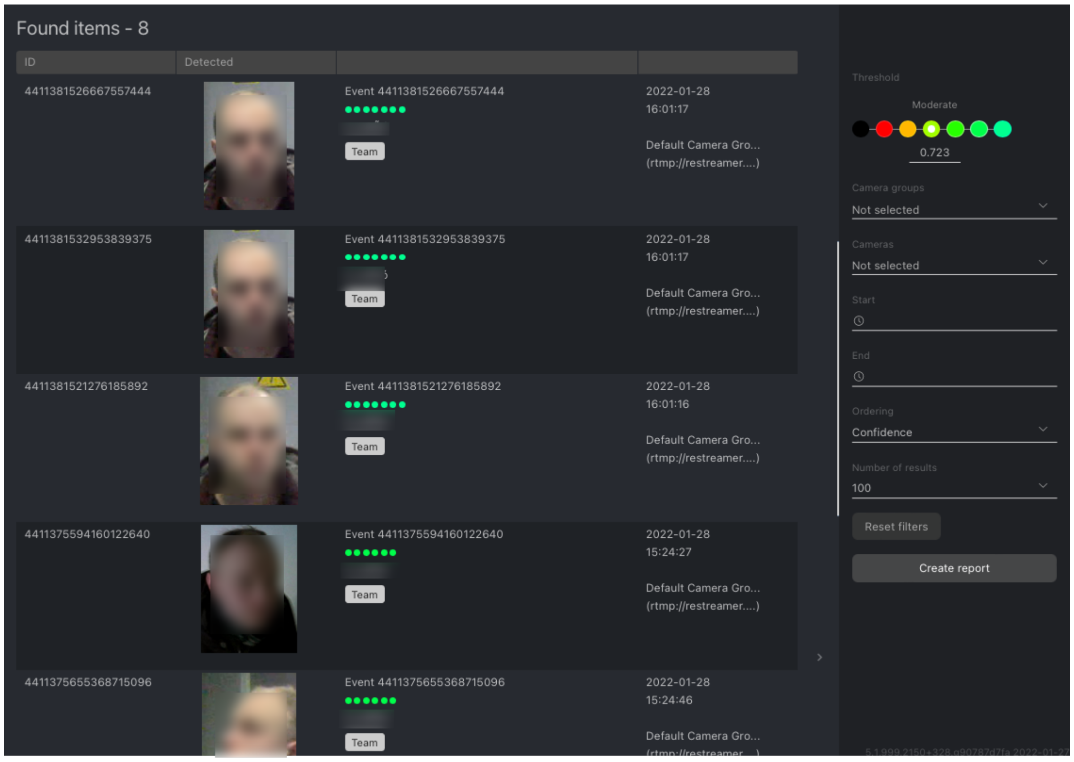
1. Navigate to the *Search* tab.



Event ID: 4411381532953839375
Photo
Where are we looking for? In cards [✓ In events]
Search looks like: faceevent:4411381532953839375
Threshold: 0.723
Camera groups: Not selected
Cameras: Not selected
Ordering: Confidence
Number of results: 100

2. Select the object type you are searching for: *Faces*, *Bodies*, *Cars*.
3. Specify the database to search in: *In events*, *In cards*.
4. Specify the exact object to search for in one of the following ways:
   - By event ID.
   - By card ID. Should the card contain multiple photos, select some of them to use in the search.
   - By uploading a photo. It will be displayed in the *Photo* area. If there are multiple objects in the image, select the one of your interest.
5. Specify the maximum number of search results.
6. If you are searching in events, you can narrow down your search by specifying a camera, camera group, and time period of your interest.

7. Click *Search*. You will see the search results appear below. For each object found, the matching confidence level is provided.



Found items - 8

ID	Detected		
4411381526667557444		Event 4411381526667557444 ●●●●●●● [redacted] Team	2022-01-28 16:01:17 Default Camera Gro... (rtmp://restreamer....)
4411381532953839375		Event 4411381532953839375 ●●●●●●● [redacted] Team	2022-01-28 16:01:17 Default Camera Gro... (rtmp://restreamer....)
4411381521276185892		Event 4411381521276185892 ●●●●●●● [redacted] Team	2022-01-28 16:01:16 Default Camera Gro... (rtmp://restreamer....)
4411375594160122640		Event 4411375594160122640 ●●●●●● [redacted] Team	2022-01-28 15:24:27 Default Camera Gro... (rtmp://restreamer....)
4411375655368715096		Event 4411375655368715096 ●●●●●● [redacted] Team	2022-01-28 15:24:46 Default Camera Gro... (rtmp://restreamer....)

Threshold: Moderate, 0.723

Camera groups: Not selected

Cameras: Not selected

Start:

End:

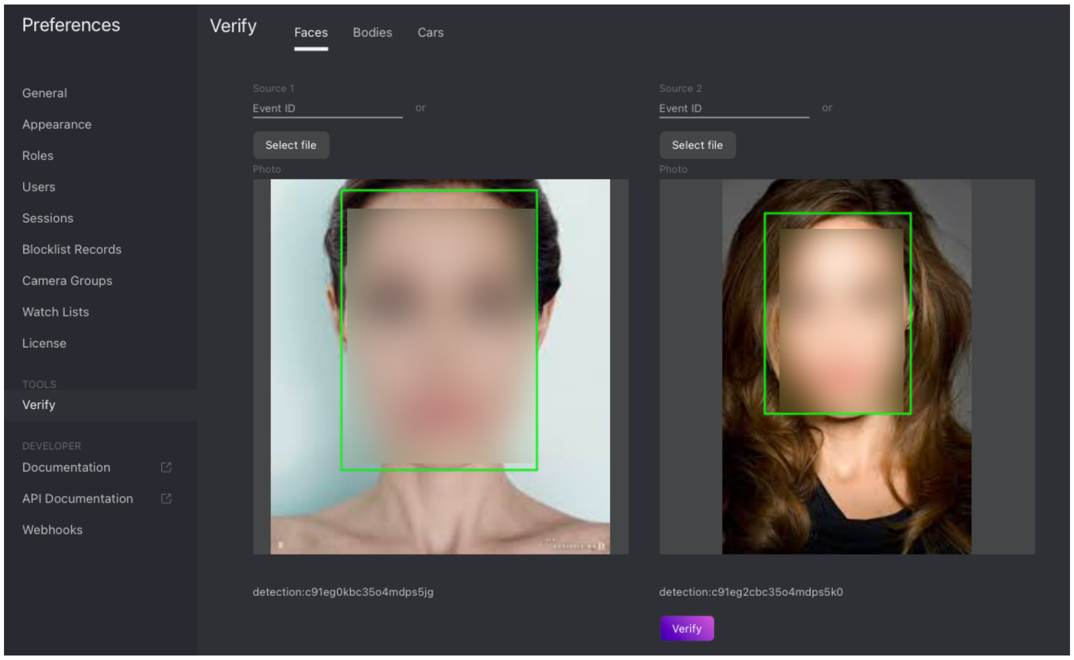
Ordering: Confidence

Number of results: 100

3.10 Compare Two Objects

FindFace Multi allows you to compare two objects and verify that they match. Do the following:

1. Navigate to the *Preferences* tab. Click *Verify*. Choose the proper tab, depending on the type of objects you are going to compare: *Faces*, *Bodies*, *Cars*.



2. Specify the IDs of events that feature the objects you want to compare, and/or upload photos with the objects.

   Tip: You can find event IDs on the *Events* tab.

3. Click *Verify*. You will see the probability that the objects match.

3.11 Face, Body, Car Clusters

FindFace Multi supports automatic clustering of objects of the same origin:

- Face images belonging to the same person form a face cluster.
- Body images belonging to the same person form a body cluster.
- Images of the same car constitute a car cluster.

Aggregated cluster galleries of faces, bodies, and cars are available on the *Clusters* tab.

Note: If a face cluster or a body cluster matches with a *person card*, such a cluster will automatically appear in that card. Similarly, a car cluster will be saved to the corresponding car card.

Important: By default, the object clustering is disabled. *Enable and configure it* via the `/etc/findface-security/config.py` configuration file.

In this section:

3.11.1 Clustering Algorithms

FindFace Multi uses the following object clustering algorithms:

- Real-time clustering. This clustering algorithm processes episodes to select suitable object images and clusters the selected ones. It works on the fly after an episode is closed. The real-time clustering results are dynamically displayed on the *Clusters* tab and in the relevant *card*.

  Not all episodes are used for clustering. If an episode meets all requirements (see the details *below*), the system forms a cluster in the following way:

  - Selects the best quality event.
  - Creates a new entity `cluster event` in the main system database **`PostgreSQL`**. The entity contains the selected event metadata, a link to the parent episode, object feature vector, and thumbnail.
  - Searches for a matching object centroid in the `cluster_events` gallery of the **`Tarantool`** feature vector database. An object centroid is a virtual feature vector averaged across all twin objects that have been detected so far (for example, a face centroid is a feature vector averaged across all face images of the same person). The system updates a matching centroid using the new event if such a centroid was found or creates a new centroid otherwise.

- Scheduled clustering. This clustering algorithm works over and revises the cluster events created during the real-time clustering. This algorithm improves the cluster centroid quality as the centroid will be averaged across a more extensive array of accumulated feature vectors. The results of the scheduled clustering are displayed on the *Clusters* tab and in the relevant *card* after each scheduled iteration.

  Use the RRULE format to define the schedule in the `CLUSTERS_CLUSTERIZATION_SCHEDULE` parameter at `/etc/findface-security/config.py`. Late-night hours are preferred as the scheduled clustering takes up a lot of CPU resources and time.

  Important: The scheduled clustering completely overwrites the cluster galleries, including ids, unless you pin specific clusters by enabling the `CLUSTERS_AUTO_PIN_HEURISTICS` and `PIN_MATCHED_CLUSTERS` parameters (see *below*).

3.11.2 Enable and Configure Clustering

By default, the clustering is disabled. To enable and configure it, do the following:

1. Open the `/etc/findface-security/config.py` configuration file. Find the `Clusters configuration` section.

```
sudo vi /etc/findface-security/config.py


# -- Clusters configuration --
    'ENABLE_NIGHT_CLUSTERIZATION': True,
    'ENABLE_REALTIME_CLUSTERIZATION': True,
    # rrule (recurrence rule) for scheduling clusters clusterization
    'CLUSTERIZATION_SCHEDULE': 'RRULE:FREQ=DAILY;INTERVAL=1;WKST=MO;BYHOUR=0;
↪BYMINUTE=0',
    # clusterize only selected objects types (for realtime and nightly␣
↪clusterization)
    # available are: face, body, car
    'CLUSTERIZE_OBJECT_TYPES': ['face','body','car'],
    # skip clusterization if unpinned cluster events count is greater than this␣
↪value
    'CLUSTERIZATION_MAX_CLUSTER_EVENTS': None,
    # cluster event to cluster matching confidence threshold
    'FACE_CLUSTER_CONFIDENCE_THRESHOLD': 0.723,  # model: [kiwi_320]
    'BODY_CLUSTER_CONFIDENCE_THRESHOLD': 0.65,  # model: [andariel]
    'CAR_CLUSTER_CONFIDENCE_THRESHOLD': 0.65,  # model: [alonso]
    # minimum required event quality for cluster creation
    'FACE_CLUSTER_EVENT_MIN_QUALITY': 0.45,  # model: [quality.v1]
    'BODY_CLUSTER_EVENT_MIN_QUALITY': 0.6,  # model: [pedattr.quality.v0]
    'CAR_CLUSTER_EVENT_MIN_QUALITY': 0.73,  # model: [carattr.quality.v0]
    # minimum required number events in episode for cluster creation
    'FACE_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 1,
    'BODY_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 1,
    'CAR_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 1,
    # coefficient of dependence of the clustering threshold on the person event's␣
↪quality
    'FACE_CLUSTER_SOFT_CLUSTERIZATION_COEFFICIENT': 0.1,
    'BODY_CLUSTER_SOFT_CLUSTERIZATION_COEFFICIENT': 0.1,
    'CAR_CLUSTER_SOFT_CLUSTERIZATION_COEFFICIENT': 0.1,
    # match with clusters when no card objects matches found
    'MATCH_CLUSTERS': False,
    # create auto cards for unmatched clusters
    'CREATE_AUTO_CARDS': False,
    # pinned clusters keep their id and events after reclusterization
    'CLUSTERS_AUTO_PIN_HEURISTICS': {
        'face': {
            # pin clusters with `value` minimum cluster events
            'min_events': {'enabled': True, 'value': 10},
            # cluster's centroid similarity confidence is less then
            'max_centroid_similarity_threshold': {'enabled': True, 'value': 0.55},
            # minimum average event's quality
            'min_average_events_quality': {'enabled': True, 'value': 0.45},
        },
```

(continues on next page)

(continued from previous page)

```
        'body': {},
        'car': {},
    },
    # always pin clusters with matched events (not affected by heuristics above)
    'PIN_MATCHED_CLUSTERS': False,
```

2. Enable the real-time clustering by setting `ENABLE_REALTIME_CLUSTERIZATION: True`.
3. If necessary, enable the scheduled clustering by setting `ENABLE_NIGHT_CLUSTERIZATION: True`.

   Important: Enabling the scheduled clustering only makes sense if the real-time clustering is enabled. Otherwise, the system won't form any new clusters, since only the real-time clustering produces **unique** cluster events.

```
...
# -- Clusters configuration --
    'ENABLE_NIGHT_CLUSTERIZATION': True,
    'ENABLE_REALTIME_CLUSTERIZATION': True,
...
```

4. If necessary, specify a recurrence rule (RRULE) for the scheduled clustering. If the RRULE is not specified, the clustering automatically starts at 00:00 GMT.

   Tip: See the RRULE calculator here.

```
# rrule (recurrence rule) for scheduling clusters clusterization
'CLUSTERIZATION_SCHEDULE': 'RRULE:FREQ=DAILY;INTERVAL=1;WKST=MO;BYHOUR=0;BYMINUTE=0
↪',
```

5. By default, the system forms only face clusters. To enable cluster formation of bodies and cars, add relevant object types to the following line:

```
# available are: face, body, car
'CLUSTERIZE_OBJECT_TYPES': ['face','body','car'],
```

6. If necessary, modify the minimum number of events in the episodes used for clustering. It's 1 by default. Do so separately for each object type.

```
# minimum required number events in episode for cluster creation
'FACE_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 3,
'BODY_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 3,
'CAR_CLUSTER_EVENT_MIN_EPISODE_EVENTS': 2,
```

7. If necessary, modify the minimum quality of the object images used for clustering. Do so separately for each object type.

