



VisionLabs
MACHINES CAN SEE

VisionLabs FaceStream

Administrator Manual

v.5.1.18

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Glossary

| Term | Meaning |
|------------------------|---|
| Aspect angle | Head rotation degree (in degrees) on each of the three axes (up/down tilt relative to the horizontal axis; left/right tilt, relative to the vertical axis; a rotation about the vertical axis). |
| Bestshot | The frame of the video stream on which the face/body is fixed in the optimal angle for further processing. |
| Detection | FaceStream entity that contains the coordinates of face or body and the estimated value of the object that determines the bestshot. |
| Descriptor | A set of unique features received from the warp. A descriptor requires much less storage memory in comparison with the sample and is used for comparison of faces. |
| Event | LUNA PLATFORM entity, which contains information (city, user data, track id, etc.) about one face and/or body. This information is transferred to the LUNA PLATFORM by the FaceStream application. For a complete list of the transferred information, see the OpenAPI LUNA PLATFORM documentation. |
| LUNA Streams | Service for creating and managing streams that contain policies for processing a video stream/video file/set of images. |
| Normalized image, warp | Images containing a face or body and corresponding to VisionLabs standard. Used when working with LUNA PLATFORM. |
| Portrait | Image of face or body that has been transformed to a specific format. The portrait has two types - “warp” (the image is transformed into warp format), “gost” (detection is cut out from the source frame, considering indentation). |
| Track | Information about object’s position (face of a person) in a sequence of frames. If the object leaves the frame zone, the track doesn’t discontinue right away. For some time, the system expects the object to return and if it does, the track continues. |
| Tracking | Object (face) tracking function in the frame sequence. |

| Abbreviation Term | |
|-----------------------------|---------------|
| DB | Database |
| LP | LUNA PLATFORM |

System requirements

FaceStream is delivered in Docker containers and can be launched on CPU and GPU. Docker images of the containers are required for the installation. Internet connection is required on the server for Docker images download, or the images should be downloaded on any other device and moved to the server. It is required to manually specify login and password for Docker images downloading.

FaceStream can be launched with a Docker Compose script.

The following Docker and Docker Compose versions are recommended for FaceStream launching:

- Docker: 20.10.8 (to manually launch containers)
- Docker Compose: 1.29.2 (to automatically launch containers)

FaceStream and LUNA Streams containers launch were tested on the following operating systems:

- CentOS Linux release 7.8.2003 (Core)

The following OS is used inside the FaceStream container:

- CentOS Linux release 8.3.2011

LP services and third-party applications

FaceStream requires LUNA PLATFORM components, additional databases, and the LUNA Streams service. Basic information about this software is contained in this document.

LUNA Streams is not a component of the LUNA PLATFORM.

The following LUNA PLATFORM components are used by default with FaceStream:

- **LUNA Licenses** is used to license the LUNA Streams service.
- **LUNA Configurator** is used for quick access to the basic FaceStream settings and LUNA PLATFORM service settings.
- **PostgreSQL** is used as the default database for the LUNA Streams service. It is also possible to use an Oracle database instead of PostgreSQL.
- **InfluxDB** is used for monitoring. If necessary, monitoring can be disabled.

The following database versions are recommended for use with LUNA Streams:

- **PostgreSQL**: 12
- **Oracle**: 11.2

To upload settings to the LUNA Configurator service, **Python version 2.x or 3.x** is required.

Installation and configuration of Oracle is not described in this manual. Further in the document, examples of launching using PostgreSQL will be given.

Balancers (for example, Nginx) and other software can be used when scaling the system to provide fail-safety. Their configuration is not described in this document.

Processors

Below are the requirements to launch FaceStream in a minimal configuration. System requirements for the production system are calculated based on the intended system load.

CPU

The following minimum requirements are given per FaceStream instance.

For the application to work correctly, the hardware must meet the following minimum requirements:

- 2 GHz or faster processor;
- 4 Gb RAM or higher;
- 10 Gb available hard disk space.
- Access to the Internet (for containers and additional software download).

Hardware requirements can be affected by several factors:

- Number of video streams;
- Frame frequency and resolution of video streams;
- FaceStream settings. The default settings are the most versatile. Depending on the operating conditions of the application, using their values can affect the quality, or performance.

Hardware should be selected based on the above factors.

FaceStream can also work in the computation speedup mode due to usage of video card resources or AVX2 instructions. CPU with AVX2 support is required. The system automatically detects available instructions and runs best performance.

GPU

GPU calculations are supported for FaceDetV3 only. See “defaultDetectorType” parameter in the FaceEngine configuration (“faceengine.conf”).

A minimum of 6GB or dedicated video RAM is required. 8 GB or more VRAM recommended.

Pascal, Volta, Turing architectures are supported.

Compute Capability 6.1 or higher and CUDA 11.4 are required.

The recommended NVIDIA driver is 470.103.01.

Now only one video card is supported per FaceStream instance.

1 Introduction

This document describes:

- system and software requirements
- general description of the application and recommendations for setting up
- the process of interacting with LUNA Streams
- list of basic settings required to launch FaceStream
- detailed description of FaceStream settings
- using FaceStream with LUNA Configurator
- using FaceStream with configuration files
- API errors for FaceStream and LUNA Streams
- information about compatibility with camera models

For more information on launching the application, see the FaceStream installation manual.

2 Overview

FaceStream conducts several functions:

- **Stream reading**

Web-cameras, USB and IP-cameras (via RTSP protocol), video files and images can act as data sources.

- **Stream processing**

It searches for faces and bodies in the stream and tracks them until they leave the frame or are blocked.

- **Sending face images as HTTP-requests onto external service**

VisionLabs Software LUNA PLATFORM 5 acts as an external service.

FaceStream workflow depends on the setting of four configurations.

- [Streams management configuration](#) set in LUNA Streams

Here you can set the settings regarding stream sources such as source type, source address, filtering settings, etc. The settings are set by sending requests with a body in JSON format to the LUNA Streams service. FaceStream takes the settings from LUNA Streams for further processing. A detailed description of how FaceStream works with LUNA Streams is given in the [“Interaction of FaceStream with LUNA Streams”](#) section.

- [FaceStream settings](#) set in LUNA Configurator

Here you can set general FaceStream settings, such as logging, setting up sending images from FaceStream to external services, debugging, etc.

- [TrackEngine settings](#) set in LUNA Configurator

Here you can set general TrackEngine settings regarding the face or body detection and tracking.

- [LUNA Streams settings](#) set in LUNA Configurator

Here you can set general settings for the LUNA Streams service, such as logging, database settings, address of the LUNA Licenses service, etc.

- FaceEngine settings set in “faceengine.conf” configuration file and transferred during the launch of the FaceStream container.

Here you can set the settings for face recognition. It is recommended to change the parameters in this configuration only in consultation with VisionLabs employees.

The following features are also available when working with FaceStream:

- Dynamic creation, editing, and deletion of stream sources via API requests
- Real time video streams preview in a browser for the streams with specified parameters

- Stream metrics (number of streams, number of errors, number of faces, number of skipped frames, FPS)

FaceStream can be configured to work with either faces or bodies. Simultaneous processing of faces and bodies is not possible.

2.1 FaceStream workflow with faces and bodies

FaceStream can handle both faces and bodies. Each object has its own scheme of operation and its own set of parameters described below.

The required minimum parameters for working with both objects can be found in the section “[Priority parameters list](#)”.

2.1.1 FaceStream workflow with faces

FaceStream application workflow with faces is shown in the image below:

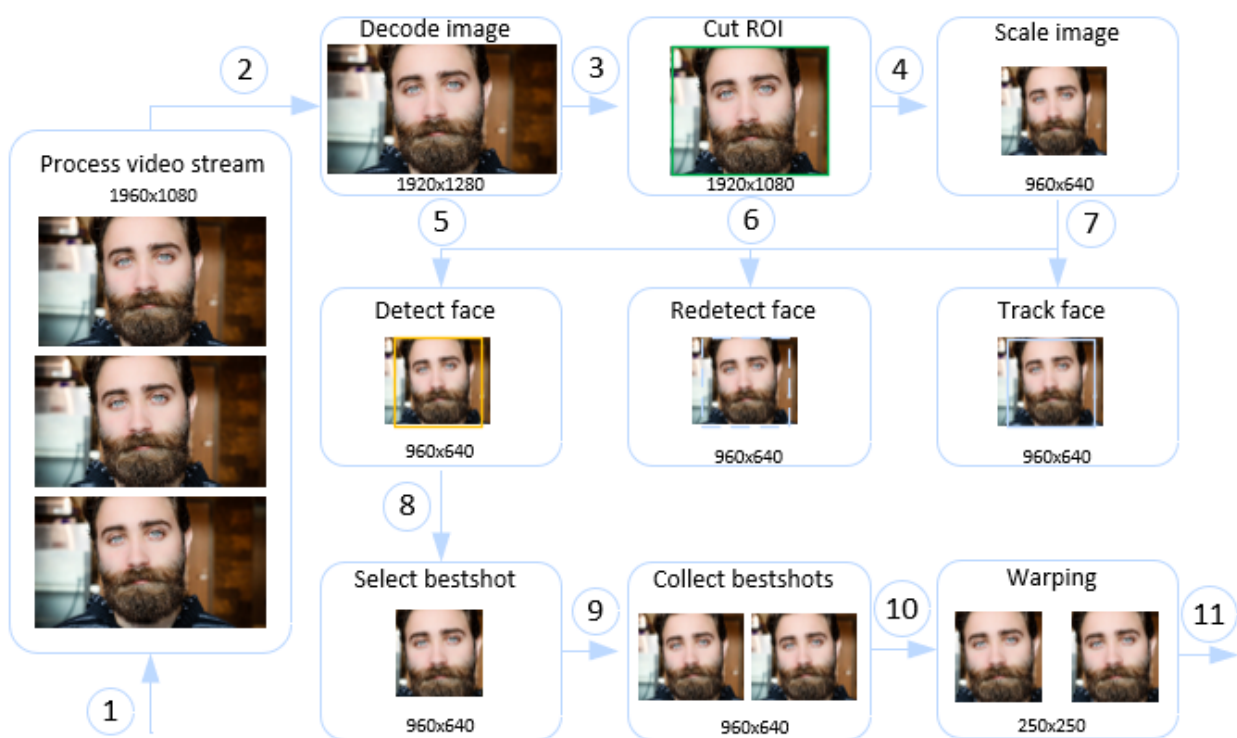


Figure 1: FaceStream workflow with faces

1. FaceStream receives video from a source (IP or USB camera, web-camera, video file) or images. FaceStream can work with several sources of video streams (the number is set by the license). Sources are set by sending requests with the necessary parameters to the [LUNA Streams](#) service;
2. FaceStream decodes video frames;
3. The ROI area is cut out from the frame if the “[roi](#)” (streams management configuration) parameter is specified;
4. The received image is scaled to the “[scale-result-size](#)” (TrackEngine configuration) size if the “[detector-scaling](#)” (TrackEngine configuration) is set;

5. Faces are detected in the frame;
6. The face is redetected in the frame instead of detection if the “[detector-step](#)” parameter (TrackEngine configuration) is set;
7. A track is created for each new face in the stream; then it is reinforced with new detections of this face from the subsequent frames. The track is interrupted if the face disappears from the frame. You can set the “[skip-frames](#)” parameter (TrackEngine configuration) so the track will not be interrupted immediately, and the system will wait for the face to appear in the area for several frames;
8. FaceStream filters the frames of low quality and selects bestshots. There are several algorithms for choosing the best detection(s) in the track. See the “[Filtering section](#)” (streams management configuration);
9. If the frame is bestshot, it is added to the collection of bestshots. Depending on the “[number_of_bestshots_to_send](#)” (streams management configuration) setting one or several best detections are collected from each track;
10. **Optional.** If the “warp” type is set in the “[portrait_type](#)” (streams management configuration) parameter, the bestshots are normalized to the LUNA PLATFORM standard, and normalized images are created. Normalized image is better for processing using LUNA PLATFORM;
11. The bestshots are sent to an external service via HTTP-request. The image may be sent as it is or transformed into the normalized image.

The frequency of images sending is specified in the “[sending](#)” (streams management configuration) section.

The sending parameters and external service address are specified in sections “[data](#)” (streams management configuration) and “[sending](#)” (FaceStream configuration).

2.1.2 FaceStream workflow with bodies

FaceStream application workflow with bodies is shown in the image below:

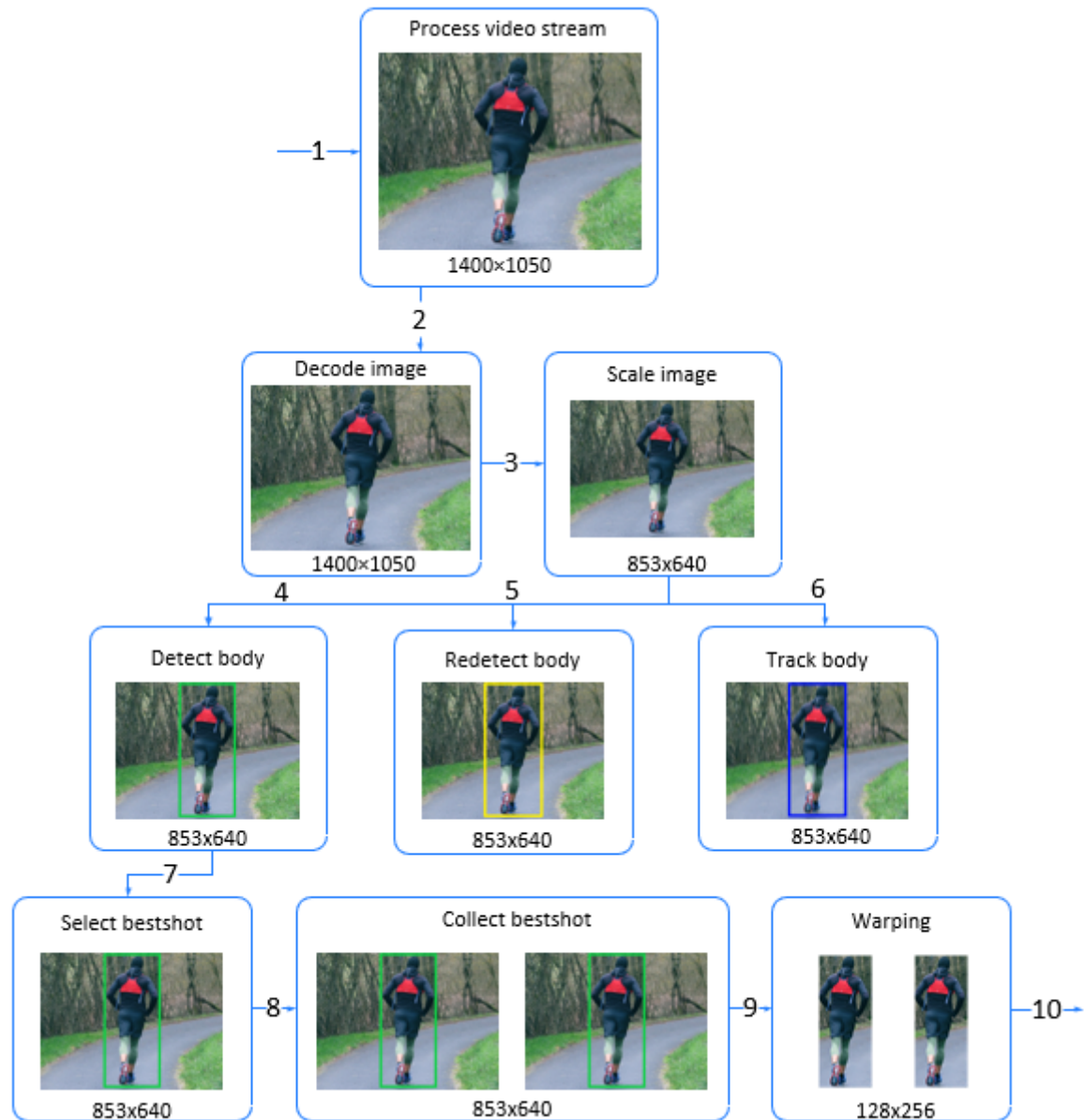


Figure 2: FaceStream workflow with bodies

1. FaceStream receives video from a source (IP or USB camera, web-camera, video file) or images. FaceStream can work with several sources of video streams (the number is set by the license). Sources are set by sending requests with the necessary parameters to the [LUNA Streams](#) service;
2. FaceStream decodes video frames;
3. The received image is scaled to the “[scale-result-size](#)” (TrackEngine configuration) size if the

“detector-scaling” (TrackEngine configuration) is set;

4. Bodies are detected in the frame;
5. The body is redetected in the frame instead of detection if the “detector-step” parameter (TrackEngine configuration) is set;
6. A track is created for each new body in the stream; then it is reinforced with new detections of this body from the subsequent frames. The track is interrupted if the body disappears from the frame. You can set the “skip-frames” parameter (TrackEngine configuration) so the track will not be interrupted immediately, and the system will wait for the body to appear in the area for several frames;
7. FaceStream filters low quality frames and selects the bestshots. See “Min-score” (streams management configuration);
8. If the frame is bestshot, it is added to the collection of bestshots. Depending on the “number_of_bestshots_to_send” (streams management configuration) parameter one or several best detections are collected from each track;
9. The bestshots are normalized to the LUNA PLATFORM standard, and normalized images are created. Normalized image is better for processing using LUNA PLATFORM;
10. The bestshots are sent to an external service via HTTP-request. Events can be generated in an external service according to the specified handler (see the description of the event in the LUNA PLATFORM administrator manual). The bestshots are transformed into warps. Along with the bestshots, the coordinates of the human body can be sent if their number is set in the “minimal_body_track_length_to_send” parameter (streams management configuration).

The frequency of images sending is specified in the “sending” (streams management configuration) section.

The sending parameters and external service address are specified in sections “data” (streams management configuration) and “sending” (FaceStream configuration).

2.2 Interaction of FaceStream with LUNA Streams

To work with FaceStream, you should first launch an additional service - LUNA Streams (the default port is 5160). In the request body to the LUNA Streams service, [settings for stream management](#) are specified. After sending the request, a stream is created, whose settings are taken by FaceStream for further processing. See the [LUNA Streams Open API Specification](#) for request examples.

LUNA Streams has its own user interface designed to work with streams. For more information, see “[LUNA Streams user interface](#)”.

To use the LUNA Streams service, you should use the LUNA PLATFORM 5 services - LUNA Licenses and LUNA Configurator, as well as PostgreSQL or Oracle and Influx.

The Influx database is needed for the purposes of [monitoring](#) the status of LUNA PLATFORM services. If necessary, monitoring can be disabled.

The FaceStream documentation does not describe the use of an Oracle database.

If necessary, you can launch LUNA Streams without LUNA Configurator. This method is not described in the documentation.

FaceStream is licensed using the LUNA PLATFORM 5 key, which contains information about the maximum number of streams that LUNA Streams can process. The license is regulated by the LUNA Licenses service.

See the FaceStream installation manual for detailed information on activating the LUNA Streams license.

The PostgreSQL/Oracle database stores all the data of LUNA Streams.

The general process of interaction between FaceStream and LUNA Streams is presented below:

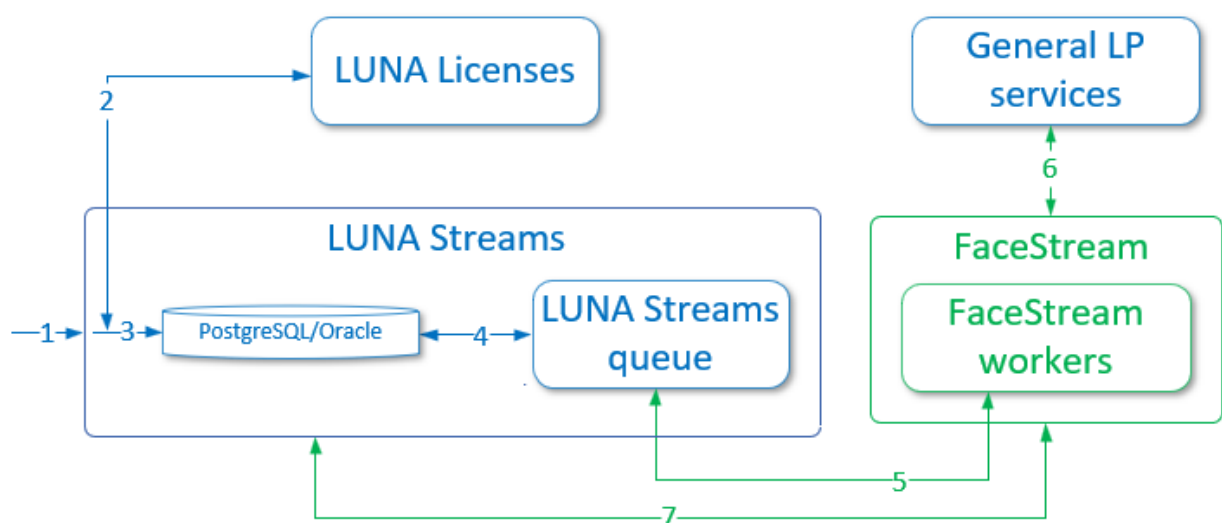


Figure 3: Interaction between FaceStream and LUNA Streams

After sending an HTTP request with the specified parameters to the LUNA Streams **(1)** service, the presence of a parameter regulating the number of streams for LUNA Streams operation is checked at the LUNA PLATFORM key using the LUNA Licenses **(2)** service. The number of streams already being processed at the time of the request is also checked using the FaceStream report **(7)** (see below).

If the key parameter is missing, a license error will be issued.

If at the time of stream creation the maximum number of available streams is not processed yet, the parameters are added to the LUNA Streams database **(3)** under the unique identifier `stream_id`. The stream with the parameters gets into the queue **(4)**, where it is in the [status](#) “pending” until a special FaceStream worker picks up the stream from the queue for subsequent processing.

You can view the streams in the queue by filtering them in a certain way using the [“streams/processing/queue”](#) GET request.

If the maximum amount is already being processed at the time of stream creation, LUNA Streams will not be able to add parameters to the database and a license error will be issued.

If FaceStream is disabled at the time of stream creation, then only the number of streams with the “pending” status that is stipulated by the license can be created. After the FaceStream is launched, the streams created in the queue order will be accepted for processing.

Streams can be created with the status “pause”. In this case, they will be added to the database and will wait for a manual status update to “pending”.

The queue is implemented in the LUNA Streams service itself and is not external.

Next, FaceStream workers take the parameters of the stream(s) from the queue **(5)** with the status “pending” and begin processing. In this case, the status of the processed streams is changed to “in_progress” and the stream is removed from the queue.

During processing, data is regularly sent to the main services of LUNA PLATFORM 5 for further processing of frames according to the specified [handler_id](#) and for creating events **(6)**, and a report on processing streams in LUNA Streams **(7)** is regularly sent.

The time of sending reports is fixed and cannot be changed.

If the report says that some stream has been processed, then the FaceStream handler takes the following parameters of the stream with the status “pending” from the LUNA Streams queue **(5)**, and the service changes the status of the stream from “pending” to “in_progress”, removing it from the queue. If, for unknown reasons, the report was not transferred, then the streams are re-queued.

Along with the report, additional information about the stream is transmitted, such as sizes and frame rate, bitrate, group of frames (gop), creation time, stream processing start time, last processing error, etc. Preview information is also returned - the URLs of preview and the last frame.

For more detailed description of LUNA Streams stream processing, see [“Stream processing pipeline”](#).

[Settings for stream management](#) are set using a POST request to the [“/streams”](#) resource.

In addition, the following actions are available for a stream:

- get existing streams by their “stream_id” with a description of the data of each stream ([“get streams”](#) request)
- get all information about a stream by its “stream_id” ([“get stream”](#) request)
- delete existing streams by their “stream_id” ([“delete streams”](#) request)
- delete stream by its “stream_id” ([“remove stream”](#) request)
- get the number of streams created ([“count streams”](#) request)
- update the “description” and “status” fields of a stream by its “stream_id” ([“update stream”](#) request)
- replace of all stream data with new ones by its “stream_id” ([“put stream”](#) request)
- get link to the last frame ([“get last frame preview”](#) request)
- get link to live stream ([“get live preview”](#) request)
- get streams logs ([“get streams logs”](#) request)
- delete streams logs ([“delete streams logs”](#) request)

A detailed description of requests and example requests can be found in the [Open API specification of LUNA Streams service](#).

2.2.1 Stream distribution in LUNA Streams

As mentioned earlier, the ability to process multiple streams at the same time is available.

For each stream, its current status is assumed:

- pending - stream is waiting for FaceStream worker
- in_progress - stream processing is in progress
- done - stream processing is completed (relevant for stream transmission types [“videofile”](#)/[“images”](#) or [[“tcp/udp”](#)] with [“endless”](#) set to [“false”](#))
- pause - stream processing is paused by user (not applicable for stream transmission types [“videofile”](#) or [“images”](#))
- restart - stream processing is restarted by server
- cancel - stream processing is cancelled by user
- failure - stream processing is failed by FaceStream worker
- handler_lost - stream processing worker is lost, needs to be passed to another worker (not applicable for stream transmission types [“videofile”](#) or [“images”](#))
- not_found - stream was removed during the processing
- deleted - stream was removed intentionally

Statuses “pause” and “cancel” can be specified when updating a stream using the [“update stream”](#) request.

Statuses “restart”, “handler_lost” are transient. With these statuses, it is impossible to receive a stream, however, the transition through these statuses is logged as usual. The “restart” status can only occur when using the “autorestart” section (see the [“Streams automatic restart”](#) section below).

The “not_found” status is internal and will be sent back for feedback if the stream was removed during processing. With this status, it is impossible to receive a stream.

The “deleted” status is virtual. Stream with this status cannot exist, but this status can be seen in the stream logs.

2.2.1.1 Statuses transition table

The following table shows statuses that may be received after each listed status.

The “+” symbol means that the status listed in the first row may occur after the status in the first column. An empty field means that there are no cases when the status may occur.

The “-” symbol means that there is no stream in the system (it was not created or it was already deleted).

| | in_- | | | | | | | | handler_- |
|-------------------|---------|----------|------|---------|-------|--------|---------|------|-----------|
| - | pending | progress | done | restart | pause | cancel | failure | lost | |
| - | + | | | | + | | | | |
| pending | + | | + | | + | + | | | |
| in_- progress | + | + | | + | + | + | + | + | |
| done | + | + | | + | + | | | | |
| restart | | + | | | + | | | | |
| pause | + | + | | + | | + | | | |
| cancel | + | + | | + | + | | | | |
| failure | + | + | | + | + | | | | |
| handler_- lost | | | | + | | | | | |

* not supported for stream transmission types [“videofile”](#) or [“images”](#)

2.2.2 Stream processing pipeline

By default, the new stream is created with the “pending” status and immediately enters the processing queue. Stream processing can be postponed by specifying the pause status when creating.

As soon as a free stream worker appears with a request for a pool from the queue, the stream is accepted for processing and it is assigned the “in_progress” status.

After the stream has been processed by the worker, it is assigned to the status “done” in case of success (relevant for stream transmission types “[videofile](#)”/“[images](#)” or [“tcp/udp”] with “[endless](#)” set to “false”), or “failure” if any errors have occurred. However, stream processing status may be downgraded from “in_progress” for the following reasons:

- no feedback from stream worker: process will be downgraded by server and record with “handler_lost” status will be added to the stream logs
- replacing the stream by user: record with “restart” status will be added to the stream logs

For stream transmission types “[tcp](#)” or “[udp](#)” with “[endless](#)” set to “true”, the status cannot change to “done”.

During the processing routine, any change in the stream status is logged. Thus, you can restore the stream processing pipeline from the logs.

Streams with “failure” status can be automatically restarted.

2.2.2.1 Streams automatic restart

The ability to automatically restart streams is relevant only for streams with a “failure” status. Automatic restart options (restart possibility, maximum number of restart attempts, delay between attempts) are specified by the user for each stream in the “[autorestart](#)” section of stream management settings. The parameters and automatic restart status can be received using the “[get stream](#)” request.

The automatic restart statuses are listed below:

- “disabled” - stream automatic restart is disabled by user (“restart” parameter is disabled)
- “enabled” -automatic restart is enabled but is not currently active because the stream is not in the “failure” status
- “in_progress” - automatic restart in progress
- “failed” - the allowed number of automatic restart attempts was exceeded and none of the attempts were successful
- “denied” - automatic restart is allowed by the user, but not possible due to a fatal error* received in the FaceStream report.

* fatal error is considered a `Failed to authorize in Luna Platform` error.

The process of performing automatic restart of streams:

- its status will be automatically changed to “restart” and then, to “pending”
- “current_attempt” parameter will be increased by 1
- “last_attempt_time” parameter will be actualized

The possibility of autorestart, the maximum number of restart attempts, the delay between attempts are specified by the user for each stream at “autorestart” section.

Stream will be considered successfully restarted if after the specified time period (delay) it has a status other than “failure”.

The number of simultaneous processing streams (statuses “pending” and “in_progress”) is regulated by the license, but the LUNA Streams database can store an infinite number of streams with a different status, for example, “pause”.

2.2.3 Streams grouping

Streams can be grouped. Grouping is intended to combine streams with multiple cameras into logical groups. For example, you can group streams by territorial characteristic.

A stream can be linked to several groups.

The group is created using the “create group” request. To create a group, you need to specify the required parameters “account_id” and “group_name”. If necessary, you can specify a description of the group.

Stream can be linked to a group in two ways:

- using the “group_name” or “group_id” parameters during stream creation (“create stream” request).
- using the “linker” request. In the request, you should specify the streams IDs and the group to which they need to be linked.

Using the “linker” request you can also unlink streams from a group.

If the stream was linked to a group, then the “get stream” or “get streams” requests will show the group in the “groups” field.

2.2.4 LUNA Streams database description

The LUNA Streams database general scheme is shown below.

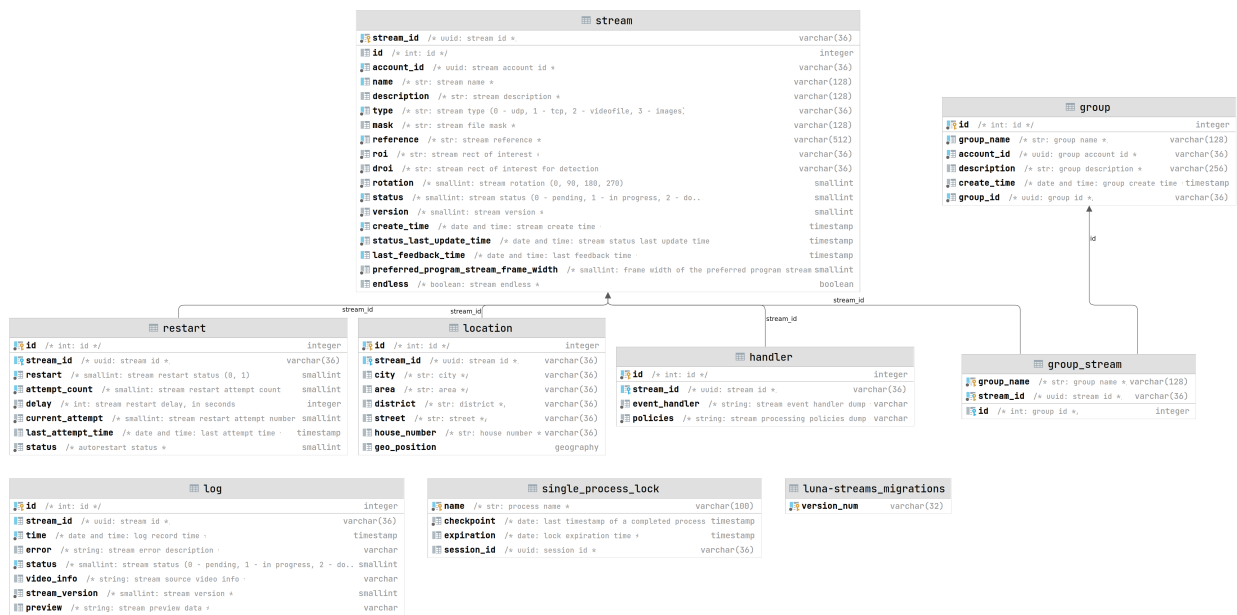


Figure 4: LUNA Streams database

See “Streams management configuration” for a description of the database data.

2.3 Recommendations for FaceStream configuration

This section provides general guidelines for setting up FaceStream.

The names of the configuration, which describes the configured parameters, are mentioned in this section.

2.3.1 Before starting configuration

You should perform the FaceStream configuration for each camera used separately. FaceStream should work with the stream of the camera, located in the standard operating conditions. The following reasons lead to these requirements:

- Frames with different cameras may differ by:
 - noise level,
 - frame size,
 - light,
 - blurring,
 - etc.;
- FaceStream settings depend on the lighting conditions, therefore, will be different for the cameras placed in a dark room and a light;
- FaceStream performance depends on the number of faces or bodies in the frame. Therefore, the settings for the camera, which detects one face every 10 seconds, will be different from the settings for the camera detecting 10 faces per second;
- The number of detected faces and bodies and the quality of these detections depend on correct location of the camera. When the camera is at a wrong angle, faces are not detected in frames. Moreover, head angles can also exceed the acceptable degree hence the frame with the detected face could not be used for further processing.
- Faces and bodies in the zone of camera view can be partially or completely blocked by some objects. There can be background objects that can prevent the proper functioning of recognition algorithms.