   Note: As this setting requires a high level of expertise and knowledge, we highly recommend consulting with our technical experts prior.

```
# minimum required event quality for cluster creation
'FACE_CLUSTER_EVENT_MIN_QUALITY': 0.45,  # model: [quality.v1]
'BODY_CLUSTER_EVENT_MIN_QUALITY': 0.6,  # model: [pedattr.quality.v0]
'CAR_CLUSTER_EVENT_MIN_QUALITY': 0.73,  # model: [carattr.quality.v0]
```

8. If necessary, modify the confidence threshold for matching a cluster event and a cluster.

   Warning: Be sure to consult with our experts by support@ntechlab.com before altering this parameter.

```
# cluster event to cluster matching confidence threshold
'FACE_CLUSTER_CONFIDENCE_THRESHOLD': 0.723,  # model: [kiwi_320]
'BODY_CLUSTER_CONFIDENCE_THRESHOLD': 0.65,  # model: [andariel]
'CAR_CLUSTER_CONFIDENCE_THRESHOLD': 0.65,  # model: [alonso]
```

9. After an object is detected in the video, the system searches for its matches through the card index. Set `'MATCH_CLUSTERS': True` to enable the system to search for matches through the cluster gallery as well if it didn't find a matching card in the card index. In this case, the system will be notifying you whenever an object matches a previously created cluster.

```
# match with clusters when no card objects matches found
'MATCH_CLUSTERS': True,
```

10. Set `'CREATE_AUTO_CARDS': True` to automatically create a new card for a cluster that has no matches in the card index. See *Auto-Generated and Completed Cards* for details.

```
# create auto cards for unmatched clusters
'CREATE_AUTO_CARDS': True,
```

11. The scheduled clustering completely overwrites all created clusters. You can "pin" specific clusters, i.e. keep them and associated cluster events, including their IDs, intact. To do so, use the following settings:

    Note: These settings are independent. Apply both if necessary.

    Note: These settings do not affect the real-time clustering. It will continue to create new cluster events for the pinned clusters.

    - `CLUSTERS_AUTO_PIN_HEURISTICS`: set `True` or `False` for the following options and specify the corresponding values:

      Note: Do so for each object type if applicable.

      – `min_events`: pin a cluster when the number of associated cluster events exceeds the given minimum value.

      – `max_centroid_similarity_threshold`: pin a cluster if the similarity between its centroid and centroids of other clusters is less than the given threshold. If a cluster looks similar to some other clusters, chances are these clusters belong to the exact person/car. In this case, the system won't pin such a cluster to have an opportunity to re-cluster it. On the contrary, dissimilar clusters will be pinned.

  - min_average_events_quality: pin a cluster if the average quality of associated cluster events is greater than the given minimum value.

```
# pinned clusters keep their id and events after reclusterization
'CLUSTERS_AUTO_PIN_HEURISTICS': {
    'face': {
        # pin clusters with `value` minimum cluster events
        'min_events': {'enabled': True, 'value': 10},
        # cluster's centroid similarity confidence is less then
        'max_centroid_similarity_threshold': {'enabled': True, 'value': 0.55},
        # minimum average event's quality
        'min_average_events_quality': {'enabled': True, 'value': 0.45},
    },
    'body': {},
    'car': {},
},
```

- Enable the PIN_MATCHED_CLUSTERS parameter to pin matched clusters and the associated cluster events.

```
 # always pin clusters with matched events (not affected by heuristics above)
'PIN_MATCHED_CLUSTERS': True,
```

12. If necessary, specify the maximum number of cluster events in the clusters that remain non-pinned. After this number is reached, the scheduled clustering will be automatically disabled.

```
# skip clusterization if unpinned cluster events count is greater than this value
'CLUSTERIZATION_MAX_CLUSTER_EVENTS': None,
```

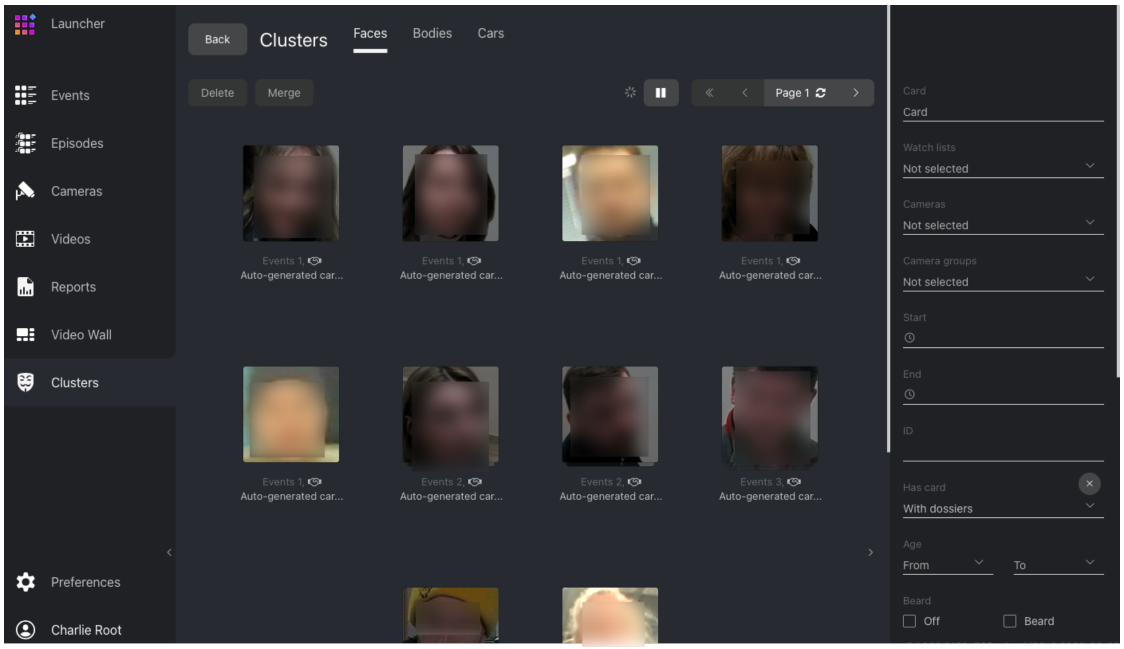
13. Restart the findface-security service. You will see the *Clusters* tab appear in the FindFace Multi web interface.

```
sudo systemctl restart findface-security.service
```

3.11.3 Work with Cluster Galleries

View and Filter Clusters

To view the cluster galleries, navigate to the *Clusters* tab.



When working with the cluster galleries, the following filters may come in handy:

Note: Some filters from the list below may be hidden, depending on which recognition features are enabled.

- *Card*: display clusters only for a selected card.
- *Cameras*: display only clusters from a selected camera.
- *Camera groups*: display only clusters from a selected group of cameras.
- *Watch lists*: display only clusters for a selected watch list.
- *Start*, *End*: display only clusters formed within a certain period.
- *ID*: display a cluster with a given ID.
- *Has card*: display clusters subject to whether they have an associated card, auto-generated or completed one (see the *Auto-Generated and Completed Cards* section for a detailed explanation).

Specific filters for face clusters

- *Age*: display clusters with people of a given age.
- *Gender*: display clusters with people of a given gender.
- *Emotions*: display clusters with given emotions.
- *Glasses*: filter clusters by the fact of wearing glasses.
- *Beard*: filter clusters by the fact of having a beard.
- *Liveness*: filter clusters by face liveness.
- *Face mask*: filter clusters by the fact of wearing a face mask.

Specific filters for body clusters

- *Headwear*: display only clusters with a person wearing headgear of a given type: hat/cap, hood/headscarf, none.
- *Upper body clothes*: display only clusters with a person wearing upper body wear of a given generalized category: long sleeves, short sleeves, no sleeve.
- *Upper clothes type*: display only clusters with a person wearing upper body wear of a given specific type: jacket, coat, sleeveless vest, sweatshirt, T-shirt, shirt, dress.
- *Upper clothes color*: display only clusters with a person wearing a top of a given color.
- *Lower body clothes*: display only clusters with a person wearing lower body wear of a given type: pants, skirt, shorts, obscured.
- *Lower clothes color*: display only clusters with a person wearing a bottom of a given color.

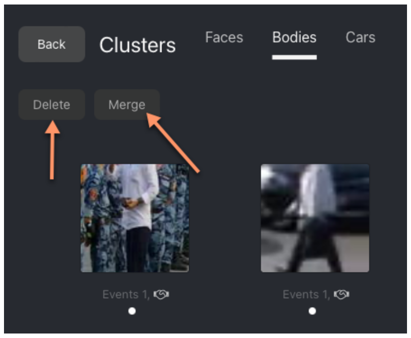
Specific filters for car clusters

- *Car body style*: display only clusters with cars of a given body style.
- *Car color*: display only clusters with cars of a given color.
- *Make*: filter clusters by car make.
- *Model*: filter clusters by car model.
- *Special vehicle*: display only clusters with cars belonging to a given type: police, ambulance, rescue service, taxi, other.

Merge and Delete Clusters

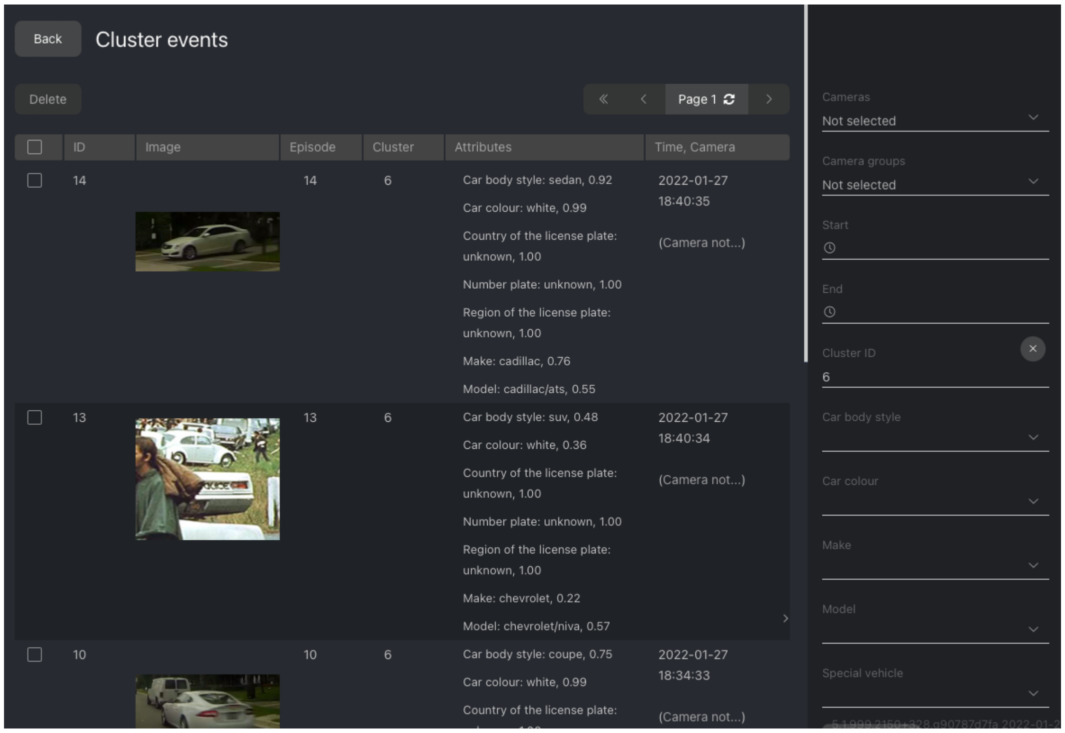
To manually merge several clusters, select them one by one and click *Merge*.

To delete a cluster, select it and click *Delete*.



View and Filter Associated Cluster Events

Click a cluster to see the associated cluster events. You will be redirected to the *Cluster events* page with the corresponding cluster identifier set in the *Cluster ID* filter.



	ID	Image	Episode	Cluster	Attributes	Time, Camera
	14		14	6	Car body style: sedan, 0.92 Car colour: white, 0.99 Country of the license plate: unknown, 1.00 Number plate: unknown, 1.00 Region of the license plate: unknown, 1.00 Make: cadillac, 0.76 Model: cadillac/ats, 0.55	2022-01-27 18:40:35 (Camera not...)
	13		13	6	Car body style: suv, 0.48 Car colour: white, 0.36 Country of the license plate: unknown, 1.00 Number plate: unknown, 1.00 Region of the license plate: unknown, 1.00 Make: chevrolet, 0.22 Model: chevrolet/niva, 0.57	2022-01-27 18:40:34 (Camera not...)
	10		10	6	Car body style: coupe, 0.75 Car colour: white, 0.99 Country of the license plate:	2022-01-27 18:34:33 (Camera not...)

Cameras: Not selected
Camera groups: Not selected
Start
End
Cluster ID: 6
Car body style
Car colour
Make
Model
Special vehicle

The set of filters to work with the cluster events are similar to *that* for the clusters.

3.11.4 Make Cluster Gallery Static

Sometimes it's necessary to finalize the object clustering at a certain point in time and then operate with a static gallery of formed clusters.

To display the *Clusters* tab upon the disabled clustering, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Add the line `"clusters":  True` to the `SERVICES` section, as shown in the example below:

```
...
SERVICES = {
    "ffsecurity": {
        ...
        "clusters": True,
    }
...
```

3. Disable the real-time and scheduled clustering processes.

```
...
'ENABLE_NIGHT_CLUSTERIZATION': False,
'ENABLE_REALTIME_CLUSTERIZATION': False,
```

4. Restart the `findface-security` service.

```
sudo systemctl restart findface-security.service
```

3.11.5 Manual Clustering

To manually launch the clustering process, use the `run_clusterization` utility.

You can invoke the `run_clusterization` help message by executing:

```
sudo findface-security run_clusterization --help
usage: findface-security run_clusterization [-h]
                                            [--object-types OBJECT_TYPES [OBJECT_TYPES ..
↪.]]
                                            [--force]
                                            [--configuration CONFIGURATION]
                                            [--version] [-v {0,1,2,3}]
                                            [--settings SETTINGS]
                                            [--pythonpath PYTHONPATH]
                                            [--traceback] [--no-color]
                                            [--force-color] [--skip-checks]

optional arguments:
  -h, --help            show this help message and exit
  --object-types OBJECT_TYPES [OBJECT_TYPES ...]
                        Clusterize selected object types. Uses
                        CLUSTERIZE_OBJECT_TYPES from config if not provided.
                        Allowed types: face, body, car
  --force               Force clusterization even if
                        CLUSTERIZATION_MAX_CLUSTER_EVENTS condition is met
  --configuration CONFIGURATION
                        The name of the configuration class to load, e.g.
                        "Development". If this isn't provided, the
                        DJANGO_CONFIGURATION environment variable will be
                        used.
  --version             show program's version number and exit
  -v {0,1,2,3}, --verbosity {0,1,2,3}
                        Verbosity level; 0=minimal output, 1=normal output,
                        2=verbose output, 3=very verbose output
  --settings SETTINGS   The Python path to a settings module, e.g.
                        "myproject.settings.main". If this isn't provided, the
                        DJANGO_SETTINGS_MODULE environment variable will be
                        used.
  --pythonpath PYTHONPATH
                        A directory to add to the Python path, e.g.
                        "/home/djangoprojects/myproject".
  --traceback           Raise on CommandError exceptions
  --no-color            Don't colorize the command output.
  --force-color         Force colorization of the command output.
  --skip-checks         Skip system checks.
```

With this utility, it is possible to separately launch clustering of faces, bodies, and cars and perform force clustering when the maximum number of cluster events exceeds the value of the `CLUSTERIZATION_MAX_CLUSTER_EVENTS` parameter (see *Enable and Configure Clustering*). For example, to force start face clustering, execute:

```
sudo findface-security run_clusterization --object-types face --force
```

See also:

- *Configuration file of findface-security*
- *Set Up Object Monitoring and Card Index*
- *Interaction Analysis*
- *Know Your Customer Analytics*

3.12 People-Related Analytics

FindFace Multi is an ideal tool to gather people-related analytics. Enable face and body *clusters* first and then make the most of it with our analytical features.