The camera can be positioned so that the lighting or shooting conditions change throughout the day. It is recommended to test FaceStream work under different conditions and choose the best mode, providing reliable FaceStream operation under any conditions.

You can specify the FPS for video processing using the “[real_time_mode_fps](#)” parameter.

The video cameras tested with FaceStream are listed in section “[Appendix A: Cameras Compatibility](#)”.

2.3.2 FaceStream performance configuration

The mentioned above parameters have the greatest impact on the FaceStream performance.

2.3.2.1 Reduction of face search area

Not all the areas of the frame contain faces. Besides, not all the faces in the frame have the required size and quality. For example, the sizes of faces in the background may be too small, and the faces near the edge of the frame may have unacceptable pitch, roll, or yaw angles.

The “roi” parameter (streams management configuration, section “data”), enables you to specify a rectangular area to search for faces.



Figure 5: Source frame with DROI area specified

The specified rectangular area is cut out from the frame and FaceStream performs further processing using this image.



Figure 6: Cropped image processed by FaceStream

The smaller the search area, the less resources are required for processing each frame.

Correct exploitation of the “roi” parameter significantly improves the performance of FaceStream.

The parameter should be used only when working with faces.

2.3.2.2 Frame scaling

Frame scaling before processing can significantly increase the performance of FaceStream. Frame scaling is enabled using the “[detector-scaling](#)” parameter.

Frame size suitable for work should be selected using the “[scale-result-size](#)” parameter. sets the maximum frame size after scaling the largest side of the frame. If the source frame had a size of 1920x1080 and the value of “scale-result-size” is equal to 640, then FaceStream will process the frame of 640x360 size. You should gradually scale the frame and check whether face or body detection occurs on the frame, to select the optimal “scale-result-size” value. You should set the minimum image size at which all objects in the area of interest are detected.

See an example of using the “scale-result-size” parameter in the appropriate section.

2.3.3 Defining area with movement

Three parameters are responsible for determining the area with movement, set in the [TrackEngine configuration](#):

- [frg-subtractor](#) - enable the mode of considering for movements in the frame;
- [frg-regions-alignment](#) - set alignment for areas with motion;
- [frg-regions-square-alignment](#) - set equal width and height of the area with movement.

Below are the recommended values for these settings when using CPU and GPU:

| | frg-subtractor | frg-regions-alignment | frg-regions-square-alignment |
|--------------------------------------|----------------|-----------------------|------------------------------|
| Recommended value when utilizing CPU | 1 | 0 | 0 |
| Recommended value when utilizing GPU | 1 | 360 | 0 |

2.3.4 Batch processing of frames

Three parameters are responsible for batch processing of frames, set in [TrackEngine configuration](#):

- [batched-processing](#) - enable batch processing of frames;
- [min-frames-batch-size](#) - minimal number of frames collected from all the cameras before processing;
- [max-frames-batch-gather-timeout](#) - time between processing of the batches.

2.3.4.1 Minimal face size

You should configure the “minFaceSize” parameter in the FaceEngine configuration file to specify the minimal face size for detection.

You should set the maximum possible face size. The larger the face, the fewer resources are required to perform detections.

Note that the face size will depend on the actual frame size set by the “[scale-result-size](#)” parameter (TrackEngine configuration). A face with a size equal to 100 pixels on a 1280x760 frame will have a size equal to 50 pixels on a 640x480 frame.

2.3.5 General configuration information

2.3.5.1 Working with track

A new track is created for each detected face or body. Bestshots are defined and sent for each track.

In general, the track is interrupted when the face can no longer be found in the frame. If a track was interrupted and the same person appears in the frame, a new track is created.

There can be a situation when two faces or bodies interact in a frame (one person behind the other). In this case, the tracks for both persons are interrupted, and new tracks are created.

There can be a situation when a person turns away, or a face or body is temporarily blocked. In this case, you can specify the “[skip-frames](#)” parameter (TrackEngine configuration) instead of interrupting the track immediately. The parameter sets the number of frames during which the system will wait for the face to reappear in the area where it disappeared.

When working with the track, it is also useful to use the “[detector-step](#)” parameter, which enables you to specify the number of frames on which face redetection will be performed in the specified area before face detection is performed.

2.3.5.2 Bestshot sending

The “[sending](#)” parameters group (streams management configuration) enables you to set parameters for the bestshot sending. FaceStream sends the received bestshots to LUNA PLATFORM (see “[Priority parameters list](#)”).

You can send several bestshots for the same face or body to increase the recognition accuracy. You should enable the “[number_of_bestshots_to_send](#)” (streams management configuration) parameters in this case.

LUNA PLATFORM enables you to aggregate the bestshots and create a single descriptor of a better quality using them.

If the required number of bestshots was not collected during the specified period or when the track was interrupted the collected bestshots are sent.

The “[time_period_of_searching](#)” and “[silent_period](#)” parameters (streams management configuration) can be specified in seconds or in frames. Use the “[type](#)” parameter to choose the type.

The general options for configuring the “[time_period_of_searching](#)” and “[silent_period](#)” parameters of the “[sending](#)” group from streams management configuration are listed below.

- The bestshot is sent after the track is interrupted and the person left the video camera zone of view. All the frames with the person’s face or body are processed and the bestshot is selected.

```
time_period_of_searching = -1
silent_period = 0
```

- It is required to quickly receive the bestshot and then send bestshots with the specified frequency.
For example, it is required to send a bestshot soon after an intruder entered the shop. The intruder will be identified by the blacklist.

The mode is also used for the demonstration of FaceStream capabilities in real-time.

The bestshot will be sent after the track is interrupted even if the specified period did not exceed.

```
time_period_of_searching = 3
silent_period = 0
```

- It is required to quickly send the bestshot and then send the bestshot only if the person is in the frame for a long time.

```
time_period_of_searching = 3
silent_period = 20
```

- It is required to quickly send the bestshot and never send the bestshot from this track again.

```
time_period_of_searching = 3
silent_period = -1
```

2.3.5.3 Frames filtration

The filtration of face frames is performed by three main criteria (they are all set in the streams management configuration):

- Head angles (“[detection_yaw_threshold](#)”, “[detection_pitch_threshold](#)”, “[detection_roll_threshold](#)”).

The “[yaw_number](#)” and “[yaw_collection_mode](#)” parameters are additionally set for the yaw angle. The parameters reduce the possibility of the error occurrence when the “0” angle is returned instead of a large angle.

- Frame quality for further processing (“[min_score](#)”);
- Mouth occlusion (“[mouth_occlusion_threshold](#)”).

If a frame did not pass at least one of the specified filters, it cannot be selected as a bestshot.

If the “[number_of_bestshots_to_send](#)” parameter is set, the frame is added to the array of bestshots to send. If the required number of bestshots to send was already collected, the one with the lowest frame quality score is replaced with the new bestshot if its quality is higher.

The filtration of body frames is performed only by one criterion - “[min_score](#)”.

2.3.5.4 Working with ACMS

Work with ACS is performed only with faces.

Use the “[primary_track_policy](#)” settings when working with ACMS. The settings enables you to activate the mode for working with a single face, which has the largest size. It is considered, that the face of interest is close to the camera.

The track of the largest face in the frame becomes primary. Other faces in the frame are detected but they are not processed. Bestshots are not sent for these faces.

As soon as another face reaches a larger size than the face from the primary track, this face track becomes primary and the processing is performed for it.

The mode is enabled using the “[use_primary_track_policy](#)” parameter.

The definition of the bestshots is performed only after the size (vertical) of the face reaches the value specified in the “[best_shot_min_size](#)” parameter. Frames with smaller faces can’t be the bestshots. When the face detection vertical size reached the value set in the “[best_shot_proper_size](#)” parameter the bestshot is sent as a bestshot at once.

The “[best_shot_min_size](#)” and “[best_shot_proper_size](#)” are set depending on the video camera used and its location.

The examples below show configuration of the “[sending](#)” group parameters from streams management configuration for working with ACMS.

- The turnstile will only open once. To re-open the turnstile you should interrupt the track (move away from the video camera zone of view).

```
time_period_of_searching = -1
silent_period = 0
```

- The turnstile will open at certain intervals (in this case, every three seconds) if a person stands directly in front of it.

```
time_period_of_searching = 3
silent_period = 0
```

If the “[use_primary_track_policy](#)” parameter is enabled, the bestshot is never sent when the track is interrupted.

2.4 Formats, video compression standards, and protocols

FaceStream utilizes the FFMPEG library to convert videos and get a stream using various protocols. All the main formats, video compression standards, and protocols that were tested when working with FaceStream are listed in this section.

FFMPEG supports more formats and video compression standards. They are not listed in this section, because they are rarely used when working with FaceStream.

2.4.1 Video formats

Video formats that are processed using FaceStream:

- AVI,
- MP4,
- MOV,
- MKV,
- FLV.

2.4.2 Encodings

Basic video compression standards that FaceStream works with:

- MPEG4,
- MS MPEG4,
- MS MPEG4v2,
- MJPEG,
- H.264,
- H.265.

2.4.3 Protocols

Basic protocols used by FaceStream for data receiving:

- HTTP,
- RTP,
- RTSP,
- RTMP,
- TCP,
- HLS,
- UDP.

2.5 Memory consumption when running FaceStream

This section lists the reasons for increasing RAM consumption when running FaceStream.

- Each stream increases memory consumption. The amount of the consumed memory depends on the settings set for FaceStream:
 - the number of Ffmpeg threads in the “[ffmpeg_threads_number](#)” parameter (streams management configuration),
 - image cache size in the “[stream_images_buffer_max_size](#)” parameter (FaceStream configuration),
 - set buffer sizes in the “frames-buffer-size” parameter (TrackEngine configuration).
- If the number of threads specified in the “[ffmpeg_threads_number](#)” parameter is greater than “1” (streams management configuration), the memory consumption increases significantly. At the same time, the increase in consumption is extremely slow and can be noticed after several hours of operation only.

For RTSP streams, you can set the “[ffmpeg_threads_number](#)” parameter to “0” or “1” (streams management configuration). In this case, memory growth is not noticed.

- Memory consumption increases after FaceStream starts. Growth occurs within 1-2 hours. This is related to caches filling (see point 1). If no new streams are created and step 2 is not executed, the memory consumption stops growing.
- Memory consumption increases when settings in the Debug section are enabled (FaceStream and TrackEngine configurations).

2.6 Stream playback interface

FaceStream has the ability to view the stream in real time. To view the stream, you should enter the following address in the browser bar after the FaceStream starts processing the stream:

```
http://127.0.0.1:34569/api/1/streams/preview/<stream_id>.
```

When objects appear in the camera's field of view, FaceStream displays them in a certain way.

Yellow bounding box occurs if a detection fails at least one of the “[detection_yaw_threshold](#)”, “[detection_pitch_threshold](#)” or “[detection_roll_threshold](#)” parameters.

Red color bounding box occurs if the detection acceptance score is lower than the value specified in the “[min_score](#)” parameter.

Blue color bounding box occurs when an object is detected (redetected) or tracked.

Green bounding box occurs in all other cases when all conditions are met.

3 Priority parameters list

To send photo images to the LUNA PLATFORM, first of all, you need to configure FaceStream to work with faces or bodies (see parameters for switching detection mode below), as well as configure the basic parameters necessary for the correct operation of the application. All parameters are separated as follows:

- FaceStream parameters are set in the in the “FACE_STREAM_CONFIG” section in the Configurator or in the “fs3config.conf” configuration file.
- Streams management parameters are set in a request with a body in JSON format to the “/streams” resource.
- TrackEngine parameters are set in the in the “TRACK_ENGINE_CONFIG” section in the Configurator or in the “trackengine.conf” configuration file.

See the detailed description of the parameters listed below in the relevant sections.

The following common parameters are available for sending both faces and bodies:

Table 5: FaceStream parameters

| Parameter | Description |
|---|---|
| sending > async_requests | Enables you to switch between asynchronous and synchronous request sending modes in LUNA PLATFORM |
| sending > send_source_frame | Enables sending the source frame to LUNA PLATFORM |
| sending > jpeg_quality_level | Enables you to set the compression ratio of the source frame |

Table 6: Streams management parameters

| Parameter | Description |
|--|--|
| event_handler > frame_store | Enables you to set the URL of the Image Store service to send the source frame |

3.1 Parameters for sending faces

The parameters for sending face images to LUNA PLATFORM 5 are listed below.

Table 7: TrackEngine parameters

| Parameter | Description |
|-----------------------------------|----------------------------|
| use-face-detector | Enables face detection - 1 |
| use-body-detector | Enables body detection - 0 |

Table 8: FaceStream parameters

| Parameter | Description |
|--|--|
| lunastreams > api_version | The version of the API of the LUNA Streams service - 1 |
| lunastreams > origin | Full network path to LUNA Streams service |
| sending > request_type | Request type for sending images to LP - jpeg |
| sending > portrait_type | Image transfer format - warp |
| sending > aggregate_attr_requests | Enables aggregation of the bestshots to get a single descriptor in LUNA PLATFORM - true or false |

Table 9: Streams management parameters

| Parameter | Description |
|--|---|
| data > type | Type of signal source (tcp, udp, videofile, images) - string |
| account_id | "Luna_account_id", to which the request is related - string in UUID format |
| event_handler > origin | full network path to LP 5 - "http://luna_api_address:5000/". The example specifies the port "5000" for the API service, which is used by default |
| event_handler > api_version | The version of the API of the LP API service - 6 |

| Parameter | Description |
|---|--|
| event_handler > bestshot_handler > handler_id | LP handler that enables you to flexibly configure the faces processing - string in UUID format |

For detailed information about the handlers, see the documentation [APIReferenceManual.html](#) included in the LUNA PLATFORM 5 distribution package.

3.2 Parameters for sending bodies

The parameters for sending body images to LUNA PLATFORM 5 are listed below.

Table 10: TrackEngine parameters

| Parameter | Description |
|-----------------------------------|----------------------------|
| use-face-detector | Enables face detection - 0 |
| use-body-detector | Enables body detection - 1 |

Table 11: FaceStream parameters

| Parameter | Description |
|--|--|
| lunastreams > api_version | The version of the API of the LUNA Streams service - 1 |
| lunastreams > origin | Full network path to LUNA Streams service |
| sending > aggregate_attr_requests | Enables aggregation of the bestshots to get a single descriptor in LUNA PLATFORM - true or false |
| sending > minimal_body_track_length_to_send | This parameter enables the sending of detections with the coordinates of the human body - x, y, width and height and sets the number of detections, less than the value of which they will not be sent - 3 |

| Parameter | Description |
|--|---|
| sending > detection_path_length | This parameter sets the maximum number of detections for the “minimal_body_track_length_to_send” parameter. - 100 |

Table 12: Streams management parameters

| Parameter | Description |
|--|--|
| data > type | Type of signal source (tcp, udp, videofile, images) - string |
| account_id | “Luna_account_id”, to which the request is related - string in UUID format |
| event_handler > origin | full network path to LP 5 - “http://luna_api_address:5000/”. The example specifies the port “5000” for the API service, which is used by default |
| event_handler > api_version | The version of the API of the LP API service - 6 |
| event_handler > bestshot_handler > handler_id | LP handler that enables you to flexibly configure the processing of bodies - string in UUID format |
| event_handler > detection_handler > handler_id | dynamic LP handler that enables you to attach body coordinates to an event - string in UUID format |

For detailed information about the handlers, see the documentation [APIReferenceManual.html](#) included in the LUNA PLATFORM 5 distribution package.

4 Streams management configuration

The application supports simultaneous work with several stream sources.

Parameters for stream management are set in the [LUNA Streams](#) service. The service enables you to create and store streams in the LUNA Streams database.

Several types of sources are supported:

- tcp, udp – real-time video signal sources. These can be both USB cameras and IP cameras (via RTSP protocol);
- videofile – video files;
- images – a set of frames in the form of separate image files.

Note that the streams management settings are not stored in the LUNA Configurator service and can only be set using HTTP requests to the LUNA Streams service. A detailed description of requests and example requests can be found in the [Open API specification of LUNA Streams service](#). The LUNA Streams settings set in LUNA Configurator are described in the section “[LUNA Streams settings](#)”.

4.1 Account_id parameter

The parameter specifies the mandatory “account_id” field, which is passed to LUNA PLATFORM 5 service API in the request header.

Account ID is set in the UUID4 format. You can find the requirements for the Account ID in the LUNA PLATFORM 5 documentation.

The parameter is used to bind the received data to a specific user.