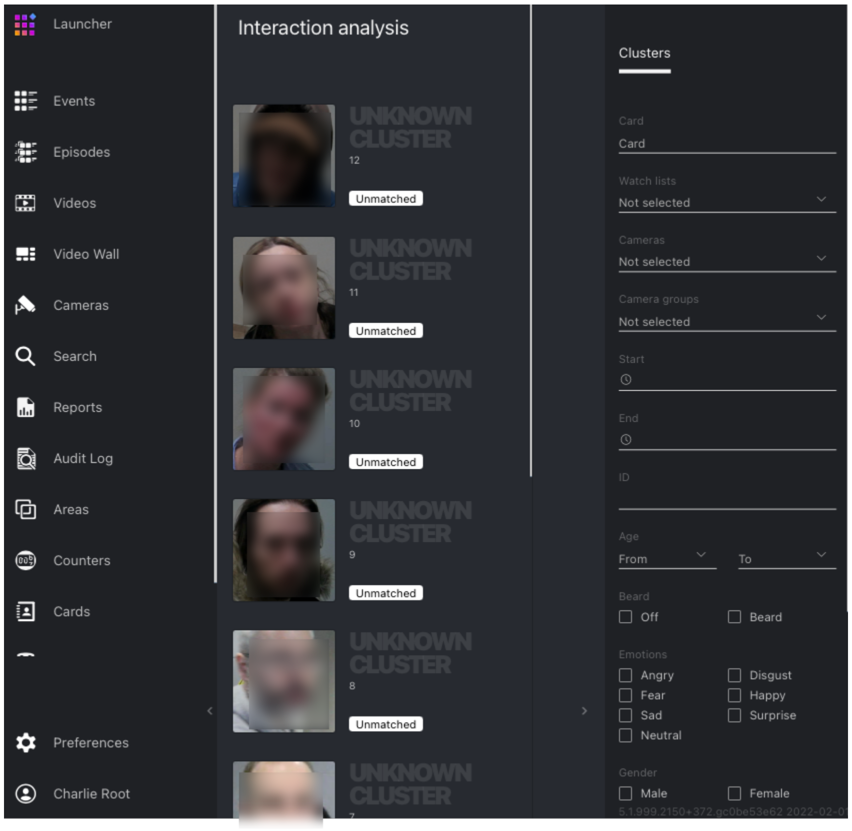
3.12.1 Interaction Analysis

FindFace Multi can provide interaction tracking and analysis. To harness this functionality, you must enable *face clustering*.

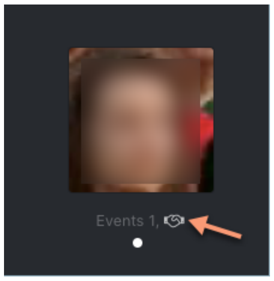
When tracking interactions, the system automatically determines a circle of people with whom a person has previously been in contact. For each person from the first circle, the system builds another circle of connected people, and so on. Overall, interaction analysis is three-circle deep.

Note: You can track interactions between bodies and cars as well. Access this functionality via *HTTP API*. Note that body and car clustering must be enabled beforehand.

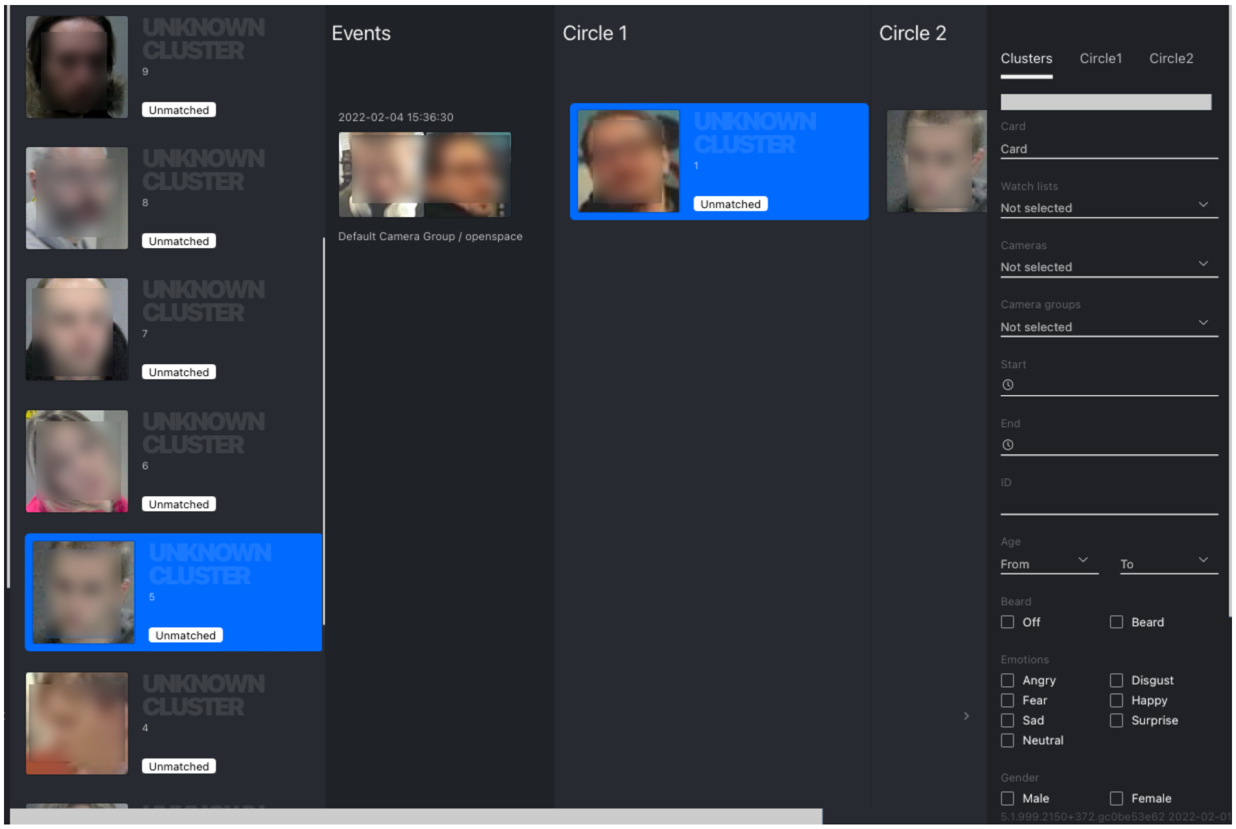
The interaction analysis is available on the *Interaction Analysis* tab.



Tip: You can also display the circle of connected people right from the *Clusters* tab by clicking on the handshake icon.



On the *Interaction Analysis* tab, click on a person to display their first circle of interactions and associated events. Keep on to unveil the entire tree of interactions.

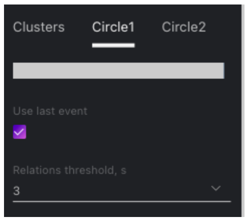


You can apply available filters to every circle.

Tip: For example, you can find older adults or people without a face mask who are directly or indirectly related to a potentially contagious person.

Tip: When searching through a circle of interactions, apply the following settings:

- *Use the last event*: use the last event of an episode to analyze contacts between individuals. In this case, having found truly associated people is most probable as they simultaneously leave a camera's field of view. If the option is disabled, the system will use the best event of an episode for interaction search.
- *Relations threshold*: maximum time in seconds between the appearance of individuals to consider them related.



Use last event
✓

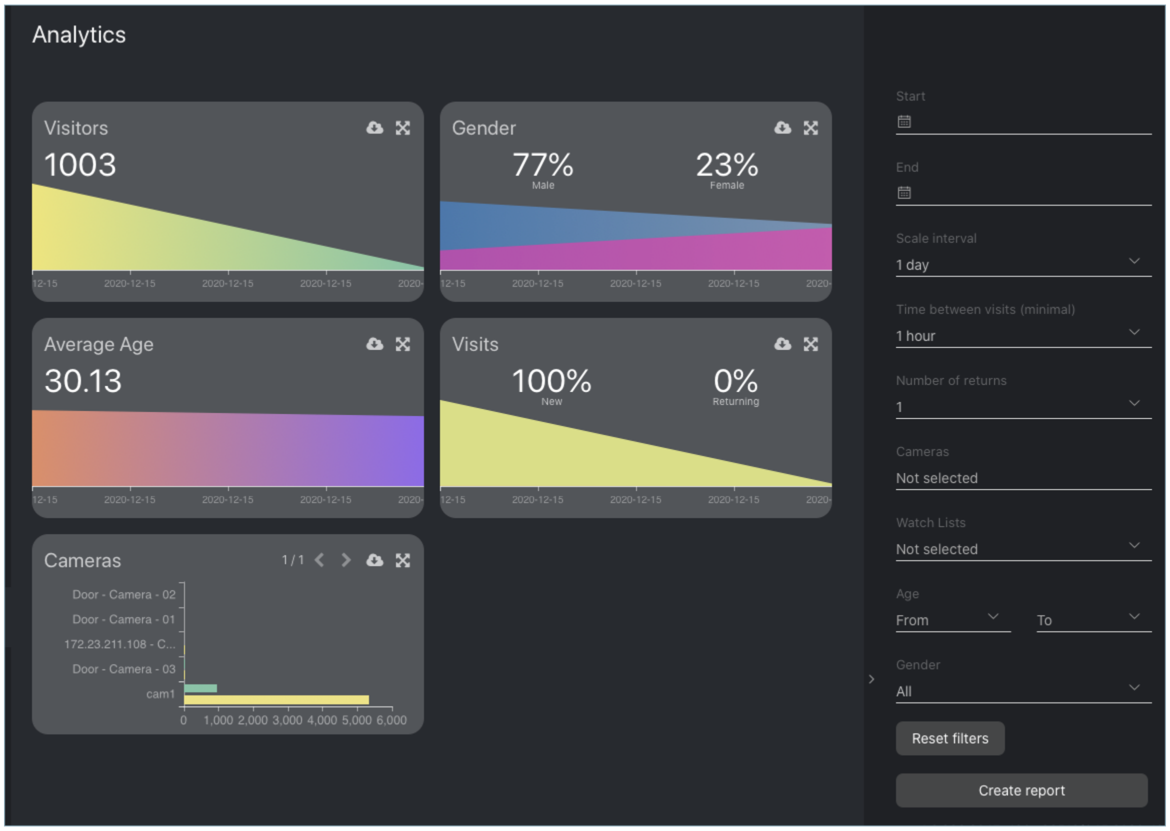
Relations threshold, s
3

3.12.2 Know Your Customer Analytics

The Know Your Customer analytics provided by FindFace Multi includes statistics on the number of visitors, their gender, average age, most frequently visited zones (judged by most active cameras), and the character of visits (first-timers or returners). It is a great starter tool to incorporate the KYC guidelines into your business.

The analytical data charts are available on the *Analytics* tab.

Important: The analytics is built only when the *face clustering* is enabled.



Start

End

Scale interval: 1 day

Time between visits (minimal): 1 hour

Number of returns: 1

Cameras: Not selected

Watch Lists: Not selected

Age: From, To

Gender: All

To work with the analytical data, use the following filters:

- Time period
- Scale interval
- Time between visits
- Number of returns
- Cameras
- Watch lists
- Age
- Gender

See also:

- *Face, Body, Car Clusters*

3.13 Reports

In this chapter:

3.13.1 Report Types

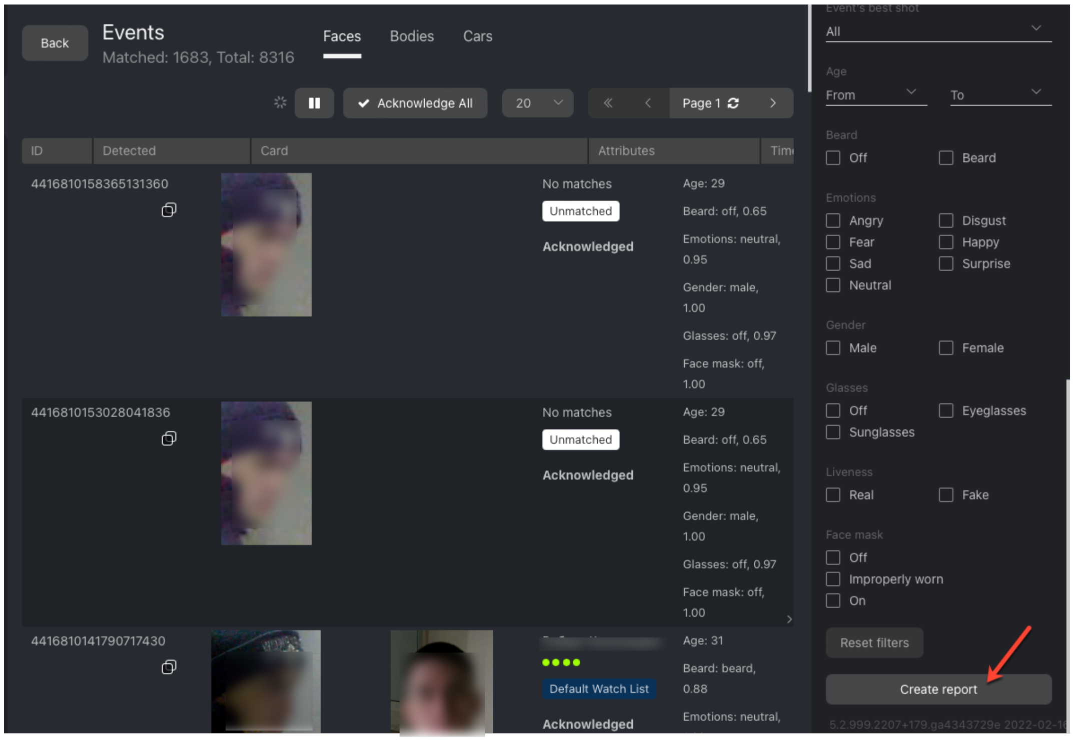
The following reports are available:

- Standard reports on the system entities:
  - *events*
  - *episodes*
  - search
  - *clusters*
  - *cameras*
  - *cards*
  - *analytical data*
  - *audit logs*
  - *areas*, area activations, area activation records
- Work time reports that allow you to regard the exact moments of staff entering and exiting an enterprise or a designated area and calculate the total time spent at it. Can be built either on the *Events* or *Areas* tab.

3.13.2 Build Standard Report

To build a standard report on a system entity, do the following:

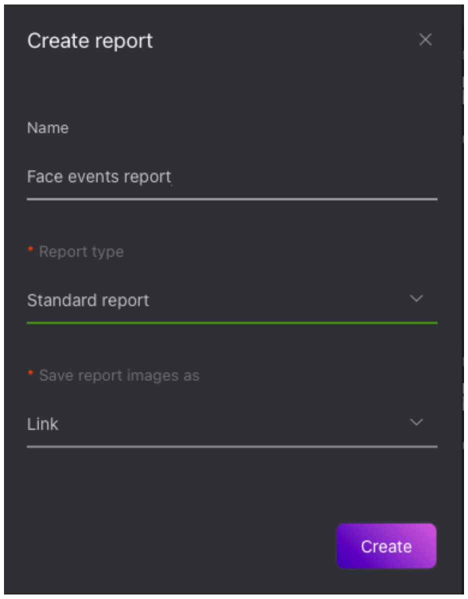
1. Navigate to the tab associated with the required entity: *Events*, *Episodes*, *Search*, *Clusters*, *Cameras*, *Cards*, *Analytics*, *Audit Logs*, *Areas*.
2. Set filters for the report.
3. Click *Create Report*.



ID	Card	Attributes
4416810158365131360	No matches Unmatched Acknowledged	Age: 29 Beard: off, 0.65 Emotions: neutral, 0.95 Gender: male, 1.00 Glasses: off, 0.97 Face mask: off, 1.00
4416810153028041836	No matches Unmatched Acknowledged	Age: 29 Beard: off, 0.65 Emotions: neutral, 0.95 Gender: male, 1.00 Glasses: off, 0.97 Face mask: off, 1.00
4416810141790717430	Default Watch List Acknowledged	Age: 31 Beard: beard, 0.88 Emotions: neutral,

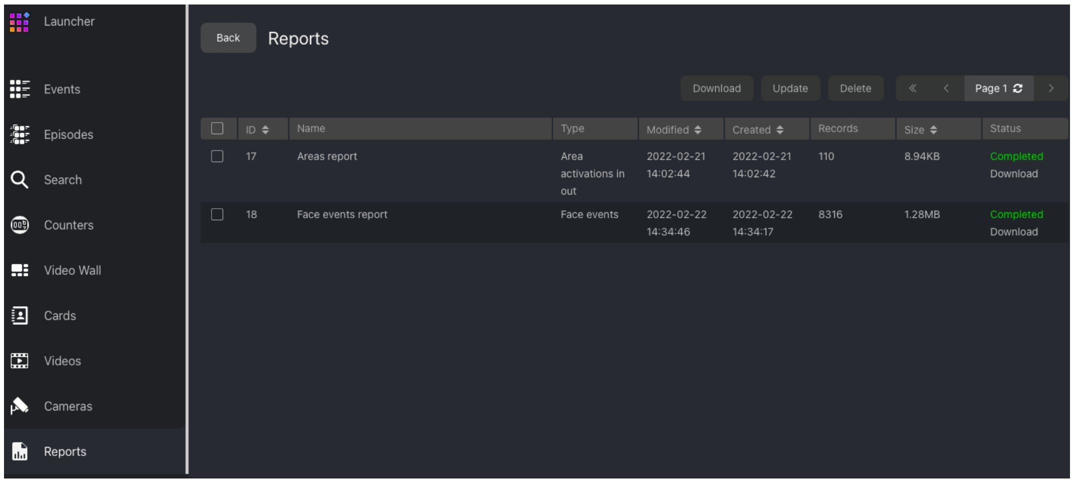
Event's best shot: All
Age: From / To
Beard: Off, Beard
Emotions: Angry, Disgust, Fear, Happy, Sad, Surprise, Neutral
Gender: Male, Female
Glasses: Off, Eyeglasses, Sunglasses
Liveness: Real, Fake
Face mask: Off, Improperly worn, On

4. Specify the report name.
5. If you are on the *Events* or *Areas* tab, select the report type *Standard report* (as there are two types of reports available).
6. If applicable, choose whether to save the report images as links, thumbnails, or full frames.



Name: Face events report
* Report type: Standard report
* Save report images as: Link

7. Click *Create*. The report will be available for download on the *Reports* tab.



	ID	Name	Type	Modified	Created	Records	Size	Status
	17	Areas report	Area activations in out	2022-02-21 14:02:44	2022-02-21 14:02:42	110	8.94KB	Completed Download
	18	Face events report	Face events	2022-02-22 14:34:46	2022-02-22 14:34:17	8316	1.28MB	Completed Download

3.13.3 Build Work Time Report

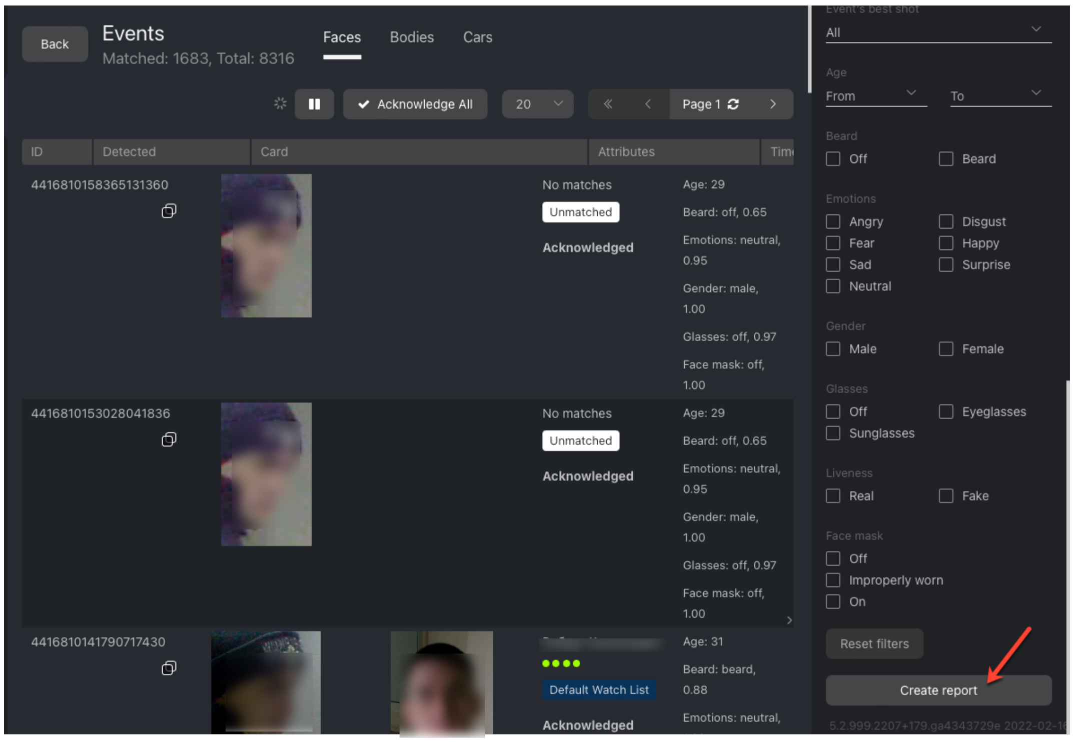
A work time report can be built on the following tabs:

- *Events*: work time personalized general report. Requires specifying cameras of entry and exit.
- *Areas*: work time non-personalized report regarding usage of a specific area. Considers moments of entering and exiting an area with a given ID.

Events

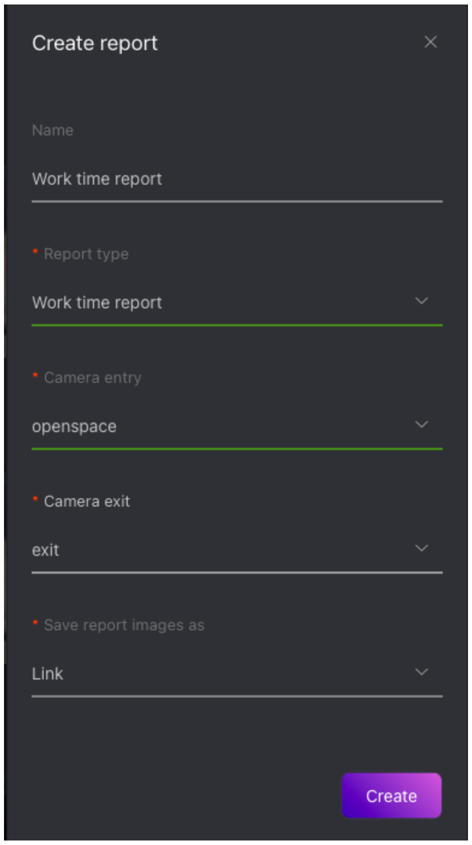
To build a work time report on the *Events* tab, do the following:

1. Set filters for the report.
2. Click *Create Report*.



ID	Card	Attributes
4416810158365131360	No matches Unmatched Acknowledged	Age: 29 Beard: off, 0.65 Emotions: neutral, 0.95 Gender: male, 1.00 Glasses: off, 0.97 Face mask: off, 1.00
4416810153028041836	No matches Unmatched Acknowledged	Age: 29 Beard: off, 0.65 Emotions: neutral, 0.95 Gender: male, 1.00 Glasses: off, 0.97 Face mask: off, 1.00
4416810141790717430	Default Watch List Acknowledged	Age: 31 Beard: beard, 0.88 Emotions: neutral,

3. Specify the report name.
4. Select the report type: *Work time report*.
5. Select the entrance camera.
6. Select the exit camera.
7. If applicable, choose whether to save the report images as links, thumbnails, or full frames.


Create report

Name: Work time report

* Report type: Work time report

* Camera entry: openspace

* Camera exit: exit

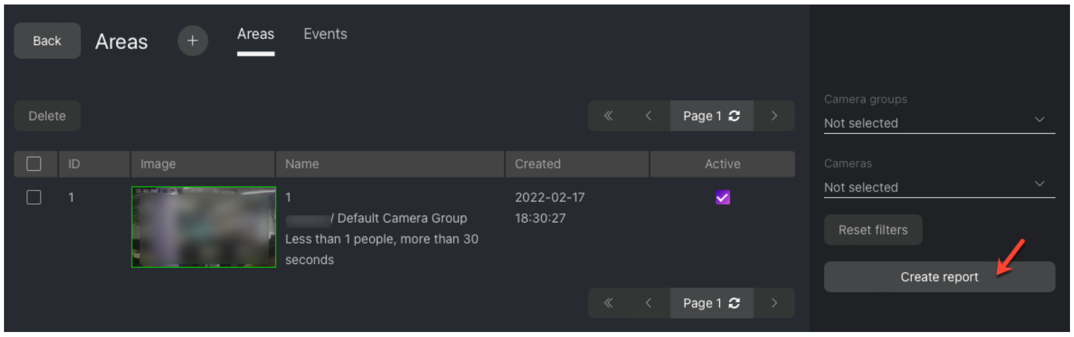
* Save report images as: Link

8. Click *Create*. The report will be available for download on the *Reports* tab.

Areas:

To build a work time report on the *Areas* tab, do the following:

1. Set filters for the report.
2. Click *Create Report*.

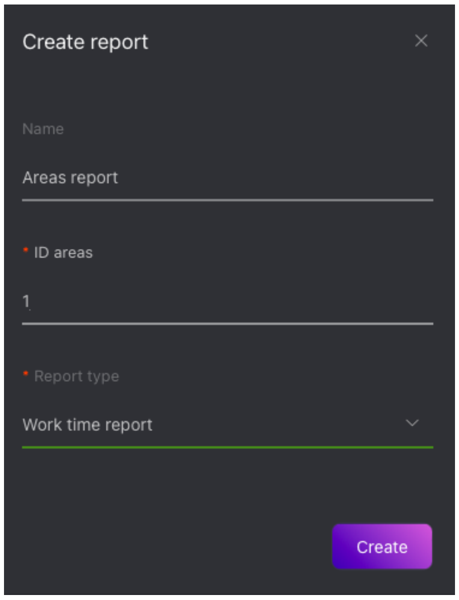


ID	Image	Name	Created	Active
1		1 / Default Camera Group Less than 1 people, more than 30 seconds	2022-02-17 18:30:27	✓

Camera groups: Not selected

Cameras: Not selected

3. Specify the report name.
4. Select the report type: *Work time report*.
5. Specify the area ID.



Create report

Name
Areas report

* ID areas
1

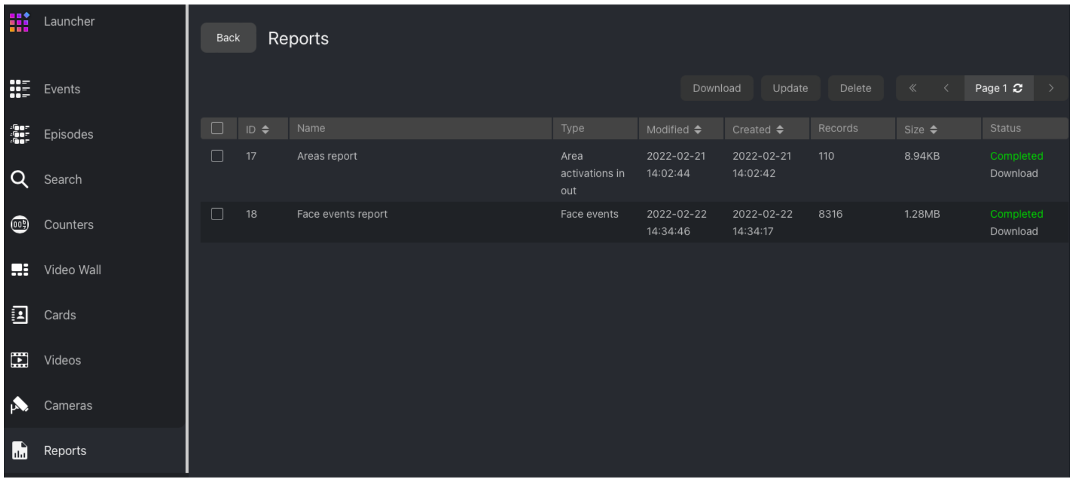
* Report type
Work time report

6. Click *Create*. The report will be available for download on the *Reports* tab.

3.13.4 Work with Reports

You can access reports previously created in the system on the *Reports* tab. The following operations are available:

- Download selected reported into the XLSX format.
- Update selected reports.
- Delete selected reports.



	ID	Name	Type	Modified	Created	Records	Size	Status
☐	17	Areas report	Area activations in out	2022-02-21 14:02:44	2022-02-21 14:02:42	110	8.94KB	Completed Download
☐	18	Face events report	Face events	2022-02-22 14:34:46	2022-02-22 14:34:17	8316	1.28MB	Completed Download

3.13.5 Configure Saving Images in Reports

When building certain reports, you will be able to choose to save the report images as links, thumbnails, or full frames. It is possible to configure the image parameters. To do so, open the `/etc/findface-security/config.py` configuration file and alter the default JPEG quality and the maximum height of thumbnails and full frames, subject to your free disc space.

```
sudo vi /etc/findface-security/config.py

# reports image saving options
'REPORT_THUMBNAIL_JPEG_QUALITY': 75,
'REPORT_THUMBNAIL_MAX_HEIGHT': 100,
'REPORT_FULLFRAME_JPEG_QUALITY': 75,
'REPORT_FULLFRAME_MAX_HEIGHT': 250,
```

3.14 Video Wall

The FindFace Multi Video Wall allows for basic video surveillance. Use it to display the video image from cameras and video files.

Important: Advanced video surveillance is available with *Video Recorder*.