4.2 Name parameter

Source name. It is used to identify the source of the sent frames.

Recorded in the “source” field of the LP event.

4.3 Description parameter

User description of the stream.

This parameter is not recorded to the LP event.

4.4 Data section

The general parameters required to configure stream are listed below.

4.4.1 Type parameter

The type of stream transmission. The application can use one of the following types of stream transmission:

- **tcp** - network protocol to receive video data
- **udp** - network protocol to receive video data
- **images** - set of frames as separate image files
- **videofile** - video file

TCP Protocol implements an error control mechanism that minimizes the loss of information and the skip of the reference frames at the cost of increasing the network delay. **Key frames** are the basis of various compression algorithms used in video codecs (for example, h264). Only the reference frames contain enough information to restore (decode) the image completely, while the **intermediate frames** contain only differences between adjacent reference frames.

In terms of broadcasting on the network, there is a risk of package loss due to imperfect communication channels. In case of loss of the package containing the data keyframe, the stream fragment cannot be correctly decoded. Consequently, distinctive artifacts appear, that are easily and visually distinguishable. These artifacts do not allow the face detector to operate in normal mode.

The **UDP protocol** does not implement an error control mechanism, so the stream is not protected from damage. The use of this protocol is recommended only, if there is a high-quality network infrastructure.

With a large number of streams (10 or more), it is strongly recommended to use the **UDP protocol**.
When using the **TCP protocol**, there may be problems with reading streams.

4.4.2 Reference parameter

Full path to the source (for “tcp”/“udp” type):

```
"reference": "rtsp://some_stream_address"
```

USB device number (for “tcp”/“udp” type):

```
"reference": "/dev/video0"
```

To use USB device, you should specify the `--device` flag with the address of the USB device when launching the FaceStream Docker container. See the “Launching keys” section of the FaceStream installation manual.

Full path to the video file (for “videofile” type):

```
"reference": https://127.0.0.1:8080/super_server/
```

Full path to the directory with the images (for “images” type).

```
"reference": "/example1/path/to/images/"
```

To use video files and images, you should first move them to a docker container.

4.4.3 Roi parameter

This parameter is used only for working with faces.

ROI specifies the region of interest in which the face detection and tracking are performed.

The specified rectangular area is cut out from the frame and FaceStream performs further processing using this image.

Correct exploitation of the “roi” parameter significantly improves the performance of FaceStream.

Region of interest (ROI) on the original frame is set in pixels as array **[x, y width, height]**, where (x, y) are the coordinates of the upper-left point of the region of interest. Coordinate system is set in the same way as it is shown on the picture below.

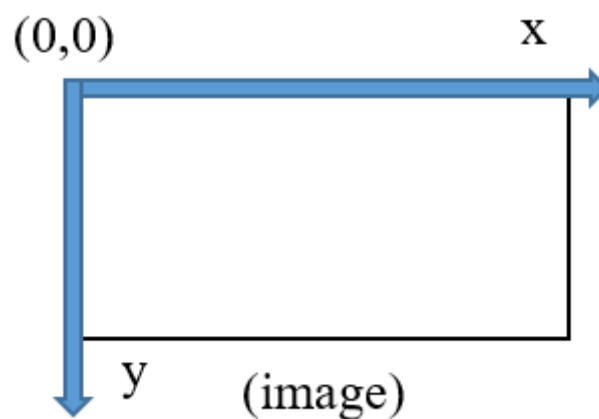


Figure 7: ROI coordinate system

When the values of width and height are set to “0”, the entire frame will be the region of interest.

4.4.4 Droiparameter

This parameter is used only for working with faces.

The parameter specifies the region of interest within the ROI zone. Face detection is performed in ROI, but the best shot is selected only in the DROI area. Face detection must be completely within the DROI zone for the frame to be considered as a best shot.

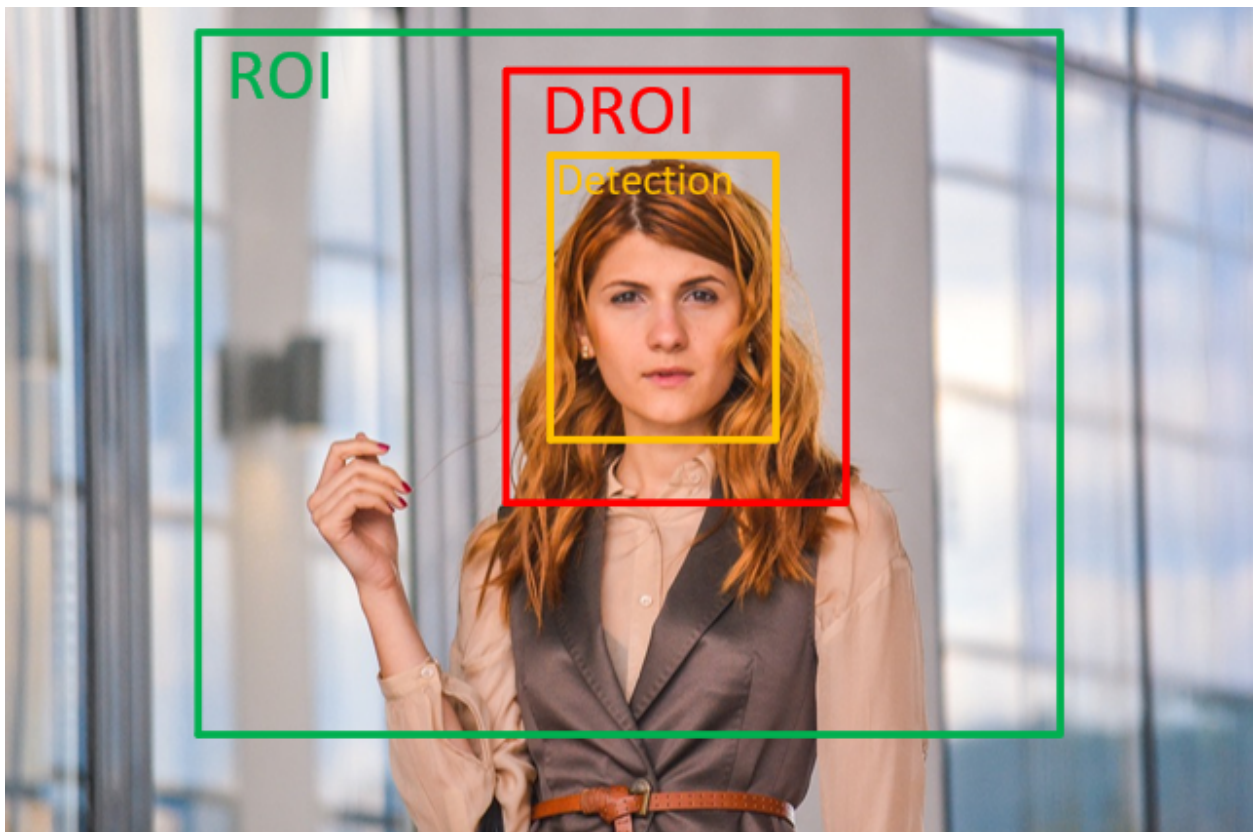


Figure 8: DROI

DROI is recommended to use when working with Access Control Systems and when the “use_mask_liveness_filtration” mode is enabled.

For example, it can be used, if there are several turnstiles close to each other and their cameras should find faces only in a small area and simultaneously perform Liveness check. Using DROI enables to limit the area of the best shot selection without losing information about the background.

Desired region of interest (DROI) on the original frame is set in pixels as array **[x, y width, height]**, where (x, y) are the coordinates of the upper-left point of the desired region of interest. When calculating DROI,

one must take into account that this region of interest is calculated relative to the original frame, and not relative to ROI.

Coordinate system is set in the same way as it is shown in the picture below.

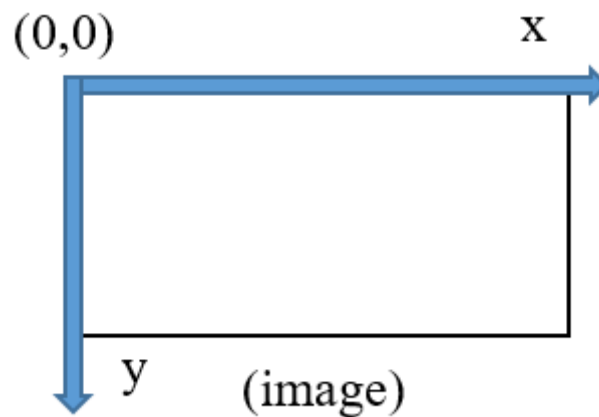


Figure 9: DROI coordinate system

When the ROI size is changed and the DROI size remains the default (0, 0, 0, 0), the DROI is not considered. If you change the size of the DROI, it will be considered when choosing the best frame.

4.4.5 Rotation parameter

The rotation angle of the image source. It is used when the incoming stream is rotated, for example, if the camera is installed on the ceiling. Rotation is clockwise.

4.4.6 Preferred_program_stream_frame_width parameter

This parameter is used only for **tcp** or **udp** types and is intended to work with protocols that imply the presence of several channels with different bitrates and resolutions (for example, HLS).

If the stream has several such channels, then this parameter will enable you to select from all the channels of the whole stream the channel whose frame width is closer to the value specified in this parameter.

For example, there are 4 channels whose frame widths are 100, 500, 1000 and 1400. If the parameter “preferred_program_stream_frame_width” is equal to “800”, then a channel with a frame width of 1000 will be selected.

If the stream has only one channel, this parameter will be ignored.

The default value is 800.

4.4.7 Endless parameter

This parameter enables you to control the restart of the stream when a network error is received (the error is determined by the system as an eof (end-of-file) marker).

The parameter is available only for the “udp” and “tcp” source types.

If the `endless` parameter takes the value `true`, then in case of receiving eof and successful reconnection, the processing of the stream will continue. If all reconnection attempts failed (see the “[healthcheck](#)” section), then the stream will take the “failure” status. If the parameter takes the value `false`, then the processing of the stream will not continue and the status of the stream will take the “done” status.

When using a video file as a “tcp” or “udp” source, it is assumed to use the value `false`. This will avoid re-processing an already processed fragment of the video file when receiving eof. If, when using a video file, the value of the `endless` parameter is `true`, then after the processing is completed, the video file will be processed from the beginning.

4.4.8 Mask parameter

This parameter is used only for the **images** type and is a mandatory parameter.

A mask of file names in the directory with images. The mask allows FaceStream to understand which files from the specified folder should be used and in what order.

If you set the mask “`Img_%02d.jpg`”, then FaceStream will take from the folder files which names consist of: Prefix (`Img_`) + two-digit number (`%02d`) + format (`.jpg`)

The following images will be taken in turn:

- `Img_00.jpg`
- `Img_01.jpg`
- `Img_02.jpg`
- `Img_03.jpg`

Another example of a mask is `Photo-%09d.jpg`. The following images will be taken:

- `Photo-000000000.jpg`
- `Photo-000000001.jpg`
- `Photo-000000002.jpg`
- `Photo-000000003.jpg`

FaceStream processes files in numerical order and does not skip nonexistent files. If there is a missing file in the file sequence FaceStream stops files processing.

The specified mask “`example1_%04d.jpg`” in the example will result in image processing, which name is composed of an “`example1_`” prefix and of a sequential frame number, of 4 characters size (for example: `example1_0001.jpg`, `example1_0002.jpg`, etc.).

```
"mask": "example1_%04d.jpg"
```

4.5 Event_handler section

This section defines the parameters of the handler created in the LUNA PLATFORM, with which video streams will be processed. Different handlers should be used for the face and bodies. Handler should be created in LP 5 in advance.

For more information about handlers, see the LUNA PLATFORM administrator manual.

4.5.1 Origin parameter

The full network path to the API service of the deployed LUNA PLATFORM, which includes the LUNA Handlers and LUNA Events services necessary to generate an event by handler.

```
"origin": "http://luna_address:port/"
```

luna_address - the LUNA API service address,

port - the port used by the LUNA API service. The default port is 5000.

4.5.2 Api_version parameter

The API version for generating events in the LUNA PLATFORM. Currently, version 6 of the API is supported.

4.5.3 Handler_id parameter of bestshot_handler section

The parameter enables you to use the external “handler_id” LUNA PLATFORM to process face or body samples according to the specified rules. When using this handler, LUNA PLATFORM generates an event that contains all the information received from FaceStream and processes it in accordance with the processing rules.

Handler should be created in LP 5 in advance.

4.5.4 Handler_id parameter of detection_handler section

The parameter enables you to use the external dynamic “handler_id” LUNA PLATFORM for working **with bodies**. This parameter is used in conjunction with the [minimal_body_track_length_to_send](#) parameter and their interaction enables you to send detections with human body coordinates (x, y, width and height) along with the bestshots.

Handler should be created in LP 5 in advance.

This parameter is optional and is required only if it is necessary to detect the coordinates of the human body.

For more information about dynamic handlers, see the LUNA PLATFORM administrator manual.

4.5.5 Frame_store parameter

This parameter sets a URL for saving the source frames of faces or bodies in LUNA PLATFORM 5.

As the URL, you can specify either the address to the LUNA Image Store service bucket, or the address to the “/images” resource of the LUNA API service. When specifying the address to the “/images” resource, the source frame will be saved under the “image_id”.

The [send_source_frame](#) option should be enabled for sending source frames.

Example of address to LUNA Image Store bucket:

```
"frame_store": "http://127.0.0.1:5020/1/buckets/<frames>/images"
```

127.0.0.1 - IP address where the LUNA Image Store service is deployed;

5020 - the default Image Store service port.

1 - API version of the LUNA Image Store service;

<frames> - the name of the LUNA Image Store bucket where the source image of face or body should be saved. The bucket should be created in advance.

An example of the “source-images” bucket creation:

```
curl -X POST http://127.0.0.1:5020/1/buckets?bucket=source-images
```

Example of address to “/images” resource of LUNA API service:

```
"frame_store": "http://127.0.0.1:5000/6/images"
```

127.0.0.1 - IP address where the LUNA API service is deployed;

6 - API version of the LUNA API service;

5000 - default port of the API service.

See the LUNA PLATFORM 5 administrator’s manual for more information about buckets and the “/images” resource.

4.5.6 Authorization section

In this section, either token or account_id are set to make requests to the LUNA API service.

The `event_handler > authorization > account_id` parameter must match the `account_id` parameter specified in the request. If the `authorization` field is not filled in, then the `account_id` specified when the stream was created will be used (see [Account_id parameter](#)).

See the LUNA PLATFORM 5 administrator manual for details on LUNA PLATFORM authorization.

4.6 Policies section

4.6.1 Sending section

This section defines a period during which frames will be analyzed to select the bestshot, as well as all parameters associated with compiling a collection of the bestshots.

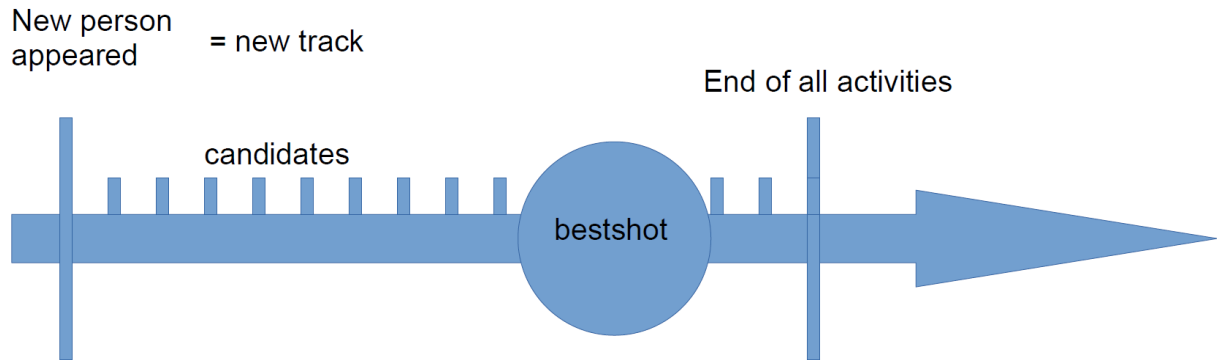


Figure 10: Best bestshot

```
"sending": {  
  "time_period_of_searching": -1,  
  "silent_period" : 0,  
  "type" : "sec",  
  "number_of_bestshots_to_send": 1  
  "send_only_full_set": true  
  "delete_track_after_sending" false  
},
```

4.6.1.1 Time_period_of_searching parameter

Interval in track after the end of which a best shot is sent to the server (period starts with the first detection – person appears in the frame). Lowering this parameter speeds up recognition but decreases precision.