In this chapter:

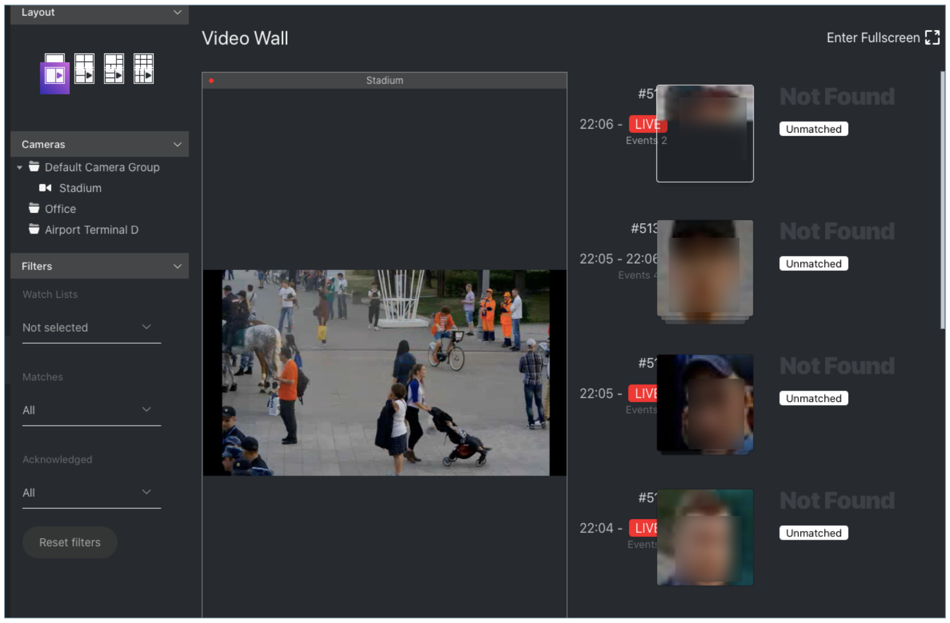
3.14.1 Display Video

The Video Wall offers two modes, four predefined layouts in each:

- video streaming
- video streaming with object detection and episode feed

To display video on the Video Wall, do the following:

1. Navigate to the *Video Wall* tab.
2. Select a mode and camera layout.



3. Drag-n-drop cameras of your choice to the Video Wall.

You can work with the episode feed on the Video Wall in the *same manner* as with the *Episodes* tab, including the following basic filters:

- *Watch Lists*
- *Matches*
- *Acknowledged*

3.14.2 Configure Video Wall

You can set up the Video Wall features that determine how it highlights objects in the video:

- turn on/off the bbox and attribute data display for faces, cars, and bodies

  Note: The attribute data are displayed if you have previously enabled neural networks for attribute recognition. See *Enable Face Attribute Recognition*, *Enable Car and Car Attribute Recognition*, *Enable Body and Body Attribute Recognition*.

- enable blurring unmatched objects to comply with personal data protection laws (GDPR and similar)

To configure the Video Wall, do the following:

1. Open the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py
```

2. Find the `FFSECURITY_UI_CONFIG` -> `available_video_wall_features` section.
3. Set `"faces"`, `"cars"`, `"bodies"` `True` or `False` to enable/disable the bbox and attribute data display for the relevant objects.

```
FFSECURITY_UI_CONFIG = {
    ...
    "available_video_wall_features": {
        "faces": True,
        "cars": False,
        "bodies": True,
        ...
    }
}
```

4. Set `"gdpr": True` to enable blurring all unmatched objects displayed on the Video Wall.

Tip: To fully comply with the personal data protection laws, follow *this guide*.

```
FFSECURITY_UI_CONFIG = {
    ...
    "available_video_wall_features": {
        ...
        "gdpr": True
    }
}
```

5. Restart `findface-security`.

```
sudo systemctl restart findface-security.service
```

See also:

Enable Personal Data Protection

CHAPTER

FOUR

INTEGRATIONS

This chapter is all about integration with FindFace Multi. Integrate your system through HTTP API and webhooks, or check out our turnkey partner integrations.

4.1 HTTP API

Detailed interactive documentation on the FindFace Multi HTTP API is available after installation at `http://<findface-security-ip:port>/api-docs`. Learn and try it out.

Tip: You can also find it by navigating to *Preferences* -> *API Documentation* in the web interface.

4.2 Webhooks

You can set up FindFace Multi to automatically send notifications about specific events, episodes, counter records, and area activations to a given URL. To do so, create and configure a webhook. In this case, when such an event, episode, counter record, or an area activation occurs, FindFace Multi will send an HTTP request to the URL configured for the webhook.

You can use webhooks for various purposes, for instance, to notify a user about a specific event, invoke required behavior on a target website, and solve security tasks such as automated access control.

In this section:

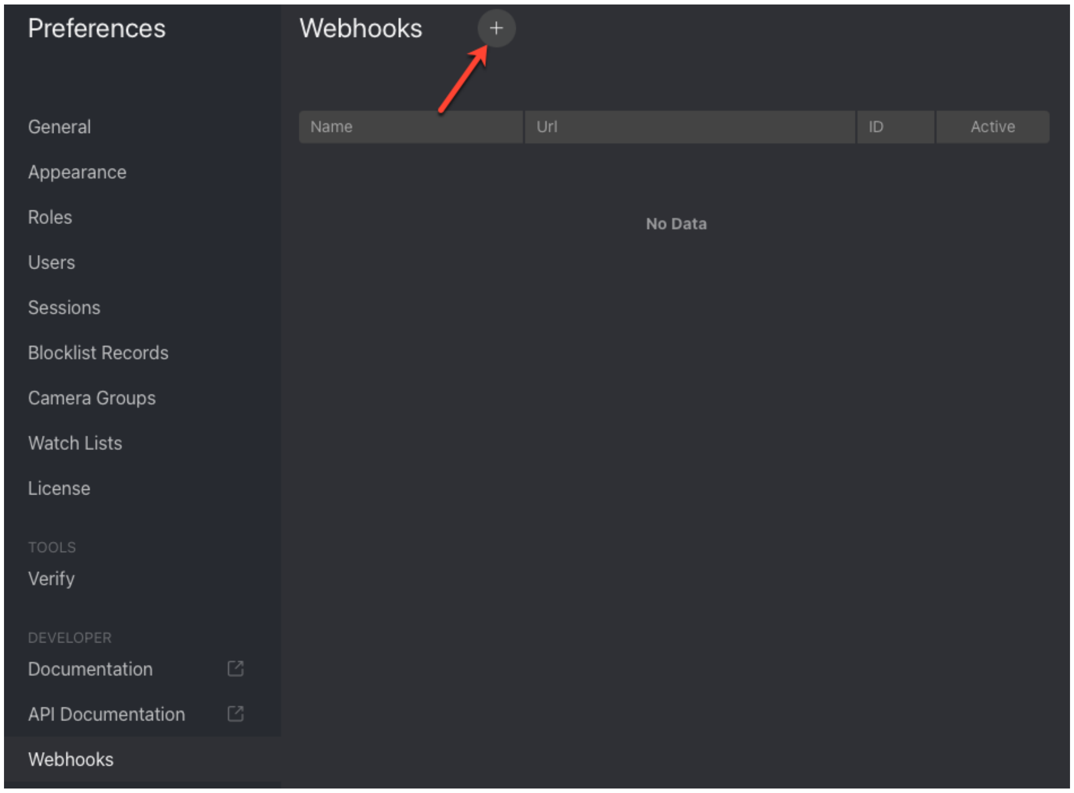
4.2.1 Configure Webhook

Important: You need Administrator privileges to create a webhook.

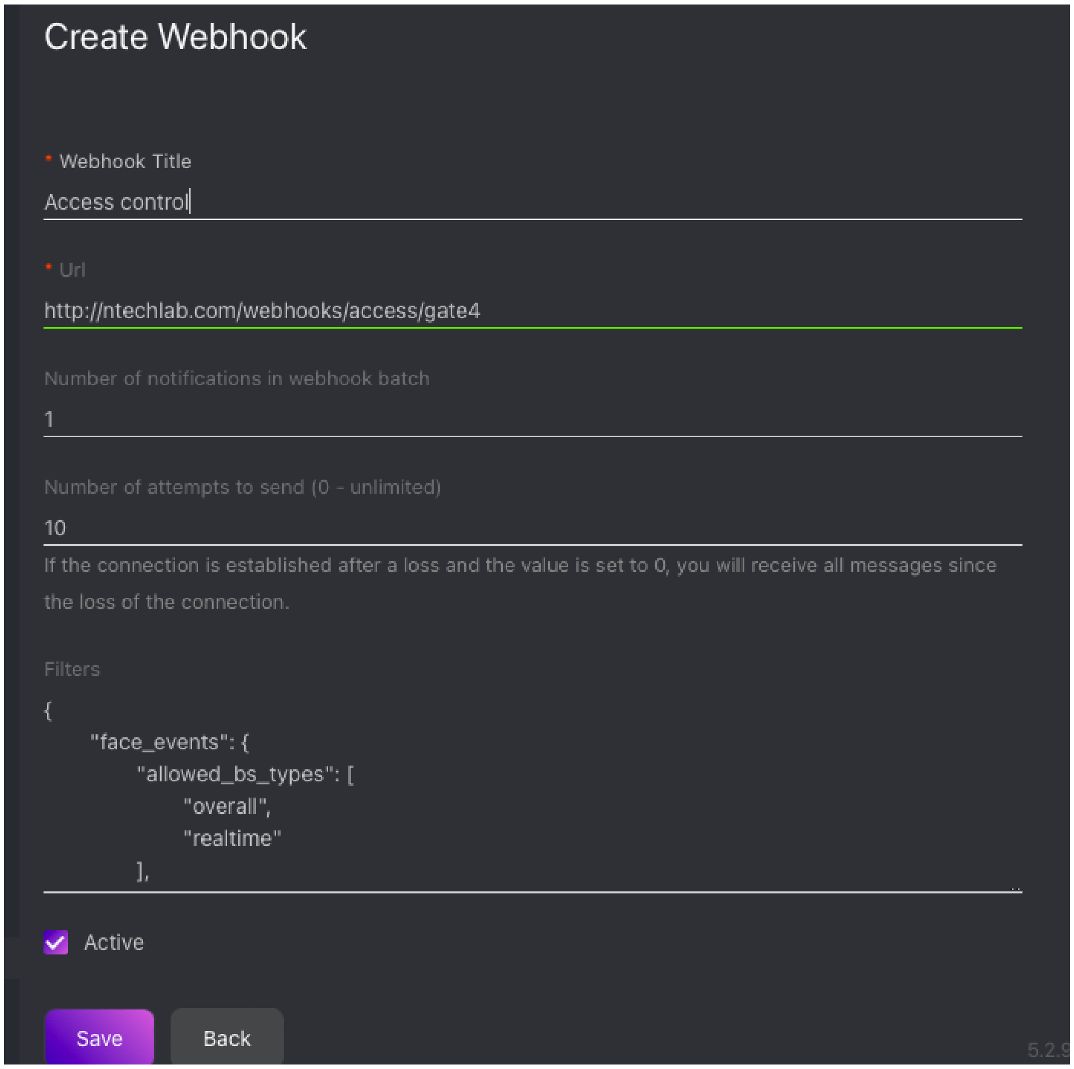
Note: To use the webhooks, make sure that at least one of the following parameters is specified in `/etc/findface-security/config.py`: `SERVICE_EXTERNAL_ADDRESS` or `EXTERNAL_ADDRESS`.

To create and configure a webhook, do the following:

1. Navigate to the *Preferences* tab. Click *Webhooks*.
2. Click +.



3. Specify the webhook title.



Create Webhook

* Webhook Title

Access control

* Url

http://ntechlab.com/webhooks/access/gate4

Number of notifications in webhook batch

1

Number of attempts to send (0 - unlimited)

10

If the connection is established after a loss and the value is set to 0, you will receive all messages since the loss of the connection.

Filters

```
{
    "face_events": {
        "allowed_bs_types": [
            "overall",
            "realtime"
        ],
```

✓ Active

4. Specify URL to automatically send notifications to.
5. You can send notifications in batches. Specify the maximum number of notifications in a webhook batch. The actual number may be less.
6. Specify the maximum number of attempts to send a notification. The interval between attempts increases exponentially with a maximum of 100 seconds.

Important: To receive all messages since the connection loss, should it happen, set `0`. Set `1` to omit old messages.

7. FindFace Multi will be automatically sending notifications on events, episodes, counter records, and area activations that match given filters. The following filters are available:

Recognition events (face, body, car):

Sections: `face_events`, `body_events`, `car_events`.

- `allowed_bs_types`: *object tracking mode*, possible values: `overall`, `realtime`.
- `camera_group_in`: camera group id, number.
- `camera_in`: camera id, number.
- `matched_lists_in`: watch list id, number.
- `matched_card_in`: matched card id, number.
- `matched`: the `matched` status. Set `true` or `false` if only matched or unmatched events must trigger sending a notification, boolean.
- `confidence_gte`: minimum confidence, number.

Episodes with people:

Section: `human_episodes`.

- `allowed_types`: episode status, possible values: an episode opening (`episode_open`), adding a new event into an episode (`episode_event`), an episode closing (`episode_close`).
- `camera_group_in`: camera group id, number.
- `camera_in`: camera id, number.
- `matched_lists_in`: watch list id, number.
- `face_matched`: the `matched` status of face events in an episode, boolean. Set `true` if only matched faces or `false` if only unmatched faces must trigger sending a notification.
- `body_matched`: the `matched` status of body events in an episode, boolean. Set `true` if only matched bodies or `false` if only unmatched bodies must trigger sending a notification.
- `events_count_gte`: minimum number of events in an episode, number.
- `events_count_lte`: maximum number of events in an episode, number.

Episodes with cars:

Section: `car_episodes`.

- `allowed_types`: episode status, possible values: an episode opening (`episode_open`), adding a new event into an episode (`episode_event`), an episode closing (`episode_close`).
- `camera_group_in`: camera group id, number.
- `camera_in`: camera id, number.
- `matched_lists_in`: watch list id, number.
- `car_matched`: the `matched` status of car events in an episode, boolean. Set `true` if only matched cars or `false` if only unmatched cars must trigger sending a notification.
- `events_count_gte`: minimum number of events in an episode, number.
- `events_count_lte`: maximum number of events in an episode, number.

Counter records:

Section: counters.

- counter_in: counter id, number.
- camera_group_in: camera group id, number.
- camera_in: camera id, number.
- faces_gte: minimum number of faces in a counter record, number.
- faces_lte: maximum number of faces in a counter record, number.
- silhouettes_gte: minimum number of bodies in a counter record, number.
- silhouettes_lte: maximum number of bodies in a counter record, number.
- cars_gte: minimum number of cars in a counter record, number.
- cars_lte: maximum number of cars in a counter record, number.
- proximity_min_lte: send a notification if the minimum detected distance in meters is less than this value, number.
- proximity_min_gte: send a notification if the minimum detected distance in meters is greater than this value, number.
- proximity_avg_lte: send a notification if the average detected distance in meters is less than this value, number.
- proximity_avg_gte: send a notification if the average detected distance in meters is greater than this value, number.
- proximity_max_lte: send a notification if the maximum detected distance in meters is less than this value, number.
- proximity_max_gte: send a notification if the maximum detected distance in meters is greater than this value, number.

Area activations:

Section: areas.

- area_in: area id, number.
- camera_group_in: camera group id, number.
- camera_in: camera id, number.

```
{
            "face_events": {
                        "allowed_bs_types": [
                                    "overall",
                                    "realtime"
                        ],
                        "camera_group_in": [],
                        "camera_in": [],
                        "matched_lists_in": [],
                        "matched_card_in": [],
                        "matched": true,
                        "confidence_gte": 0.75
```

(continues on next page)

(continued from previous page)

```
            },
            "body_events": {
                        "allowed_bs_types": [
                                    "overall",
                                    "realtime"
                        ],
                        "camera_group_in": [],
                        "camera_in": [],
                        "matched_lists_in": [],
                        "matched_card_in": [],
                        "matched": true,
                        "confidence_gte": 0.75
            },
            "car_events": {
                        "allowed_bs_types": [
                                    "overall",
                                    "realtime"
                        ],
                        "camera_group_in": [],
                        "camera_in": [],
                        "matched_lists_in": [],
                        "matched_card_in": [],
                        "matched": true,
                        "confidence_gte": 0.75
            },
            "human_episodes": {
                        "allowed_types": [
                                    "episode_open",
                                    "episode_event",
                                    "episode_close"
                        ],
                        "camera_group_in": [],
                        "camera_in": [],
                        "matched_lists_in": [],
                        "face_matched": true,
                        "body_matched": true,
                        "events_count_gte": 0,
                        "events_count_lte": 999
            },
            "car_episodes": {
                        "allowed_types": [
                                    "episode_open",
                                    "episode_event",
                                    "episode_close"
                        ],
                        "camera_group_in": [],
                        "camera_in": [],
                        "matched_lists_in": [],
                        "car_matched": true,
                        "events_count_gte": 0,
                        "events_count_lte": 999
            },
```

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```
                "counters": {
                                "counter_in": [],
                                "camera_group_in": [],
                                "camera_in": [],
                                "faces_gte": 1,
                                "faces_lte": 100,
                                "silhouettes_gte": 1,
                                "silhouettes_lte": 100,
                                "cars_gte": 1,
                                "cars_lte": 100,
                                "proximity_min_lte": 100,
                                "proximity_min_gte": 0,
                                "proximity_avg_lte": 100,
                                "proximity_avg_gte": 0,
                                "proximity_max_lte": 100,
                                "proximity_max_gte": 0
                },
                "areas": {
                                "area_in": [],
                                "camera_group_in": [],
                                "camera_in": []
                }
}
```

Important: Use only filters which match your search needs. To turn off a filter, remove it from a webhook. Do not leave a filter empty (`[]`) as in this case, the result of filtration will be empty as well.