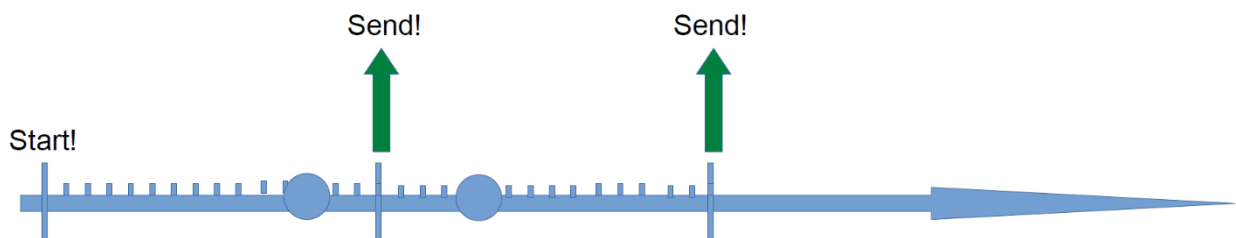


Figure 11: Sending period

The measurement type is set in the “type” parameter (see below). If the value equals “-1” (by default), analysis is conducted on all frames until the end of track. Once the track is over (person leaves the frame), best shot is sent to an external service.

4.6.1.2 Silent_period parameter

Interval between period. Once the analysis period is over, the system holds this silent_period before starting next period of frame analysis.

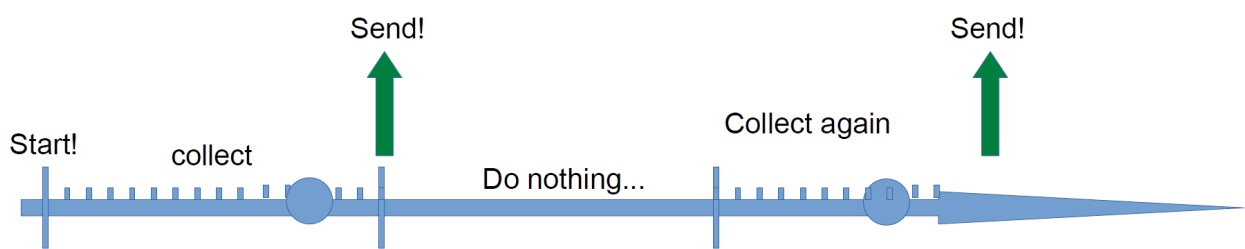


Figure 12: Silent period

The measurement type is set in the “type” parameter (see below). If the value equals “-1”, system holds silent period indefinitely.

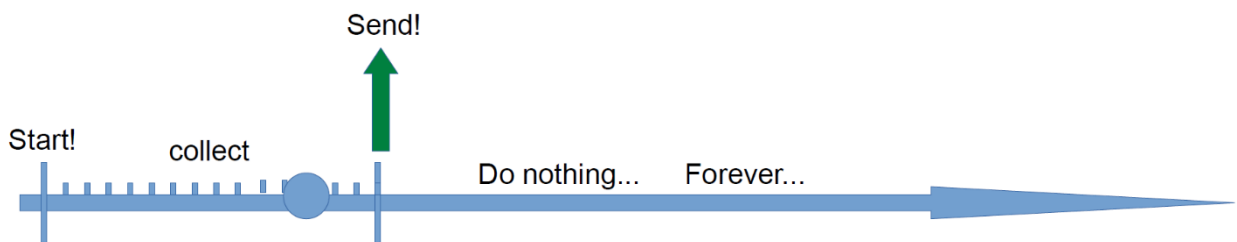


Figure 13: Endless waiting period

4.6.1.3 Type parameter

The parameter specifies the measurement type for the “silent_period” and “time_period_of_searing” parameters. It can take two values - “frames” or “sec”.

4.6.1.4 Number_of_bestshots_to_send parameter

Number of bestshots that the user sets to receive from the track or certain periods of this track. This parameter enables collection of bestshots from a track or a certain period of a track set in parameter *time_period_of_searching*.

Increasing parameter’s value increases the probability of correct object recognition but affects the network load.

4.6.1.5 [Send_only_full_set](#) parameter

This parameter is used only for working with bodies.

This parameter enables to send data only if the required number of best shots ([“number_of_bestshots_to_send”](#) parameter of FaceStream settings) and detections with human body coordinates ([“minimal_body_track_length_to_send”](#) parameter of FaceStream settings) have been collected.

4.6.1.6 [Delete_track_after_sending](#) parameter

This parameter is used only for working with bodies.

This parameter enables to delete the best shots and detections with human body coordinates after sending the data. If the value is “false” (by default), then the data will remain in memory.

4.6.2 Primary_track_policy section

This section is used only for working with faces.

This section is designed to work with Access Control Systems (ACS, turnstiles at the entrances to banks/office buildings) to simplify the control and the introduction of facial recognition technology at the entrance to a protected area. The parameters group **is not used** for the “images” type.

4.6.2.1 Use_primary_track_policy parameter

Use_primary_track_policy parameter is used in cases of Access Control Systems (turnstiles/gates at the office/bank entrances) for easier control and face recognition implementation in a secured area.

If the parameter value is “true”, the primary track implementation mode is enabled.

Out of all detections, one of the biggest sizes is selected and its track becomes the primary one. Further analysis is conducted on this track. The best shot from this track is then sent to the server.

All other tracks are processed in regular mode. However, the best shot is sent only from the primary track.

As soon as another face reaches a larger size than the face from the primary track, this face track becomes primary and the processing is performed for it.

While using this parameter at the access control checkpoint, only the best shots of the person who is the closest to the turnstiles will be sent to the server (here the biggest detection size condition is held)

4.6.2.2 Best_shot_min_size parameter

The parameter is used when “use_primary_track_policy” parameter is enabled.

Best_shot_min_size parameter sets the minimal height of detection in pixels at which the analysis of frames and bestshot definition begins.

4.6.2.3 Best_shot_proper_size parameter

The parameter is used when “use_primary_track_policy” parameter is enabled.

Best_shot_proper_size parameter sets the height of detection in pixels for Primary track policy. When a detection reaches the defined value, track immediately sends all its best shots to the server.

4.6.3 Liveness section

This section is used only for working with faces.

Liveness is used to check whether a person in the frame is real and prevents fraud when printed photos or images on the phone are used to pass the Liveness check.

It is recommended to use this functionality only after discussing it with the VisionLabs team.

The parameters group is not used for the “images” type.

4.6.3.1 General recommendations for Liveness usage

Liveness can be used at access control checkpoints only. This is a case when a person does not stay in front of the camera for more than ten seconds.

Liveness is used to minimize the risk of fraud when someone is trying to enter a secured area using a printed photo or a photo on a phone of someone who has the access rights.

Liveness returns a value, which defines the degree of the system certainty on whether the person in the frame is real. The value is in the range of 0 to 1.

Camera placement requirements

The following conditions must be met for Liveness check set up:

- Face should remain within a frame. The distance from left and right edges of the frame should be greater than or equal to the width of the face, the distance from the top and bottom edges of the frame should be greater than or equal to the height of the face;
- The frame should include the chest region;
- A camera should be located about waist height and should look upwards capturing the body and head;
- The frame should not include rectangular elements framing the face area from all four sides (such as doorways or windows).

An example of the correct camera location is given in the image below.

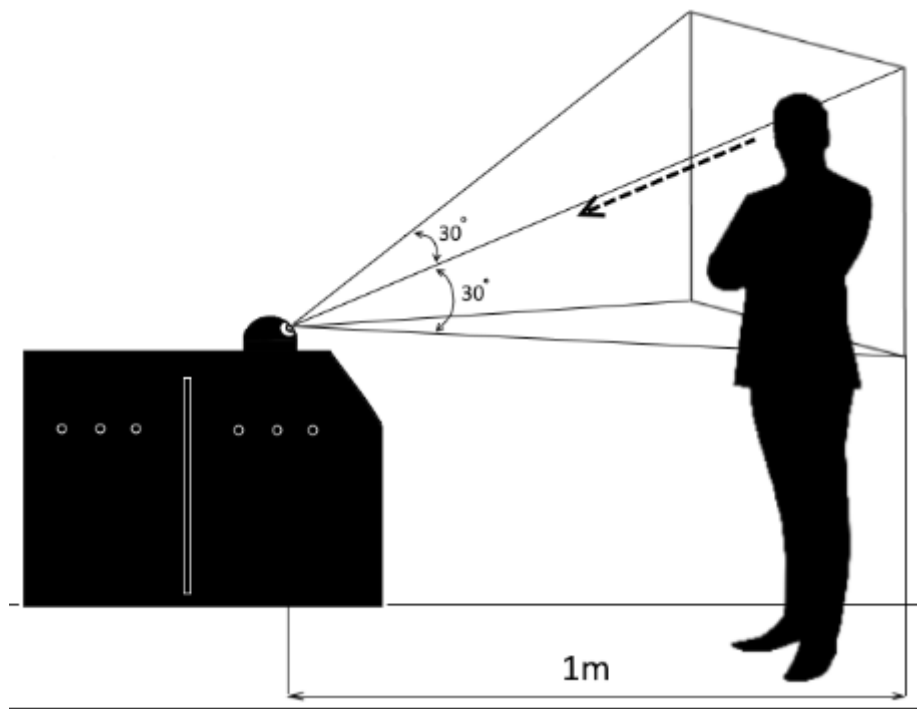


Figure 14: Proper camera placement for Liveness

FS starts collecting frames and selecting the bestshot at a distance of 3-4 meters when a camera is placed properly.

Foreign objects and people who do not pass through the turnstile do not get into the camera view zone.

FS sends the bestshot when a person is at a distance of 1 meter from the camera. At this distance, the face reaches the size required for sending.

An example of inappropriate camera placement is given in the image below.

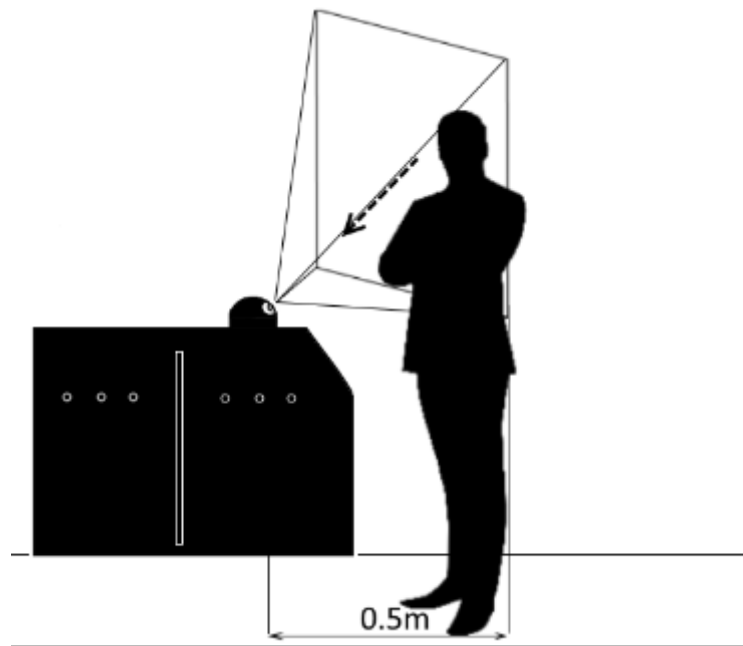


Figure 15: Inappropriate camera placement for Liveness

If the camera is not configured correctly:

- The person gets into the frame too late. FS does not have time to get the required number of frames for processing;
- The person looks upside-down at the camera. This degrades the quality of the frame for subsequent processing;
- The camera field of view covers the area outside the area of interest. This space may contain people or objects that interfere with the correct operation of the FS.

Recommendations for configuring FS

The recommended values for the “Liveness” section parameters are given below.

```
"use_shoulders_liveness_filtration": true,  
"use_mask_liveness_filtration": true,  
"use_flying_faces_liveness_filtration": true,  
"liveness_mode": 1,  
"number_of_liveness_checks": 10,  
"liveness_threshold": 0.8,  
"liveness_weights": [0.0, 0.25, 0.75],  
"mask_backgrounds_count": 300
```

We do not recommend changing these settings.

The “[best_shot_min_size](#)” parameter should be set based on the fact that the person is at a distance of 3-4 meters from the turnstile.

The “[best_shot_proper_size](#)” parameter should be set based on the fact that the person is at a distance of 1 meter from the turnstile.

To control the selection of the right person, use the “[droi](#)” parameter. The rectangle is selected so that people who have the intention to approach this turnstile appear in the rectangle as early as possible. This is true for turnstiles located close to each other. People from neighboring queues can get into the view zone of the cameras of such turnstiles.

FAQ Liveness

Stream processing is slow when using Liveness

When the camera resolution is 1920 x 1080 and higher, Mask Liveness is working slowly.

To solve the problem, you should manually reduce the resolution in the camera to 720p. This will not affect the quality of recognition and the work of Liveness, because they work without loss of quality with faces that are approximately 100 pixels in size.

People cannot pass the Liveness check under the default FS settings

Possible causes:

- The default settings in the Liveness section have been changed.

Do not change the settings in the Liveness section, except for the “[liveness_threshold](#)” setting.

The value of the “[liveness_threshold](#)” parameter can be reduced, but it should not be lower than “0.6”.

- Liveness is not applied to the target case.

FS Liveness is not intended for authorization processes and cases of a long stay in front of the camera.

- Unacceptable objects fall into the camera’s view zone.

For example, if there is a screen broadcasting a video in the background, Liveness will not work.

- The camera is set to the wrong resolution.

Check the camera resolution. See “Stream processing is slow when using Liveness”.

- There is a delay in the transmission of frames.

If the camera does not transmit frames in real-time, then the frames may arrive with a delay.

- The value “[best_shot_min_size](#)” is set incorrectly.

If the “[best_shot_min_size](#)” parameter is too high, Liveness does not have time to accumulate the required number of different frames.

4.6.3.2 Use_shoulders_liveness_filtration parameter

The parameter enables checking the presence of a real person in the frame based on the head and shoulder areas.

4.6.3.3 Use_mask_liveness_filtration parameter

The parameter enables checking the presence of a real person in the frame based on backgrounds.

The check performance depends on the size of the video frames. If the processing speed decreases when the parameter is enabled, it is necessary to reduce the video resolution in the camera settings (e.g., up to 1280x720).

4.6.3.4 Use_flying_faces_liveness_filtration parameter

The parameter enables checking the presence of a real person in the frame based on the facial surrounding.

4.6.3.5 Liveness_mode parameter

This parameter enables to specify which frames from a track will undergo Liveness check. There are three options for selecting a frame:

- 0 - First N frames;
- 1 - Last N frames before the best shot sending (recommended value);
- 2 - All frames in a track.

N value is specified in the `number_of_liveness_checks` parameter.

4.6.3.6 Number_of_liveness_checks parameter

The parameter enables to specify the number of frames to check for Liveness. The specified value is used in the `liveness_mode` parameter.

It is not recommended to set a value less than 10.

4.6.3.7 Liveness_threshold parameter

The `liveness_threshold` parameter value is used to define the presence of a real person in a frame. The system confirms that it is a real person in the frame, and not a photo, only if Liveness returned a value higher than the one specified in the parameter.

The recommended value is “0.8”. It is not recommended to set a value lower than “0.6”.

4.6.3.8 Liveness_weights parameter

The parameter determines the involvement of each liveness check type (shoulders, mask, and flying_faces) in the resulting estimation of the presence of a human face in the frame.

User must specify three values assigned to different types of liveness. Values are specified in decimals in the following order:

- Use_shoulders_liveness_filtration,
- Use_mask_liveness_filtration,
- Use_flying_faces_liveness_filtration.

In the example present (which is the system default) below 0.0 determines that 5% of liveness estimation will be based on shoulders_liveness, 0.25 - 25% on mask_liveness, and 0.75 - 75% on flying_faces_liveness.

```
"liveness_weights": [0.0, 0.25, 0.75]
```

The ratio is always calculated based on liveness_weights values, even if they don't add up to one, or not all liveness types are active.

4.6.3.9 Mask_backgrounds_count parameter

The number of background frames that are used for the corresponding checks.

Do not change this parameter.

4.6.4 Filtering section

The section describes the filter object parameters and modes of sending the resulting bestshots.

```
"filtering": {
  "min_score": 0.5187,
  "detection_yaw_threshold": 40,
  "detection_pitch_threshold": 40,
  "detection_roll_threshold": 30,
  "yaw_number": 1,
  "yaw_collection_mode": false,
  "mouth_occlusion_threshold" : 0.0
},
```

4.6.4.1 Min_score parameter

Min_score, also known as Approximate Garbage Score (AGS) for faces or Detector score for bodies – score that defines detection quality, threshold for filtering detections sent to the server. All detections with score higher than the value of this parameter can be sent to the server as HTTP-requests, otherwise detections are considered as not appropriate for further analysis.

If a new detection has a higher threshold than those in the existing collection, it will replace the detection with lowest threshold.

Recommended value was established through research and analysis of detections on various face and body images. Default value - 0.5187.

4.6.4.2 Detection_yaw_threshold parameter

This parameter is used only for working with faces.

This parameter sets the maximum value of head yaw angle in relation to camera.

If, in a frame, head yaw angle is above the value of this parameter, the frame is considered as **not** appropriate for further analysis.

4.6.4.3 Detection_pitch_threshold parameter

This parameter is used only for working with faces.

This parameter sets the maximum value of head pitch angle in relation to camera.

If, in a frame, head pitch angle is above the value of this parameter, the frame is considered as **not** appropriate for further analysis.

4.6.4.4 Detection_roll_threshold parameter

This parameter is used only for working with faces.

This parameter sets the maximum value of head yaw angle in relation to camera.

If, in a frame, head roll angle is above the value of this parameter, the frame is considered as not appropriate for further analysis.

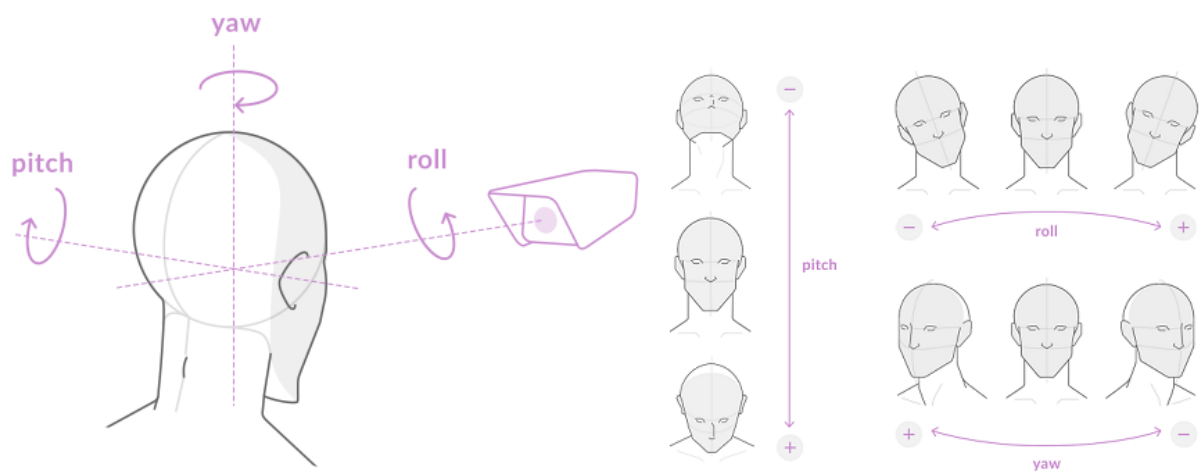


Figure 16: Head pose

4.6.4.5 Yaw_number parameter

This parameter is used only for working with faces.

This parameter defines the number of frames for image filtration based on head yaw angle. This filter removes images where head's yaw angle is too high.

How it works:

Parameter specifies the number of frames to analyze. A special algorithm analyzes head yaw angles on each of those frames. If on one of them the angle is significantly different from the average value of angles, the frame will not be considered as a candidate for best shot.

Example. Parameter value is set "7", meaning 7 frames will be analyzed. If on six of the frames the rotation angle is in the range between 50-60 degrees and the angle on the seventh frame is estimated at 0, the angle on the seventh frame is, most likely, estimated incorrectly. Reason is: a person cannot turn his head so abruptly in such short period of time. The seventh frame will not be considered for best shot.

By default, the parameter is disabled, the value is "1". The recommended value is "7".

4.6.4.6 Yaw_collection_mode parameter

This parameter is used only for working with faces.

This parameter sets the number of frames the system must collect the number of frames specified in the "yaw_number" parameter to analyze the head yaw angle.

If "yaw_collection_mode" parameter is disabled, the system will analyze the frames sequentially, meaning it analyzes one frame, then two, then three and so on. Maximum number of frames to analyze is set in "yaw_number" parameter.

Parameter is disabled by default.

The purpose of utilizing “yaw_number” and “yaw_collection_mode” parameters is to increase the accuracy of best shot selection from a track.

4.6.4.7 Mouth_occlusion_threshold parameter

This parameter is used only for working with faces.

This parameter determines how much the mouth can be obscured in the frame.

I.e. when the value is equal to “0.5”, 50% of the mouth can be occluded.

If mouth occlusion of a face in a frame exceeds the value of this threshold, the frame is considered as **not** appropriate for further analysis.

The filtration is performed when the set value is “0.3” or higher. When the value is lower, the filtration is **disabled**.

4.6.4.8 Min_body_size_threshold parameter

The parameter sets the body detection size, less than which it will not be sent for processing. It is calculated as the square root of the product of the body detection height (in pixels) by its width (in pixels).

Example: $\text{min_body_size_threshold} = \sqrt{64 \times 128} = 90.5$

If the value is “0”, then filtering of body detection by size will not be performed.

4.6.5 `Frame_processing_mode` parameter

This parameter is used for “tcp”, “udp” and “videofile” types only.

This parameter is similar to `convert_full_frame`, but is set for a specific FaceStream instance.

If the value is set to “full”, the frame is immediately converted to RGB image of the required size after decoding. This results in a better image quality and reduces the speed of frames processing.

When set to “scale”, the image is scaled according to the settings in the TrackEngine configuration (standard behavior for releases 3.2.4 and earlier).

The default value is “auto”. In this case, one of the two modes is selected automatically.

4.6.6 `Real_time_mode_fps` parameter

This parameter is used for “videofile” type only.

This parameter enables you to set the number of FPS with which the video stream will be processed.

If a video has high FPS value and FaceStream cannot work with the specified number of frames per second, frames are skipped.

Thus, the video file emits a stream from a real video camera. It can be useful for performance tuning. The video will be played at the specified speed, which is convenient for load testing and subsequent analysis.

This parameter is disabled when set to “0”.

4.6.7 Ffmpeg_threads_number

The parameter enables to specify the number of threads for decoding video using FFMPEG.

The number of processor cores involved in decoding process increases according to the number of threads. An increase in the number of threads is recommended when processing high-resolution video (4K or higher).

4.6.8 Health_check section

The section is used only for the “tcp”, “udp” and “videofile” types.

In this group, you can set the parameters for reconnecting to the stream when errors occur while the video is streamed.

4.6.8.1 Max_error_count parameter

The maximum number of errors when playing the stream.

The parameter works in conjunction with the “period” and “retry_delay” parameters. After receiving the first error, the wait specified in the “retry_delay” parameter is performed, and then the connection to the stream is retried. If during the time specified in the “period” parameter, the number of errors greater than or equal to the number specified in “max_error_count” was accumulated, then the processing of the stream will be terminated and its [status](#) will change to “failure”.

For example, when it is unable to retrieve or decode a frame. Network problems or inaccessibility of a video can cause the errors.

4.6.8.2 Period parameter

The parameter represents the period during which the number of errors is calculated. The value is set in seconds.

The parameter works in conjunction with the “retry_delay” and “max_error_count” parameters. See the description of working with this parameter in the [“max_error_count”](#) section.

4.6.8.3 Retry_delay parameter

The parameter specifies the period after which the reconnection attempt is performed. The value is set in seconds.

The parameter works in conjunction with the “period” and “max_error_count” parameters. See the description of working with this parameter in the [“max_error_count”](#) section.

4.7 Location section

This section includes information about the location of the video source.

- “city”
- “area”
- “district”
- “street”
- “house_number”
- “geo_position” - latitude and longitude in degrees. Geo position is considered as properly specified if both longitude and latitude are set.

The `send_location_data` parameter enables the sending of location data of the video source.

```
"location": {  
  "send_location_data" : false,  
  "city": "Moscow",  
  "area": "CAO",  
  "district": "Arbat",  
  "street": "Arbat",  
  "house_number": "37",  
  "geo_position": {  
    "longitude": 36.616,  
    "latitude": 55.752  
  }  
}
```

This parameter is used to generate events in the LUNA PLATFORM (see the LUNA PLATFORM documentation).

4.8 Autorestart section

This section enables you to configure the automatic restart of the stream. Three parameters are available:

- restart - whether to use automatic restart of the stream
- attempt_count - number of attempts to automatically restart the thread (default 10)
- delay - stream automatic restart delay, in seconds (default 60 seconds)

4.9 Status parameter

The status at the start of processing. Two states are available - “pending” and “pause”.

In addition to the two states at the start of processing, other states that occur during FaceStream operation are also available (see the [“Stream distribution in LUNA Streams”](#) section).

4.10 Group_name and group_id parameters

Parameters for linking a stream to a [group](#). You can specify either the “group_id” or “group_name”.

5 Settings in LUNA Configurator service

The LUNA Configurator service stores general settings for:

- [FaceStream](#)
- [TrackEngine](#)
- [LUNA Streams](#)

See [“Use FaceStream with LUNA Configurator”](#) for details on how the LUNA Configurator service interacts with FaceStream.

5.1 FaceStream settings

Settings configuration is performed by editing parameters in the “FACE_STREAM_CONFIG” section in the Configurator service (see [“Use FaceStream with Configurator”](#));

You can also setting up FaceStream by editing the configuration file “fs3Config.conf” in the mode of working without the Configurator service (see [“Use FaceStream with configuration files”](#)).

Below are the settings divided into logical blocks depending on the main functions performed by the block.

5.1.1 Logging section

Settings section of the application logging process. It is responsible for message output on errors and/or current state of the application.

5.1.1.1 Severity parameter

Severity parameter defines which information the user receives in logs. There are three information filter options:

- 0 - outputs all the information,
- 1 - outputs system warnings only,
- 2 - outputs errors only.

5.1.1.2 Tags parameter

Tags enable you to get information about the processing of frames and errors that occur only for FaceStream processes of interest.

This parameter enables you to list tags that are associated with logging of relevant information.

If a corresponding tag is not specified, the information is not logged.

Information on specified tags is displayed according to the *severity* parameter value.

Logs text includes the corresponding tag. It can be used for logs filtration.

Errors are always written in the log. They do not require additional tags.

Table 13: Tags description

| Tag | Description |
|-----------------|---|
| streams | Information about LUNA Streams operation |
| common | General information |
| ffmpeg | Information about FFMPEG library operation |
| liveness | Information about the presence of a living person in the frame (“liveness” section): is there enough information for liveness check, and does the frame pass the liveness check |
| primary-track | Information about the primary track (“primary_track_policy” section): the frame passed the specified thresholds and what track is selected as primary |
| bestshot | Information about the best shot selection: best shot occurrence, its change and sending to external service |
| angles | Information about filtration by head pose |
| ags | Information corresponding to the frames quality. The information is used for further processing using LUNA PLATFORM |
| mouth-occlusion | Information about mouth occlusion is recorded to the log file |
| statistics | Information about performance, the number of frames processed per second, and the number of frames skipped |
| http_api | Information about API requests sent to FaceStream in server mode and received responses |
| client | Information about sending messages to LUNA PLATFORM and the responses received |
| json | Information about processing parameters from configuration files and the Configurator service |
| debug | Debug information. It is recommended to use this tag when debugging only and not during FS operation. It provides a large amount of debugging information |

5.1.1.3 Mode parameter

Mode parameter sets the logging mode of the application: file or console. There are three modes available:

- “l2c” – output information to console only;
- “l2f” – output information to file only;
- “l2b” – output to both, console and file.

In the FaceStream mode of working with configuration files, you can configure the directory to save logs when information is output to a file using the `--log-dir` launching parameter.

5.1.2 Sending section

This section is used to send portraits in the form of HTTP-requests from FaceStream to external services.

5.1.2.1 Request_type section

This parameter is used only for working with faces.

This parameter defines a type of query that is used to send portraits to external services. There are 2 supported types (to work with different versions of LUNA):

- “jpeg” is used to send normalized images to VisionLabs LUNA PLATFORM;
- “json” may be used to send portraits to custom user services for further image processing.

For a detailed description of the requests, see the table below.

Table 14: Request types

| Format | Request type | Authorization headers | Body |
|--------|--------------|--|--|
| JSON | PUT | Authorization: Basic, login/password(Base64) | Media type: application/json; frame – the original frame in Base64 (if send_source_frame option is on); data – a portrait in Base64; identification – Cid parameter value. JSON example: {frame: "", "data": "image_in_base_64", "identification": "camera_1"} |

| Format | Request type | Authorization headers | Body |
|--------|--------------|--|------------------------|
| JPEG | POST | Authorization: Basic, login/password(Base64) or X-Auth-Token: 11c59254-e83f-41a3- b0eb- 28fae998f271(UUID4) | Media type: image/jpeg |

5.1.2.2 Portrait_type parameter

This parameter is used only for working with faces.

This parameter defines the format of a detected face to send to an external service. Possible values:

- “warp” - use a normalized image;
- “gost” - do not use the transformation, cut the detected area from the source frame, considering indentation.

Properties of the normalized image (warp):

- size of 250x250 pixels;
- face is centered;
- face should be aligned in the way that, if you draw an imaginary line connecting the corners of the eyes, it is close to horizontal.

Such image format when working with LUNA PLATFORM offers the following advantages:

- a constant minimal predictable amount of data for network transfer;
- face detecting phases in LUNA PLATFORM automatically turn off for such images, which leads to the significant reduction of interaction time.

5.1.2.3 Send_source_frame parameter

This parameter enables to send a full source frame where the face was detected.

When sending image to LUNA PLATFORM you should specify the URL of LUNA Image Store service in the “[frame_store](#)” parameter.

For the collection of bestshots (“[number_of_bestshots_to_send](#)” > 1), only one source frame is sent, which is determined by FaceStream to be the best of all bestshots. For example, if the setting value “[number_of_bestshots_to_send](#)” is 3, then three bestshots will be sent to LP and only one source frame, which will be automatically selected from the three bestshots.

The source frame is sent to LP some time before the bestshot is sent. It is stored in the LUNA Events database and assigned a unique ID, which is stored in the “image_origin” field of the “face_detect_result”/“body_detect_result” table. Next, the bestshot is sent to the LP and an event is generated, where the “image_origin” field indicates the ID of the source frame taken from the LUNA Events database.

5.1.2.4 Size_source_frame parameter

Parameter changes the width of the source frame to the specified value. Valid range is [0...1024]. The value “0” means that the width will not change. The fractional part of the input is affected.

5.1.2.5 Detection_path_length parameter

This parameter is used only for working with bodies.

Parameter sets the maximum number of detections for the “minimal_body_track_length_to_send” parameter. Values from 1 to 100 inclusive are available.

The maximum number of detections cannot exceed 100. If there are more than 100 detections, then the FaceStream algorithm will remove unnecessary detections with some step.

5.1.2.6 Minimal_body_track_length_to_send parameter

This parameter is used only for working with bodies.

This parameter enables you to send a specified number of detections with the coordinates of the human body - x, y, width and height along with the bestshots (see the “save event” request in the LUNA PLATFORM OpenAPI document). According to the sets of detections of the human body, it is possible to determine its path.

The parameter should be used in conjunction with the [detection handler > handler_id](#) parameter. When this parameter is enabled, in addition to generating the general event, one more event will be created, associated with the general one by “track_id”. This event will contain the coordinates of the human body and basic information about the event (detection time, event creation time, account ID, etc.)

The detection with the bestshot is mandatory to be sent.