Note: To get all notifications, pass only curly braces without any enclosed filters:

```
{}
```

Tip: Example #1. Get notifications about all car events:

```
{ "car_events": {} }
```

Example #2. Get notifications of the opening of matched episodes that feature human faces and bodies:

```
{ "human_episodes": { "allowed_types": ["episode_open"], "face_matched": true,
↪"body_matched": true }}
```

Note: You can specify several values for filters with square braces. In this case, the webhook will be triggered once one of the values from this filter has been matched. In the example below, you will get a body event from the camera group 1 or 3 if a matched card is 12 or 25.

```
{
        "body_events": {
                "camera_group_in": [1, 3],
                "matched_card_in": [12, 25]
        }
}
```

8. Check *Active*.
9. Click *Save*.

4.2.2 Webhook in Action

Try out a webhook by capturing event notifications with a simple web server in Python:

```
from pprint import pprint
from aiohttp import web


async def handle(request):
    pprint(await request.json())
    return web.Response(status=200)


app = web.Application()
# for aiohttp v 3.x
# app.add_routes([web.post('/', handle)])

# for aiohttp v 2.x
app.router.add_post('/', handle)

web.run_app(app, port=8888)
```

Important: A webhook catcher that you use must return an `HTTP 200` response after receiving the webhook request from FindFace Multi, like in the example above.

If no filters are configured for a webhook, this web server will be getting notifications about all events, episodes, counter records, and area notifications that occur in the system. The notifications have the following formats:

- `Face event`
- `Body event`
- `Car event`
- `Opening of a person episode`
- `Opening of a car episode`
- `Closing of a person episode`
- `Closing of a car episode`
- `Counter record`
- `Area activation`

To view a webhook pulling status, execute:

```
sudo journalctl -u findface-security.service | grep 'Webhook'
```

Success:

```
May 30 14:13:43 ffsecurity[12441]: INFO    [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Sent batch(len-1, type-"face_events"): ['4355024961160384430']
May 30 14:13:43 ffsecurity[12441]: INFO    [SC:OQSrsPV9] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪003450
May 30 14:13:43 ffsecurity[12441]: INFO    [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Sent batch(len-1, type-"face_events"): ['4355024961658847580']
May 30 14:13:44 ffsecurity[12441]: INFO    [SC:JtRz2Vuo] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001263
May 30 14:13:44 ffsecurity[12441]: INFO    [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Sent batch(len-1, type-"face_events"): ['4355024962087522421']
May 30 14:13:44 ffsecurity[12441]: INFO    [SC:9AnzRJwU] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001691
May 30 14:13:44 ffsecurity[12441]: INFO    [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Sent batch(len-1, type-"face_events"): ['4355024962355957878']
```

Failure:

```
May 30 14:18:49 ffsecurity[12441]: INFO    [SC:sp34rVQR] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001376
May 30 14:18:49 ffsecurity[12441]: WARNING [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Error sending webhook: Cannot connect to host 127.0.0.1:8888 ssl:None␣
↪[Connection refused]. Attempt 1 out of 10. Next attempt in 0.270 seconds.
May 30 14:18:50 ffsecurity[12441]: WARNING [Webhook(id=6) worker(type=face_events]
↪<queue:  0> Error sending webhook: Cannot connect to host 127.0.0.1:8888 ssl:None␣
↪[Connection refused]. Attempt 2 out of 10. Next attempt in 0.729 seconds.
May 30 14:18:50 ffsecurity[12441]: INFO    [SC:zUhLHNxN] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001368
May 30 14:18:50 ffsecurity[12441]: INFO    [SC:1Q66tcUS] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001386
May 30 14:18:50 ffsecurity[12441]: WARNING [Webhook(id=6) worker(type=face_events]
↪<queue:  2> Error sending webhook: Cannot connect to host 127.0.0.1:8888 ssl:None␣
↪[Connection refused]. Attempt 3 out of 10. Next attempt in 1.968 seconds.
May 30 14:18:52 ffsecurity[12441]: WARNING [Webhook(id=6) worker(type=face_events]
↪<queue:  2> Error sending webhook: Cannot connect to host 127.0.0.1:8888 ssl:None␣
↪[Connection refused]. Attempt 4 out of 10. Next attempt in 5.314 seconds.
May 30 14:18:55 ffsecurity[12441]: INFO    [SC:5kl6zGrF] [Webhooks manager-38bc5]␣
↪Processing message(type="face_events:event_created"). Consumer reception delta: 0.
↪001542
```

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```
May 30 14:18:58 ffsecurity[12441]: WARNING [Webhook(id=6) worker(type=face_events]
↪<queue:  3> Error sending webhook: Cannot connect to host 127.0.0.1:8888 ssl:None␣
↪[Connection refused]. Attempt 5 out of 10. Next attempt in 14.349 seconds.
```

4.2.3 Verbose Webhooks

By default, webhook notifications contain only ids of such entities as cards, watch lists, cameras, and camera groups. It is possible to get the full content of the mentioned entities by switching webhooks to the verbose mode.

To do so, open the `/etc/findface-security/config.py` configuration file and set `'VERBOSE_WEBHOOKS': True`:

```
sudo vi /etc/findface-security/config.py

...
FFSECURITY = {
    ...
    # send serialized cards, card-lists, camera and camera groups in webhooks
    'VERBOSE_WEBHOOKS': True,
    ...
}
...
```

Be sure to restart the `findface-security` service after making changes.

```
sudo systemctl restart findface-security.service
```

In the verbose mode, webhook notifications have the following formats:

- `Face event (verbose)`
- `Body event (verbose)`
- `Car event (verbose)`
- `Opening of a person episode (verbose)`
- `Opening of a car episode (verbose)`
- `Closing of a person episode (verbose)`
- `Closing of a car episode (verbose)`
- `Counter record (verbose)`
- `Area activation (verbose)`

4.3 Partner Integrations

4.3.1 Genetec Security Center

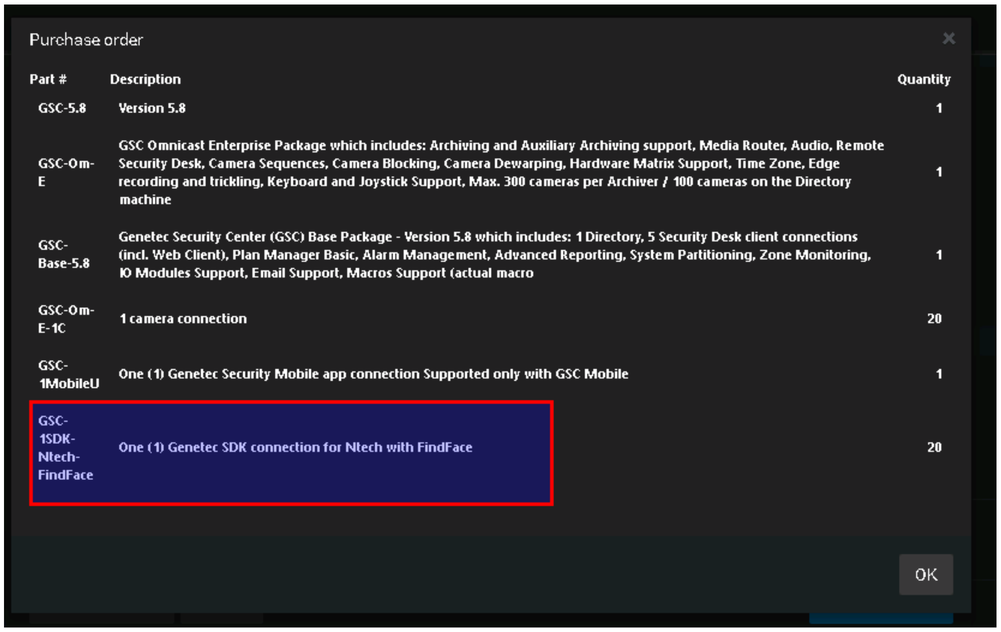
FindFace Multi integration with Genetec Security Center allows you to expand the capabilities of your Genetec-based security system with face recognition functionality.

Configure Integration

Integration with Genetec Security Center is implemented via the `findface-genetec` plugin. By default, the plugin is disabled.

Before getting started with the integration on the FindFace Multi side, deploy the Genetec Web SDK and Media Gateway packages, and create an `Alarm` entity that will be triggered in Genetec Security Center when a face recognition event occurs in FindFace Multi.

Important: For the Genetec-FindFace integration to work, you also need to purchase a proper license from Genetec (license part number `GSC-1SDK-Ntech-FindFace`) and activate it in Genetec Security Center.



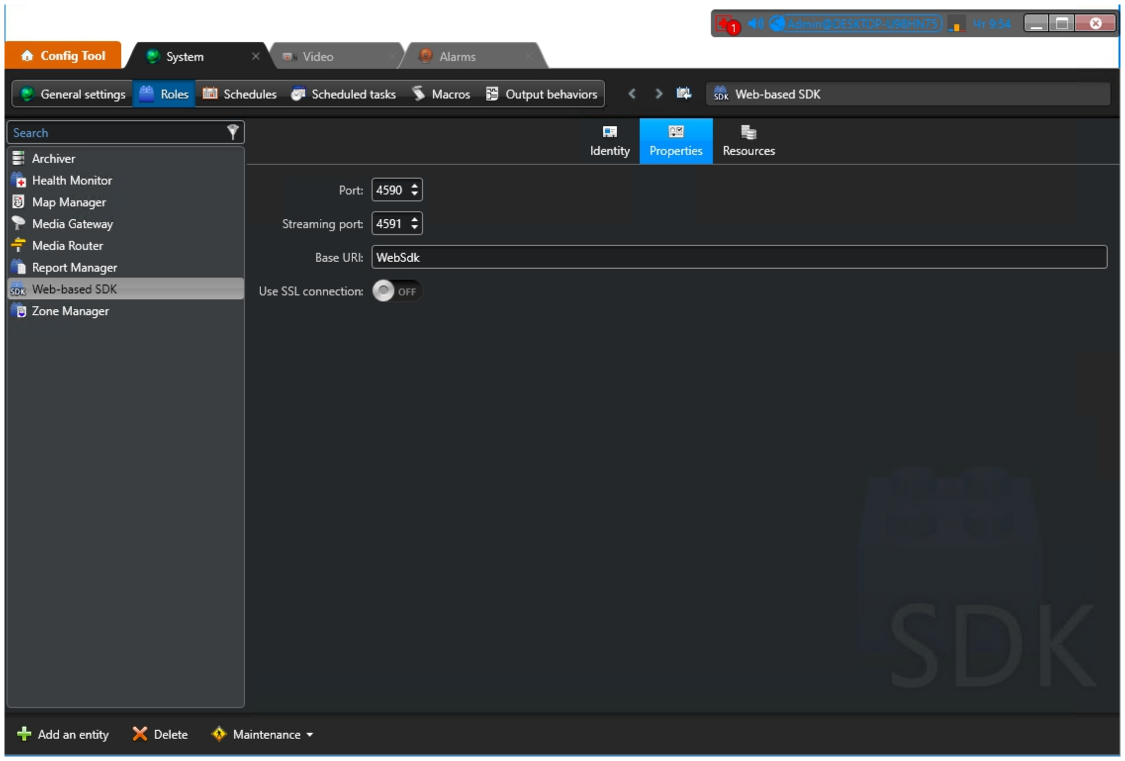
Purchase order

Part #	Description	Quantity
GSC-5.8	Version 5.8	1
GSC-Om-E	GSC Omnicast Enterprise Package which includes: Archiving and Auxiliary Archiving support, Media Router, Audio, Remote Security Desk, Camera Sequences, Camera Blocking, Camera Dewarping, Hardware Matrix Support, Time Zone, Edge recording and trickling, Keyboard and Joystick Support, Max. 300 cameras per Archiver / 100 cameras on the Directory machine	1
GSC-Base-5.8	Genetec Security Center (GSC) Base Package - Version 5.8 which includes: 1 Directory, 5 Security Desk client connections (incl. Web Client), Plan Manager Basic, Alarm Management, Advanced Reporting, System Partitioning, Zone Monitoring, IO Modules Support, Email Support, Macros Support (actual macro	1
GSC-Om-E-1C	1 camera connection	20
GSC-1MobileU	One (1) Genetec Security Mobile app connection Supported only with GSC Mobile	1
GSC-1SDK-Ntech-FindFace	One (1) Genetec SDK connection for Ntech with FindFace	20

In this chapter:

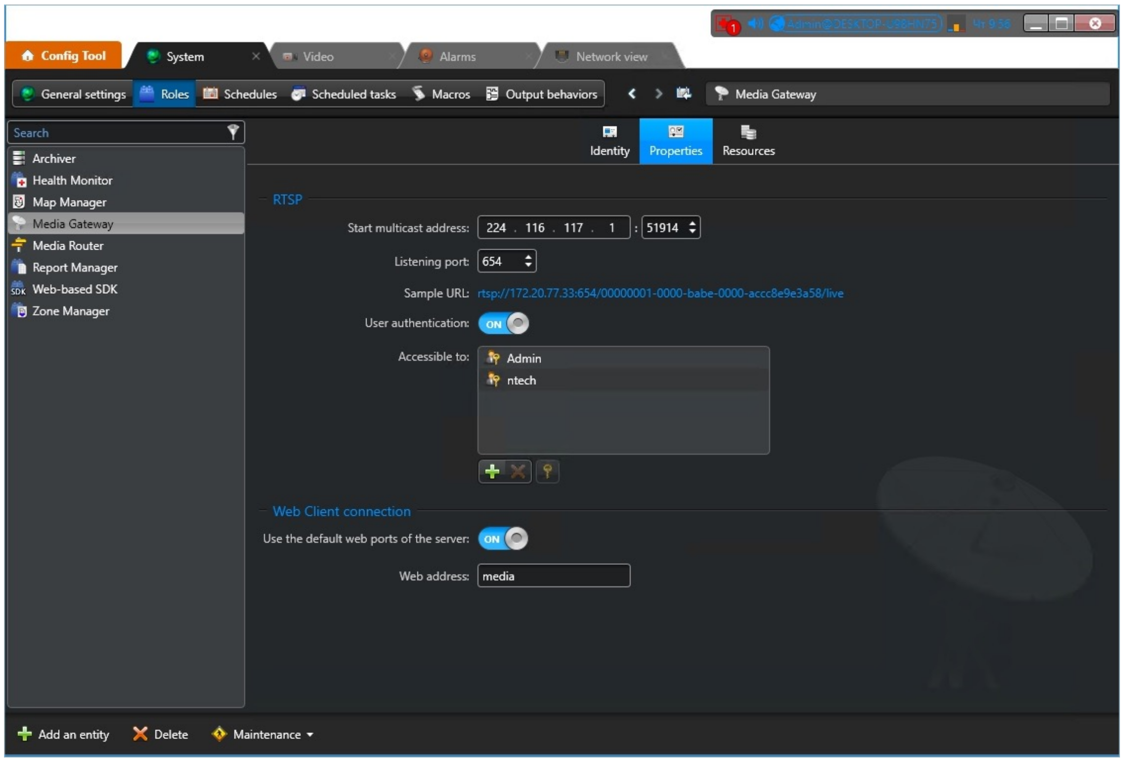
Configure Genetec Web SDK and Media Gateway

To enable and configure Web SDK, use Genetec Config Tool. For details, refer to *Security Center Administrator Guide -> Chapter 52: Role Types -> Web-based SDK configuration tabs*.



Port: 4590
Streaming port: 4591
Base URI: WebSdk
Use SSL connection: OFF

When enabling and configuring Media Getaway in Genetec Config Tool, refer to *Security Center Administrator Guide -> Chapter 24: Video Deployment*.



RTSP

Start multicast address: 224 . 116 . 117 . 1 : 51914

Listening port: 654

Sample URL: rtsp://172.20.77.33:654/00000001-0000-babe-0000-accc8e9e3a58/live

User authentication: ON

Accessible to: Admin, ntech

Web Client connection

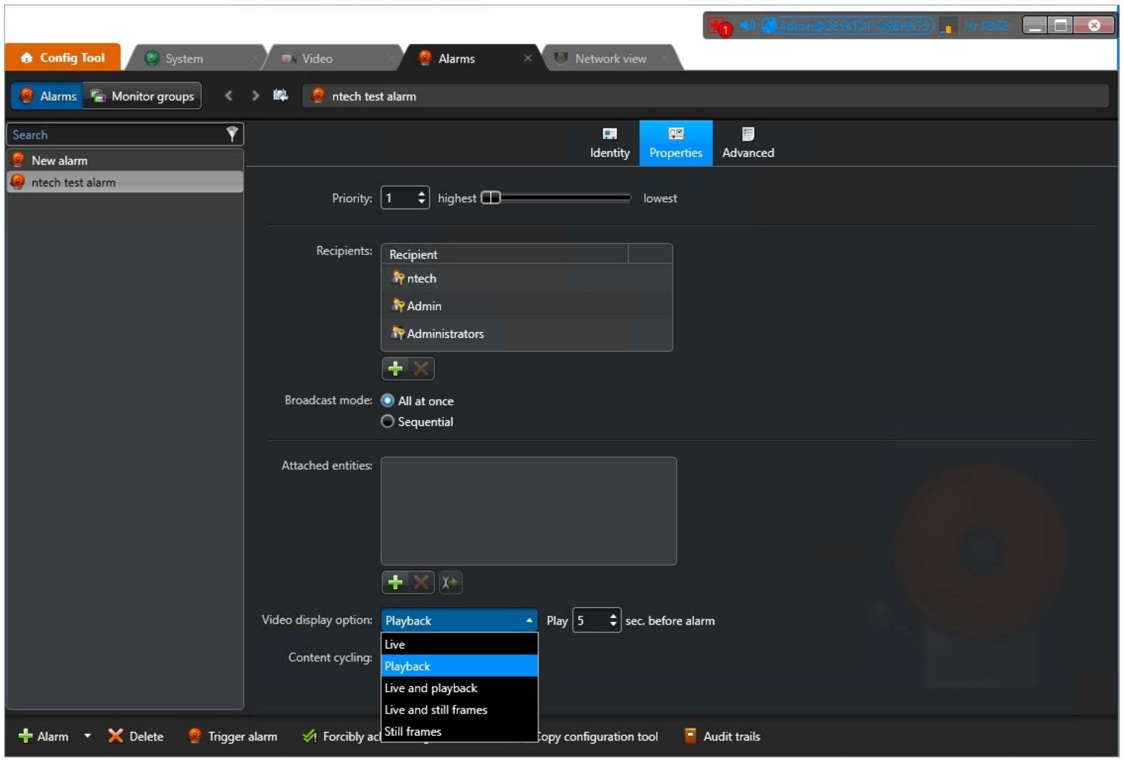
Use the default web ports of the server: ON

Web address: media

Important: Make sure that the firewall is configured so that the ports for the WebSDK and Media Gateway are open.

Create Alarm in Genetec Security Center

Create and configure a new `Alarm` entity in Genetec Config Tool. Refer to *Security Center Administrator Guide -> Chapter 48: Alarms -> Creating Alarms* for details.



Priority: 1 highest lowest

Recipients:

Recipient
ntech
Admin
Administrators

Broadcast mode: All at once / Sequential

Attached entities:

Video display option: Playback — Play 5 sec. before alarm

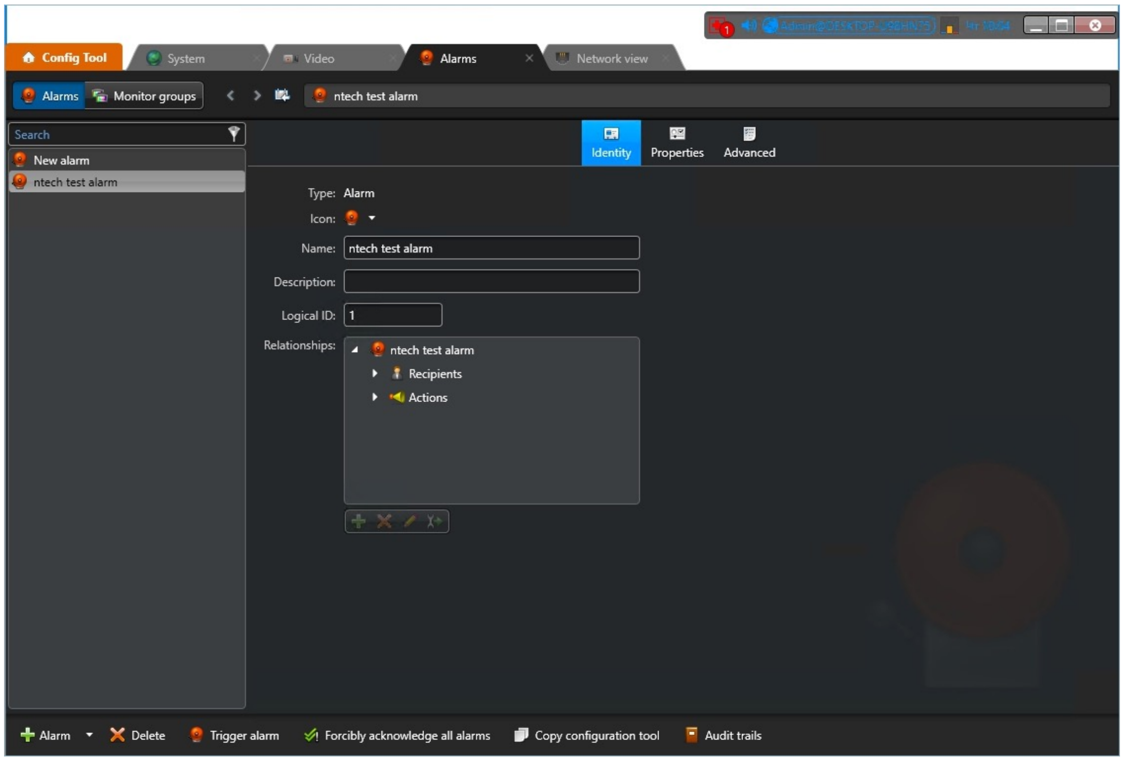
Live
Playback
Live and playback
Live and still frames
Still frames

Content cycling:

Tip: On the *Properties* tab, select the *Video display option* that suits your needs the best. Available options are *Live*, *Playback*, etc.

Tip: To enable alarm procedures and auto rotation of video right within the alarm pop-up window, enable *Content cycling*.

When configuring the integration in FindFace Multi, you will have to enter the alarm logical id that is specified on the *Identity* tab.



Type: Alarm
Icon:
Name: ntech test alarm
Description:
Logical ID: 1
Relationships: ntech test alarm
Recipients
Actions

Enable Genetec Integration in FindFace Multi

To enable the Genetec integration in FindFace Multi, do the following:

1. Enable the `findface-genetec` plugin. To do so, open the `/etc/findface-security/config.py` configuration file and uncomment the `INSTALLED_APPS.append('ffsecurity_genetec')` line. Make sure that at least one of the following parameters is specified: `SERVICE_EXTERNAL_ADDRESS` or `EXTERNAL_ADDRESS`.