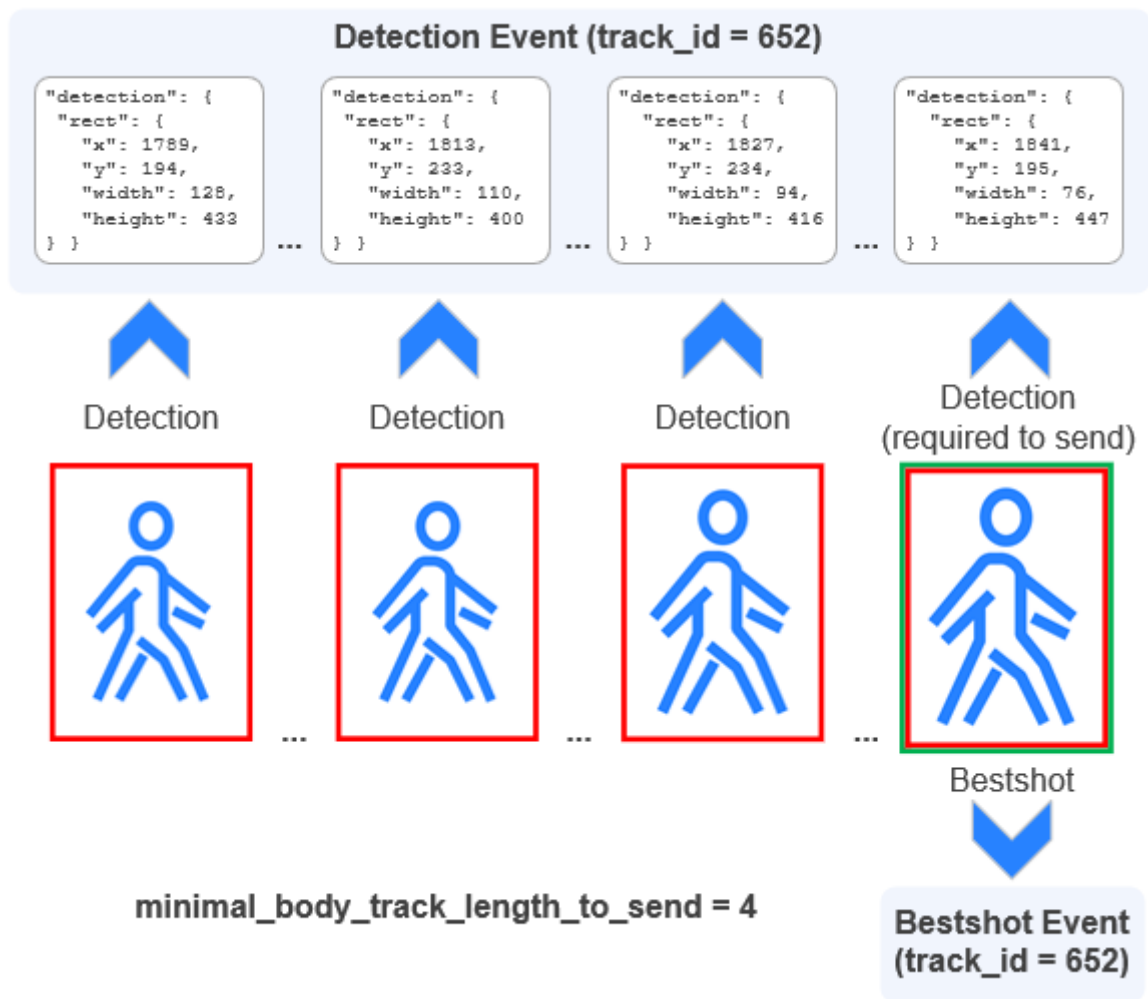


Figure 17: Sending detections

If the number of detections is less than the specified value, then these detections will not be sent. For example, if the number of detections is “3” and the value of “minimal_body_track_length_to_send” is “4”, then no detections will be sent and the following message will be displayed in the FaceStream logs:

Track is too short and will not be sent. Length 3 < 4

If the parameter value is “0”, then no detections will be sent.

5.1.2.7 Async_requests parameter

The parameter specifies whether to execute requests asynchronously or synchronously in LUNA PLATFORM.

By default, the asynchronous mode is set, in which all requests to the LUNA PLATFORM are performed in parallel.

5.1.2.8 [Aggregate_attr_requests](#) parameter

This parameter enables the bestshots aggregation to receive a single descriptor in LUNA PLATFORM.

Aggregation is performed if there is more than one bestshot sent. The number of frames to send is set by the “[number_of_bestshots_to_send](#)” parameter.

The accuracy of face and body recognition is higher when using an aggregated descriptor.

5.1.2.9 [Jpeg_quality_level](#) parameter

JPEG quality for source frames sending:

- “best” - compression is not performed
- “good” - 75% of source quality
- “normal” - 50% of source quality
- “average” - 25% of source quality
- “bad” - 10% of source quality

The “best” quality is set by default.

High quality images sending can affect the frames processing speed.

5.1.3 [Lunastreams](#) section

This section describes how to send ready-made images as HTTP requests from FaceStream to the LUNA Streams service.

See “[Interaction of FaceStream with LUNA Streams](#)” section for details on how LUNA Streams works with FaceStream.

5.1.3.1 [Origin](#) parameter

The address and port of the server where the LUNA Streams service is running.

5.1.3.2 [Api_version](#) parameter

The parameter specifies the API version of the LUNA Streams service. At the moment, the API version “1” is supported.

The current version of the API can always be found in the API service documentation.

5.1.3.3 [Max_number_streams](#) parameter

The parameter sets the upper bound on the number of streams. The value must be greater than 0.

5.1.3.4 Request_stream_period parameter

The parameter sets the time period between requests to receive new streams from LUNA Streams in the range from 0.1 to 3600 seconds.

The default value is 1 second.

5.1.3.5 Send_feedback_period parameter

The parameter sets the time period between sending reports on processed streams to LUNA Streams in the range from 1.0 to 3600 seconds.

The default value is 5 seconds.

The value of this parameter should not exceed the value of the “[STREAM_STATUS_OBSOLETING_PERIOD](#)” parameter, set in the LUNA Streams service settings.

5.1.3.6 Max_feedback_delay parameter

The parameter sets the maximum report sending delay in the range from 1.0 to 3600 seconds. If the report has not been sent within the given time, then FaceStream will stop processing the current streams.

The default value is 10 seconds.

The value of this parameter should not be less than the value of the parameter [“send_feedback_period”] (#send_feedback_period) and should not exceed the value of the parameter “[STREAM_STATUS_OBSOLETING_PERIOD](#)”, set in the LUNA Streams service settings.

5.1.4 Performance section

5.1.4.1 Stream_images_buffer_max_size parameter

The parameter specifies the maximum size of buffer with images for a single stream.

When you increase the parameter value, the FaceStream performance increases. The higher is the value, the more memory is required.

We recommend setting this parameter to 40 when working with GPU, if there is enough GPU memory.

5.1.4.2 Enable_gpu_processing parameter

This parameter enables you to utilize GPU instead of CPU for calculations.

GPU enables you to speed up calculations, but it increases the consumption of RAM.

GPU calculations are supported for FaceDetV3 only. See “defaultDetectorType” parameter in the FaceEngine configuration (“faceengine.conf”).

5.1.4.3 Convert_full_frame parameter

If this parameter is enabled, the frame is immediately converted to an RGB image of the required size after decoding. This results in a better image quality but reduces the speed of frames processing.

If this parameter is disabled, the image is scaled according to the settings in the TrackEngine configuration (standard behavior for releases 3.2.4 and earlier).

This parameter is similar to [frame_processing_mode](#) parameter, but it is set for all FaceStream instances at once.

5.1.5 Monitoring section

Monitoring settings are set in this section. The organization, bucket and token settings should be set at the start of the InfluxDB container as follows:

```
docker run \  
-e DOCKER_INFLUXDB_INIT_BUCKET=facestream_monitoring \  
-e DOCKER_INFLUXDB_INIT_ORG=facestream \  
-e DOCKER_INFLUXDB_INIT_ADMIN_TOKEN=token \  

```

5.1.5.1 Storage_type parameter

This parameter enables to select the type of data storage for monitoring. For now, only the Influx database can be used.

5.1.5.2 Send_data parameter

This parameter enables sending monitoring. Disabled by default.

5.1.5.3 Organization parameter

This parameter specifies the InfluxDB 2.x workspace.

The workspace is created by passing the corresponding argument at the start of the Influx container.

5.1.5.4 Bucket parameter

This parameter sets the InfluxDB 2.x bucket.

The bucket is not created automatically. It can be created using the Influx UI or by passing the appropriate argument at the start of the Influx container.

5.1.5.5 Token parameter

This parameter specifies the InfluxDB 2.x authentication token.

5.1.5.6 Origin parameter

This parameter specifies the IP address and port of the server with InfluxDB 2.x.

The default address is “127.0.0.1”. Such an address means that InfluxDB 2.x, located on a server with LUNA Configurator, will be used. If InfluxDB 2.x is located on a different server, then in this parameter you need to specify the correct IP address of InfluxDB 2.x.

```
"origin": "http://127.0.0.1:8086/"
```

5.1.5.7 Flushing_period parameter

This parameter sets frequency of sending monitoring data to InfluxDB (in seconds).

The default is 1 second.

5.2 TrackEngine settings

This section describes the parameters of the TrackEngine configuration file that are used to configure FaceStream.

Settings configuration is performed by editing parameters in the “TRACK_ENGINE_CONFIG” configuration in the Configurator service (see [“Use FaceStream with Configurator”](#));

You can also setting up TrackEngine by editing the configuration file “trackengine.conf” in the mode of operation without the Configurator service (see [“Use FaceStream with configuration files”](#)).

5.2.1 Use-face-detector and use-body-detector parameters

These parameters enable you to change the detection of faces to bodies and vice versa. Simultaneous detection of faces and bodies is not possible.

It should be remembered that in order to successfully change the detection, it is necessary to set the appropriate FaceStream settings and settings of stream sources.

```
<!-- use-face-detector: Flag to use or not face detection -->
<param name="use-face-detector" type="Value::Int1" x="1" />

<!-- use-body-detector: Flag to use or not body detection -->
<param name="use-body-detector" type="Value::Int1" x="0" />
```

5.2.2 Detector-step parameter

The “detector-step” parameter enables you to specify the number of frames on which face redetection will be performed in the specified area before face detection is performed. Redetection requires fewer resources, but the face may be lost if you set a large number of frames for redetection.

```
<!-- detector-step: The count of frames between frames with full detection,
[0 .. 30] ('7' by default). -->
<param name="detector-step" type="Value::Int1" x="7" />
```

5.2.3 Detector-scaling parameter

The “detector-scaling” parameter enables you to scale the frame before processing.

```
<!-- detector-scaling: Scale frame before detection for performance reasons,
[0, 1] ('0' by default). -->
```

```
<param name="detector-scaling" type="Value::Int1" x="0" />
```

5.2.4 Scale-result-size parameter

The “scale-result-size” parameter sets the maximum frame size after scaling the largest side of the frame. If the source frame had a size of 1920x1080 and the value of “scale-result-size” is equal to 640, then FaceStream will process the frame of 640x360 size.

If the frame was cut out using the “roi” parameter, the scaling will be applied to this cropped frame. In this case, you should specify the “scale-result-size” parameter value according to the greater ROI side.

You should gradually scale the frame and check whether face or body detection occurs on the frame, to select the optimal “scale-result-size” value. You should set the minimum image size at which all objects in the area of interest are detected.

Further extending our example, images below depict a video frame without resize (at original 1920x1080 resolution) and after resize to 960x640 with face detections visualized as bounding boxes.

Six faces can be detected when the source image resolution is 1920x1080.



Figure 18: Detections in image 1920X1080

Three faces are detected after the image is scaled to the 960x640 resolution. The faces in the background are smaller in size and are of poor quality.

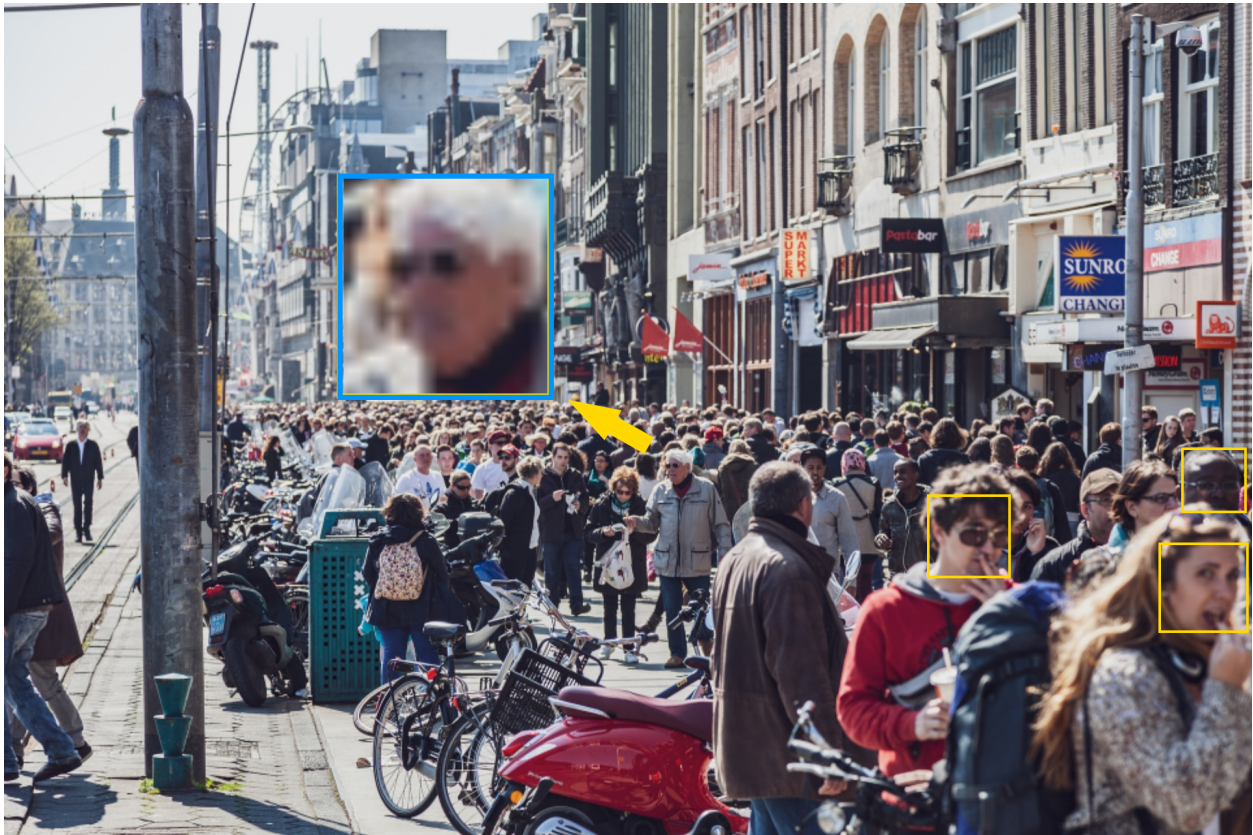


Figure 19: Detections in image 960X640

The smaller the frame resolution, the less resources are consumed.

When working with bodies, this parameter works the same way.

```
<!-- scale-result-size: If scaling is enable, frame will be scaled to this
      size in pixels (by the max dimension - width or height).
      Upper scaling is not possible. ('640 by default') -->
<param name="scale-result-size" type="Value::Int1" x="640" />
```

5.2.5 Skip-frames parameter

This parameter is used only for working with faces.

The “skip-frames” parameter sets the number of frames during which the system will wait for the object to reappear in the area where it disappeared.

Note that very high values may lead to performance degradation.

```
<!-- skip-frames: If track wasn't updated by detect/redetect for this number
of frames, then track is finished ('36' by default). -->
<!-- note: very high values may lead to performance degradation. Parameter
doesn't affect on human tracking. -->
<param name="skip-frames" type="Value::Int1" x="36" />
```

5.2.6 Frg-subtractor parameter

When the “frg-subtractor” parameter is enabled, motion in the frame is considered. The following face and body detection will be performed in the area with motion, not in the entire frame.

The areas with motion are determined after the frame is scaled.

When the “frg-subtractor” is enabled, the performance of FaceStream is increased.

```
<!-- frg-subtractor: Use foreground subtractor for filter of frames, [0, 1]
('1' by default). -->
<param name="frg-subtractor" type="Value::Int1" x="1" />
```

5.2.7 Frg-regions-alignment parameter

The “frg-regions-alignment” parameter enables you to set the alignment for the area with motion.

```
<!-- frg-regions-alignment: frg regions alignment. Useful for detector
better batching utilization. -->
<!-- 0 or negative values mean using non aligned regions, (0 by default).
-->
<param name="frg-regions-alignment" type="Value::Int1" x="0" />
```

5.2.8 Frg-regions-square-alignment parameter

When the “frg-regions-square-alignment” parameter is enabled, the width and height of the area with motion will always be equal.

```
<!-- align frg regions to rect with equal sides (max side choosen). See frg-
regions-alignment, [0, 1] ('1' by default). -->
<param name="frg-regions-square-alignment" type="Value::Int1" x="1" />
```

5.2.9 Batched-processing parameter

The “batched-processing” parameter enables batch processing of frames.

When working with several video cameras, a frame is collected from each frame. Then the batch of frames is processed.

When the parameter is disabled, the frames are processed one by one.

When using batch processing mode, the delay before processing increases, but the processing itself is faster.

It is recommended to enable the parameter both when using the GPU and when using the CPU.

```
<!-- batched-processing: Process streams frames in batch or separately, [0, 1] ('1' by default). -->
<param name="batched-processing" type="Value::Int1" x="1" />
```

5.2.10 Min-frames-batch-size parameter

The “min-frames-batch-size” parameter sets the minimal number of frames collected from all the cameras before processing.

It is recommended to set the “min-frames-batch-size” parameter value equal to the number of streams when using the GPU.