```
sudo vi /etc/findface-security/config.py

...
# SERVICE_EXTERNAL_ADDRESS is prioritized for FFSecurity webhooks and Genetec␣
↪plugin.
# EXTERNAL_ADDRESS is used instead if SERVICE_EXTERNAL_ADDRESS is not provided.
# You must provide either SERVICE_EXTERNAL_ADDRESS or EXTERNAL_ADDRESS in order
# to be able to work with FFSecurity webhooks and Genetec plugin.
SERVICE_EXTERNAL_ADDRESS = 'http://127.0.0.1'
# EXTERNAL_ADDRESS is used to access objects created inside FFSecurity via external␣
↪links.
EXTERNAL_ADDRESS = ''

...
# FINDFACE SECURITY PLUGINS
# ==============================================================================
# Uncomment lines below to enable plugins. Please consult documentation for
# a plugin specific settings.
...
# =============== Genetec ================
```

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```
INSTALLED_APPS.append('ffsecurity_genetec')
```

2. Migrate the main database architecture from FindFace Multi to **PostgreSQL** and re-create user groups with *predefined* rights.

```
sudo findface-security migrate
sudo findface-security create_groups
```

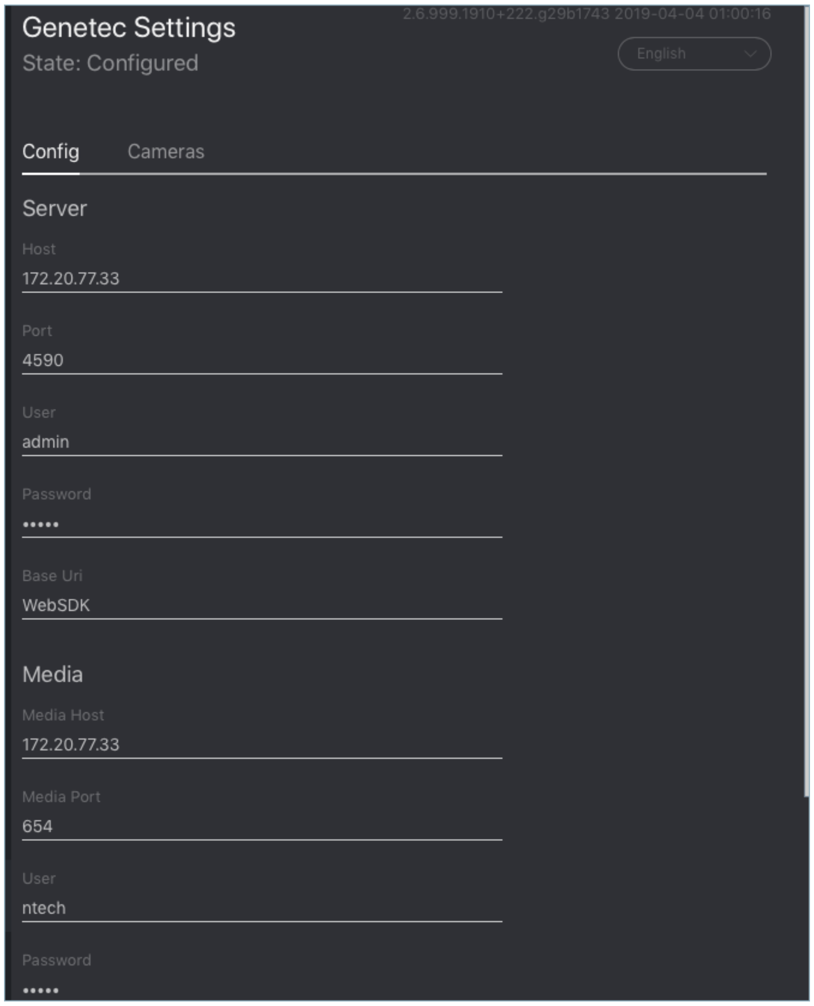
3. Restart `findface-security`.

```
sudo systemctl restart findface-security.service
```

Configure Endpoints in FindFace Multi

To establish connection between FindFace Multi and Genetec Security Center, do the following:

1. Navigate to the *Preferences* tab. Click *Genetec*.



Genetec Settings
State: Configured
2.6.999.1910+222.g29b1743 2019-04-04 01:00:16

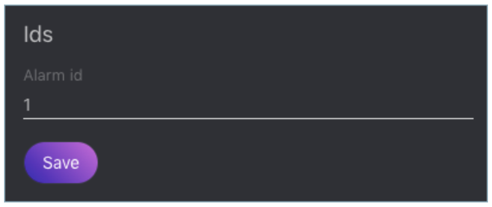
Server
Host
172.20.77.33
Port
4590
User
admin
Password
•••••
Base Uri
WebSDK

Media
Media Host
172.20.77.33
Media Port
654
User
ntech
Password
•••••

2. In the *Server* and *Media* sections, specify *settings* of the Web SDK and Media Gateway endpoints.

Important: The ports for the WebSDK and Media Gateway need to be open.

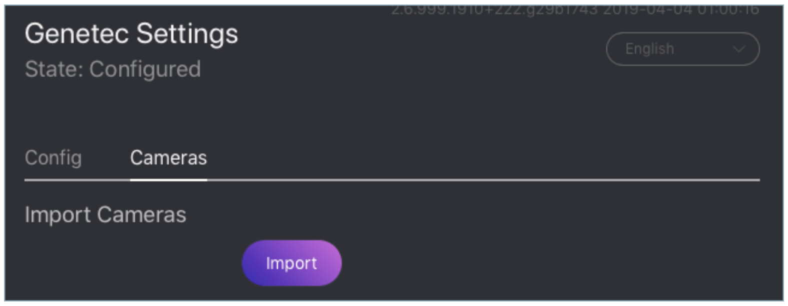
3. In the *Ids* section, specify the *logical id* of the `Alarm` entity that will be triggered in Genetec Security Center when a face recognition event occurs in FindFace Multi.



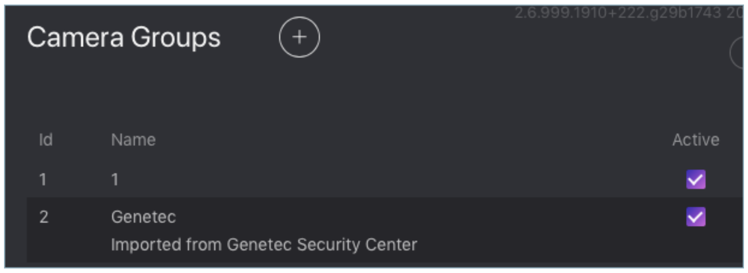
4. Click *Save*. If the connection to Genetec Security Center is successfully established, you will see the *State* change to *Configured*.

Import Cameras from Genetec Security Center

Once the connection to Genetec Security Center is established, import cameras. To do so, click *Cameras* on the *Genetec* tab. Click *Import*.



This action will create a *group of cameras* `Genetec` listing all the cameras from Genetec Security Center.



Id	Name	Active
1	1	✓
2	Genetec Imported from Genetec Security Center	✓

To view this list of cameras, navigate to the *Cameras* tab on the FindFace Multi navigation bar. If you want to exclude a camera from face recognition, simply deactivate it in the list.

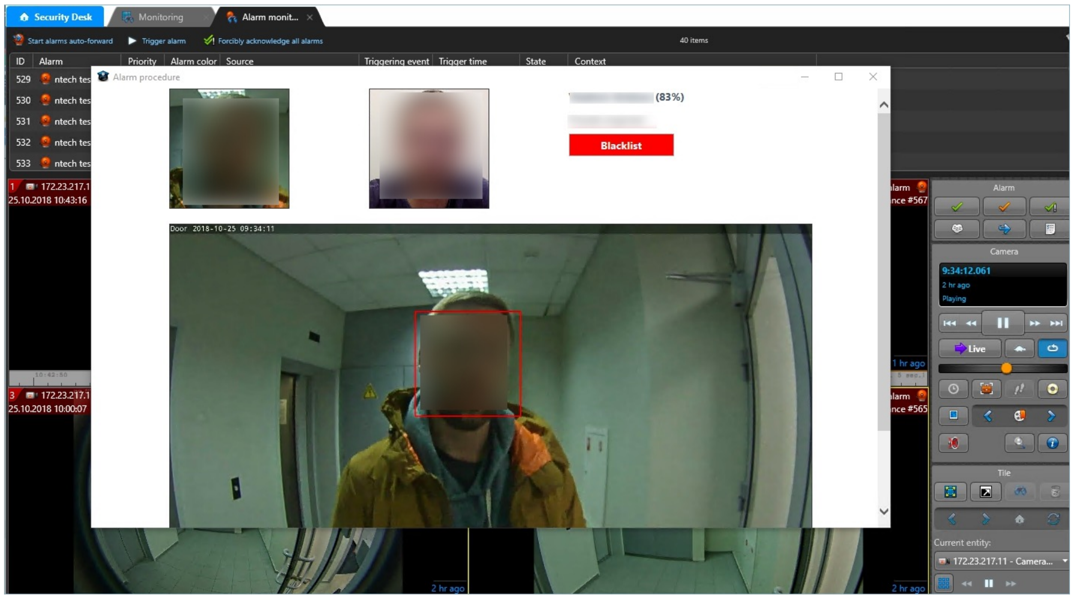
Create Watch Lists and Cards in FindFace Multi

After you have configured the endpoints and camera settings, finish the integration by creating a *card index*. Notifications about face recognition events will be automatically sent to Genetec Security Center. See *Notifications in Genetec Security Center*.

Notifications in Genetec Security Center

Each face recognition event from a Genetec camera, that has a match with a card, triggers a relevant alarm in Genetec Security Center. Every alarm triggered by FindFace Multi is associated with a relevant camera (source of the face recognition event) so you can instantly watch live or playback video within the `Alarm Monitoring` task in Genetec Security Desk. FindFace Multi also utilizes `Alarm Procedures` to provide a user with additional content related to the alarm, such as:

- face detected in the video
- matching face from the card index
- person’s name and comment from the card
- matching confidence
- watch list’s name
- full frame



After you receive a face recognition alarm, process it as you usually do with other alarms in Genetec Security Center.

4.3.2 Axxon Next

FindFace Multi integration with Axxon Next allows you to detect and identify objects in video streams from an Axxon-based security system.

Integration with Axxon Next is implemented via the `ffsecurity_axxon` plugin.

To configure the FindFace Multi integration with Axxon Next in Ubuntu, do the following:

1. Activate the plugin by uncommenting the `INSTALLED_APPS.append('ffsecurity_axxon')` line in the `/etc/findface-security/config.py` configuration file.

```
sudo vi /etc/findface-security/config.py

...

# ==============================================================================
# FINDFACE SECURITY PLUGINS
# ==============================================================================
# Uncomment lines below to enable plugins. Please consult documentation for
# a plugin specific settings.

# =============== Axxon ================
INSTALLED_APPS.append('ffsecurity_axxon')
```

2. Uncomment the `AXXON` section in the configuration file. Fill it out by analogy with the example below. In the `api` parameter, specify the IP address and API port of the Axxon Next server that will provide FindFace Multi with Axxon API and HLS-archive streams. In the `rtsp` parameter, specify the common segment of Axxon video stream addresses. `name`, `user`, `password`: the Axxon Next server name and credentials to access it.

```
=============== Axxon ================
 INSTALLED_APPS.append('ffsecurity_axxon')

 AXXON = [
     {
         'name': 'my_axxon',
         'api': 'http://192.168.0.2:8000',
         'rtsp': 'rtsp://192.168.0.2:50554/',
         'user': 'cinderella',
         'password': '1@love$ocean8',
     }
 ]
```

Note: You can establish connections to several Axxon Next servers by multiplying the `AXXON` section content as follows:

```
AXXON = [
     {
         'name': 'my_axxon1',
         'api': 'http://192.168.0.2:8000',
         'rtsp': 'rtsp://192.168.0.2:50554/',
         'user': 'user1',
         'password': 'password1',
     },
```

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```
    {
        'name': 'my_axxon2',
        'api': 'http://192.168.0.3:8000',
        'rtsp': 'rtsp://192.168.0.3:50554/',
        'user': 'user2',
        'password': 'password2',
    },
    {
        'name': 'my_axxon3',
        'api': 'http://192.168.0.4:8000',
        'rtsp': 'rtsp://192.168.0.4:50554/',
        'user': 'user3',
        'password': 'password3',
    }
]
```

3. Create representations of Axxon Next cameras in FindFace Multi (see *Camera Management and Video Recording*). A camera representation URL must be specified in the format `<server>:<friendlyNameLong>`, where `server` is the Axxon Next server name specified on the previous step in the `name` parameter, ``friendlyNameLong` is a camera name on the Axxon Next server. You can find out the camera name in the Axxon user interface, or via Axxon API by executing:

```
curl http://user:password@127.0.0.1/video-origins/

{
   "OLOLOE-DEV/DeviceIpint.vhod_1/SourceEndpoint.video:0:0" : {
      "friendlyNameLong" : "vhod_1.Vhod_1",
      "friendlyNameShort" : "Vhod_1",
      "origin" : "OLOLOE-DEV/DeviceIpint.vhod_1/SourceEndpoint.video:0:0",
      "state" : "signal_restored"
   }
}
```

   For the camera from our example, URL will specified as `my_axxon:vhod_1.Vhod_1`.

The configuration is now finished. If the integration is properly configured, FindFace Multi will be detecting and identifying objects in Axxon Next video streams, and recognition events will be featuring video clips from Axxon Next (upon relevant settings).

4.4 Edge Devices

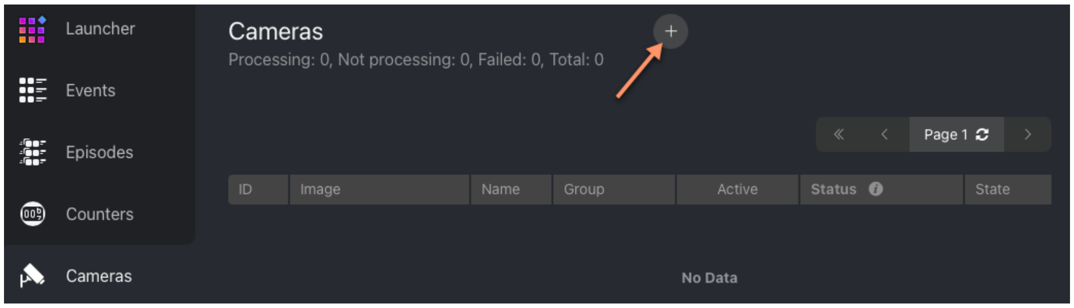
It is possible to integrate FindFace Multi with the edge devices that can source frames for object recognition, e.g., Access Control terminals. In this case, once FindFace Multi receives a frame from an edge device, it will initiate the extraction of the object's feature vector and event creation. You can work with these events by analogy with the *events* from CCTV cameras.

The edge device integration is done through *HTTP API*. After the primary configuration, FindFace Multi will issue a token. Specify this token in every API request sent by the edge device to FindFace Multi to authorize the device.

To integrate an edge device with FindFace Multi, do the following:

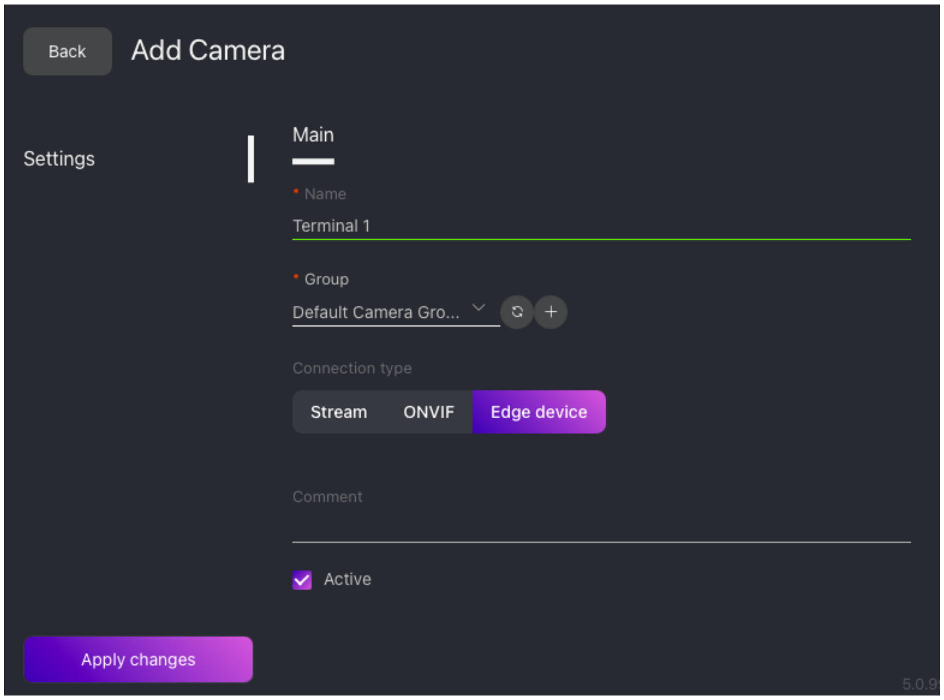
1. Navigate to the *Cameras* tab.

2. Click +.



Processing: 0, Not processing: 0, Failed: 0, Total: 0

3. On the *Settings* -> *Main* tab, enter the general edge device information:



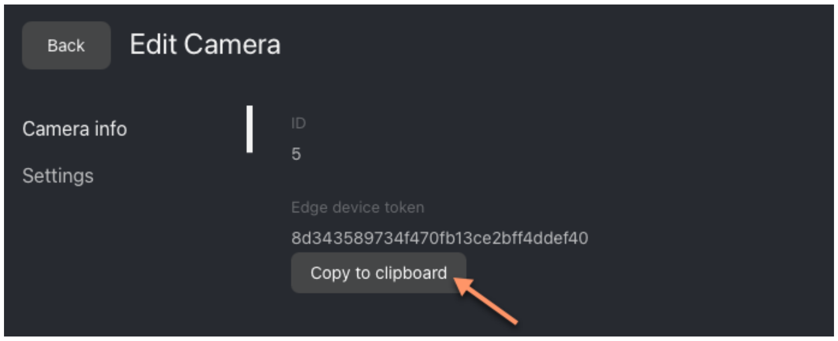
* Name: Terminal 1
* Group: Default Camera Gro...
Connection type: Edge device
Comment
Active: ✓

- *Connection type*: choose *Edge device*.
- Specify the edge device name.
- Add the edge device to a camera group, so it will be more convenient to filter events from this device later.

Tip: You can allot a separate camera group specifically to edge devices.

- If necessary, add a comment.
- Check *Active*.

4. On the *Camera info* tab, copy the provided edge device token to the clipboard.



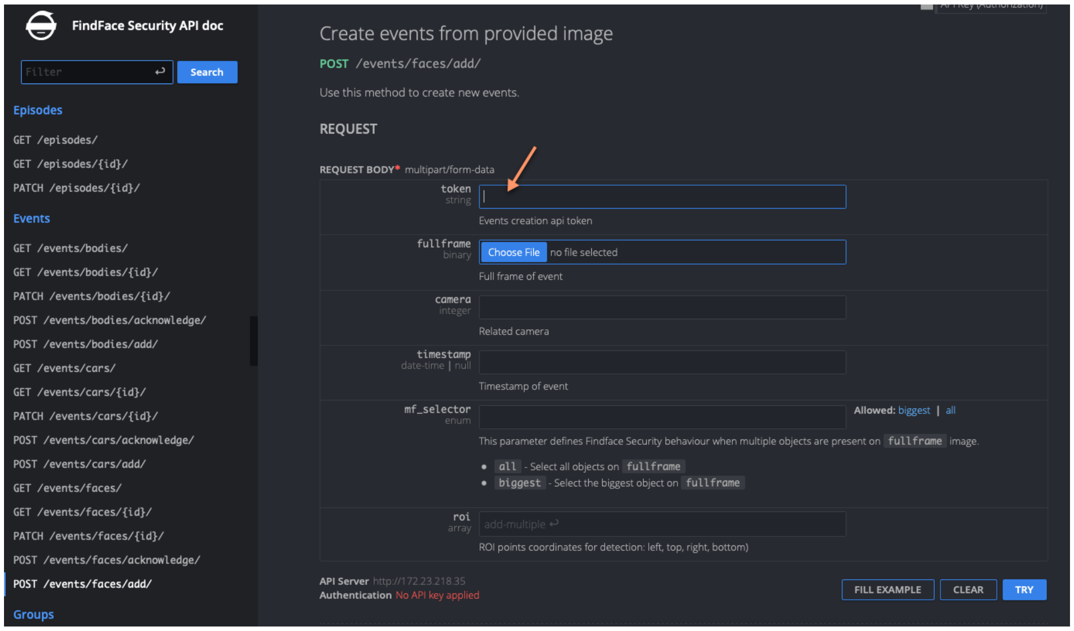
ID

5

Edge device token

8d343589734f470fb13ce2bff4ddef40

5. Specify this token in every API request that the edge device sends to FindFace Multi to create an event. As a result, frames passed in the requests will be associated with the edge device's relevant camera and processed by analogy with the frames from CCTV cameras.



Create events from provided image

POST /events/faces/add/

Use this method to create new events.

REQUEST

REQUEST BODY* multipart/form-data

token string		Events creation api token
fullframe binary	no file selected	Full frame of event
camera integer		Related camera
timestamp date-time | null		Timestamp of event
mf_selector enum	Allowed: biggest | all	This parameter defines Findface Security behaviour when multiple objects are present on `fullframe` image. • `all` - Select all objects on `fullframe` • `biggest` - Select the biggest object on `fullframe`
roi array	add-multiple ↩	ROI points coordinates for detection: left, top, right, bottom)

API Server http://172.23.218.35
Authentication No API key applied

Detailed interactive documentation on the FindFace Multi HTTP API is available after installation at `http://<findface-security-ip:port>/api-docs`. Learn and try it out.

Tip: You can also find it by navigating to *Preferences -> API Documentation* in the web interface.

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