It is recommended to set the “min-frames-batch-size” parameter value equal to “2” when using the CPU.

```
<!-- min-frames-batch-size: stream frames min batch size value to process, ('0' by default). -->
<!-- higher values lead to higher processing latency but increase throughput and device utilization. -->
<!-- zero/negative values disable this feature, so any stream frames will be processed if they are available -->
<!-- note: this parameter should be regulated with 'max-frames-batch-gather-timeout' (see below) -->
<param name="min-frames-batch-size" type="Value::Int1" x="0" />
```

5.2.11 Max-frames-batch-gather-timeout parameter

The “max-frames-batch-gather-timeout” parameter specifies the time between processing of the batches.

If a single frame is processed within the specified time and there is an additional time margin, FaceStream waits for additional frames to increase GPU utilization.

If the “max-frames-batch-gather-timeout” parameter is set to “20”, this time is used to process the previous batch and collect a new one. After 20 seconds, the processing begins even if the number of frames equal to “min-frames-batch-size” was not collected. Processing of the next batch cannot begin before the processing of the previous one is finished.

There is no timeout for collecting frames to the batch if the parameter is set to “0” and “min-frames-batch-size” is ignored.

It is recommended to set the “max-frames-batch-gather-timeout” parameter value equal to “0” both when using the GPU and when using the CPU.

```
<!-- max-frames-batch-gather-timeout: max available timeout to gather next
      stream frames batch (see 'min-frames-batch-size') from last processing
      begin time point (measured in ms), ('-1' by default). -->
<!-- negative values disable this feature (no timeout, so only stream frames
      batches with size no less than 'min-frames-batch-size' value will be
      processed) -->
<!-- note: this parameter is complementary to 'min-frames-batch-size' and
      controls min average fps of stream frames batches processing -->
<param name="max-frames-batch-gather-timeout" type="Value::Int1" x="-1" />
```

5.3 LUNA Streams settings

This section describes the parameters of the LUNA Streams service that are set in the LUNA Configurator service.

5.3.1 LUNA_STREAMS_DB section

This section sets connection settings to the created LUNA Streams database.

5.3.1.1 Db_type parameter

The parameter sets the type of database used. Two options are available - “postgres” or “oracle”.

The default type is “postgres”.

5.3.1.2 Db_user parameter

The parameter specifies the database username.

The default username is “luna”.

5.3.1.3 Db_password parameter

The parameter sets the database password.

The default password is “luna”.

5.3.1.4 Db_name parameter

The parameter sets the database name for type “postgres” and the name of the SID for type “oracle” to connect to.

The default name is “luna_streams”.

5.3.1.5 Db_host parameter

The parameter sets the IP address of the server with the LUNA Streams database.

The default address is “127.0.0.1”. This address means that the LUNA Streams database located on the server with LUNA Configurator will be used. If the database is located on another server, then in this parameter you should specify the correct IP address of the server with the database.

5.3.1.6 Db_port parameter

The parameter sets LUNA Streams database listener port.

The default port is “5432” for “postgres” and “1521” for “oracle”.

5.3.1.7 [Connection_pool_size](#) parameter

The parameter sets the database connection pool size.

The default value is “5”.

5.3.2 [LUNA_STREAMS_LOGGER](#) section

This section sets the logging settings for the LUNA Streams service.

5.3.2.1 [Log_level](#) parameter

The parameter sets the level of debug printing, by priority: “ERROR”, “WARNING”, “INFO”, “DEBUG”.

The default value is “INFO”.

5.3.2.2 [Folder_with_logs](#) parameter

The parameter sets the folder where the logs are stored (the relative path starts from the directory with the application).

The default value is “./”.

5.3.2.3 [Log_time](#) parameter

The parameter sets the time format used in log entries: “LOCAL” or “UTC”.

The default value is “LOCAL”.

5.3.2.4 [Log_to_stdout](#) parameter

The parameter enables you to send the log to standard output (stdout). Two options are available - “true” or “false”.

The default value is “true”.

5.3.2.5 [Log_to_file](#) parameter

The parameter enables you to send the log to a file. Two options are available - “true” or “false”.

The default value is “false”.

5.3.2.6 [Multiline_stack_trace](#) parameter

The parameter enables or disables multi-line traces in logs. Two options are available - “true” or “false”.

The default value is “true”.

5.3.3 LUNA_LICENSES_ADDRESS section

This section sets the settings for connecting to the LUNA Licenses service.

5.3.3.1 Origin parameter

The parameter sets the protocol, IP address and port of the LUNA Licenses service. The IP address “127.0.0.1” means that the LUNA Licenses service located on the server with LUNA Configurator will be used. If the service is located on another server, then in this parameter you need to specify the correct IP address of the server running the LUNA Licenses service.

```
"origin": "http://127.0.0.1:5120",
```

The default value is “http://127.0.0.1:5120”.

5.3.3.2 Api_version parameter

This parameter sets the API version of the LUNA Licenses service. The available API version is “1”.

5.3.4 STREAM_WORKER_ASYNC_LOCK_TIMEOUT parameter

Parameter sets timeout of the LUNA Streams instance to lock a row in a database table in seconds in the range (0, 1]. The value of this setting should be increased if the stream statuses are not updated, which may be due to a slow connection from the service to the database.

The default value is “10”.

5.3.5 STREAM_STATUS_OBSOLETING_PERIOD parameter

This parameter sets stream status obsolescence period in seconds in range (0, 86400]. For this period of time, the FaceStream worker should transfer the LUNA Streams report. Otherwise, the status of the stream will be changed to “restart”, and the belated report will be rejected.

The default value is “0.1”.

5.3.6 LUNA_STREAMS_ACTIVE_PLUGINS parameter

This parameter sets the list of active plugins (see the information about plugins workflow in the LUNA PLATFORM 5 administrator manual).

The default value is “[]”.

5.3.7 STORAGE_TIME parameter

This parameter sets time format used in LUNA Streams database records: “LOCAL” or “UTC”.

The default value is “LOCAL”.

5.3.8 INFLUX_MONITORING section

In this section, settings for monitoring LUNA PLATFORM services are set.

5.3.8.1 Send_data_for_monitoring parameter

This parameter enables you to enable or disable sending monitoring data to InfluxDB. Two options are available - “0” or “1”.

The default value is “1”.

5.3.8.2 Use_ssl parameter

This parameter enables you to use HTTPS to connect to InfluxDB. Two options are available - “0” or “1”.

The default value is “0”.

5.3.8.3 Flushing_period parameter

This parameter sets frequency of sending monitoring data to InfluxDB (in seconds).

The default is 1 second.

5.3.8.4 Host parameter

This parameter sets IP address of server with InfluxDB 2.x.

The default address is “127.0.0.1”. This address means that InfluxDB 2.x will be used, located on the server with LUNA Configurator. If InfluxDB 2.x is located on a different server, then you should specify the correct InfluxDB 2.x IP address in this parameter.

5.3.8.5 Port parameter

This parameter sets InfluxDB 2.x port.

The default value is “8086”.

5.3.8.6 Bucket parameter

This parameter sets InfluxDB 2.x bucket name.

The default bucket name is “luna_monitoring”.

5.3.8.7 Organization parameter

This parameter sets InfluxDB 2.x workspace.

The default value is “luna”.

5.3.8.8 Token parameter

This parameter sets InfluxDB 2.x authentication token.

6 Use FaceStream with LUNA Configurator

LUNA Configurator service enables you to store FaceStream, TrackEngine, and LUNA Streams settings and pass them to running FaceStream instances.

LUNA Configurator service also enables you to store the settings all the LUNA PLATFORM services necessary to launch FaceStream. See the LUNA PLATFORM settings in the LUNA PLATFORM 5 administrator manual.

After FaceStream is launched it uses the parameters specified in the LUNA Configurator service and does not request them until restart by default. If necessary, you can enable checking for changes in LUNA Configurator configurations and automatically restarting the FaceStream instance(s) using the “CONFIG_RELOAD” launch key, and set the period for receiving parameters using the “PULLING_TIME” launch key.

See description of the launch keys in the “Launch FaceStream manually” > “Commands for launching FaceStream container” > “Launching keys” section FaceStream installation manual.

If checking for changes in the settings is disabled, then to apply the FaceStream instance settings changed in LUNA Configurator, you should manually restart this FaceStream instance.

6.1 Features of working with Configurator

If the use of the LUNA Configurator service is specified in the FaceStream startup line, but the service is unavailable, or the specified parameters are incorrect, then FaceStream will issue an error in the log and will not be started. In this case, the FaceStream and TrackEngine settings will be taken from the local configuration files, if they were uploaded to the container.

LUNA Streams is not intended to use a configuration file.

6.2 Parameters in Configurator

LUNA Configurator includes records with the specified parameters.

Each of the LUNA Configurator records contains a name, a tag, and a configuration body. A record corresponds to one of the configuration files.

Parameters in the LUNA Configurator services have the same names as in configuration files (fs3Config.conf, trackengine.conf) and documentation.

Table 15: Correspondence of the LUNA Configurator data and distribution configuration files

| Record name in LUNA Configurator | Corresponding configuration | |
|----------------------------------|-----------------------------|--------------------------|
| | file | Description |
| FACE_STREAM_CONFIG | fs3Config.conf | FaceStream configuration |

| Record name in LUNA Configurator | Corresponding configuration file | Description |
|----------------------------------|----------------------------------|--|
| TRACK_ENGINE_CONFIG | trackengine.conf | Detection and tracking parameters face or body |

6.3 Set configurations for several FaceStream instances

If a single FaceStream instance is working with the Configurator service, it uses the settings that are loaded by default.

If you want to use multiple FaceStream instances with different settings, create a separate record with a unique tag for each of these settings.

The tag is a unique identifier for the record and is specified in the launching keys described in the installation manual. Thus a specific FaceStream instance can get its own unique settings.

Follow these steps:

- Duplicate the record, for example, “FACE_STREAM_CONFIG”, by pressing the **Duplicate** button.

Figure 20: Duplicate record

- Set a tag and specify parameters values.

Create new setting

Limitation

FACE_STREAM_CONFIG

Description (str <= 128 chars)

Face stream configuration

Value (depends on schema)

```
{"logging":{"severity":1,"tags":["ffmpeg","gstreamer","bestshot","primary-track"],"mode":"I2b"},"sending":{"request-type":"jpeg","portrait-type":"warp","send-source-frame":false,"luna-api":3,"async-requests":true,"luna-account-id":""},"web_tasks":{"concurrent-max-count":3,"max-file-size":52428800},"performance":{"stream-images-buffer-max-size":10,"enable-gpu-processing":false,"convert-full-frame":true}}
```

Tags (str, separate by ',')

setting tags(separate by ',')

Cancel

Create

Figure 21: Change tag

Tags are not created for the default records.

7 Use FaceStream with configuration files

If necessary, you can launch FaceStream independently of the “FACE_STREAM_CONFIG” and “TRACK_ENGINE_CONFIG” settings of the LUNA Configurator service using the settings from the configuration files.

With this launch option, it is assumed that the dependent LUNA PLATFORM services will also be launched with configuration files. The description of launching LUNA PLATFORM services with configuration files is not given in this documentation.

FaceStream can be launched with settings from configuration files using the following configuration files:

- fs3Config.conf (settings are similar to “FACE_STREAM_CONFIG” section in LUNA Configurator)
- trackengine.conf (settings are similar to “TRACK_ENGINE_CONFIG” section in LUNA Configurator)
- faceengine.conf

You should first set all the necessary parameters in these files before launching FaceStream.

The command for manually launching a container using configuration files will differ from the command for launching with Configurator and will look as follows:

```
docker run \  
-v /var/lib/fs/fs-current/extras/conf/configs/fs3Config.conf:/srv/facestream  
/data/fs3Config.conf \  
-v /var/lib/fs/fs-current/extras/conf/configs/faceengine.conf:/srv/  
facestream/data/faceengine.conf \  
-v /var/lib/fs/fs-current/extras/conf/configs/trackengine.conf:/srv/  
facestream/data/trackengine.conf \  
-v /etc/localtime:/etc/localtime:ro \  
--restart=always \  
--detach=true \  
--name=facestream \  
--network=host \  
--env=PORT=34569 \  
--entrypoint /srv/facestream/FaceStream \  
dockerhub.visionlabs.ru/luna/facestream:v.5.1.18 \  
--config-path /srv/facestream/data/fs3Config.conf \  
--data-dir /srv/facestream/data \  
--log-dir /srv/facestream/logs \  
--http-address http://0.0.0.0:34569
```

The configuration files are included in the FaceStream package in the “conf/config/” directory and are added to the container at launch with the following commands:

```
-v /var/lib/fs/fs-current/extras/conf/configs/fs3Config.conf:/srv/facestream
/data/fs3Config.conf \
-v /var/lib/fs/fs-current/extras/conf/configs/faceengine.conf:/srv/
facestream/data/faceengine.conf \
-v /var/lib/fs/fs-current/extras/conf/configs/trackengine.conf:/srv/
facestream/data/trackengine.conf \
```

7.1 Launching keys for server mode with configuration files

To launch FaceStream in server mode with configuration files inside the container, the following command is used, which enables you to specify the correct paths to directories inside the container.

```
--config-path /srv/facestream/data/fs3Config.conf \
--data-dir /srv/facestream/data \
--log-dir /srv/facestream/logs \
--streams-id 426542d6-5509-4e5b-8a01-e2abd5c0a8c6 ee4c42b6-23ae-410e-a2aa-
a4220e64ba4b
--groups-name stream_group-1 stream_group-2
--config-reload 1
--pulling-time 1800
--http-address http://0.0.0.0:34569
```

The following keys are available:

- `--help` - gives a list of available keys and their description.
- `--config-path` – full path to the configuration file “fs3Config.conf” of the application. If this parameter is defined, the path to data is ignored when searching for the configuration file.
- `--data-dir` – path to the directory with detectors and settings data.
- `--log-dir` – directory to record logging files.
- `--streams-id` - tag specifies a list of stream IDs that will be requested from LUNA Streams for processing. Other streams will be filtered. The “stream_id” parameter is given in response to the “create stream” request.

If the `--streams-id` tag is not set, then FaceStream will take all existing “stream_id” from the queue.

If a non-existent value is set, an error about an incorrect UUID will be indicated when launching FaceStream.

- `--streams-name` - list of streams names sets in this tag. Streams names are set using the “name” parameter at the time of their creation (“create streams” request). Streams with these names will be requested from LUNA Streams for processing. Other streams will be filtered.

Otherwise, the principle of operation is similar to the `--streams-id` tag.

- `--groups-id` and `--groups-name` - tags specify a list of group IDs or a list of group names. The parameters “group_id” or “group_name” are set during stream creation (“create stream” request). Streams with these parameters will be requested from LUNA Streams for processing. Other streams will be filtered.

If the `--groups-id/--groups-name` tags are not set, then FaceStream will not filter streams by groups.

If a non-existent value is set, an error about an incorrect UUID will be indicated when launching FaceStream.

- `--config-reload` - tag that enables checking for changes in the “fs3Config.conf” file and takes the following values:
 - 1 - change tracking is enabled, if there are changes in the configuration, all FaceStream containers will be automatically restarted;
 - 0 - change tracking is disabled.

By default, the value equals 1.

- `--pulling-time` - tag that sets the period for receiving new parameters from the “fs3Config.conf” file in the range [1...3600] sec. Used in conjunction with the `CONFIG-RELOAD` tag.

By default, the value equals 10.

- `--http-address` - HTTP address that FaceStream will listen to. It is set in the format “address:port” (used only for FaceStream in server mode). The user will send requests to this address.

You should set the external IP of the FaceStream server. By default, it is set to «http://0.0.0.0:34569».

8 LUNA Streams user interface

A user interface is available for the LUNA Streams service.

The interface can be opened in the browser by specifying the address and port of the LUNA Streams service:

```
<streams_server_address>:<streams_server_port>
```

The default port of the LUNA Streams service is 5160.

It is recommended to read the section [“Interaction of FaceStream with LUNA Streams”](#) before introducing this section.

The user interface of the service contains three tabs - “Streams”, “Groups” and “Queue”.

- “Streams” is a tab where [streams statuses](#) and their preview are displayed, it is possible to configure video stream parameters for each of the sources.
- “Groups” is a tab where [streams groups](#) are displayed.
- “Queue” is a tab where the streams that are in the [processing queue](#) are displayed.

The general view of the available tabs is shown in the figure below:

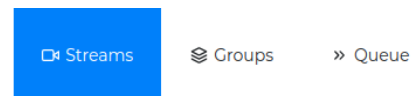


Figure 22: Available tabs

8.1 Streams tab

The “Streams” tab is designed to display all streams, their preview, ID, name, status, description, group and settings of video stream parameters for each source.

The general view of the “Streams” tab is shown in the figure below:

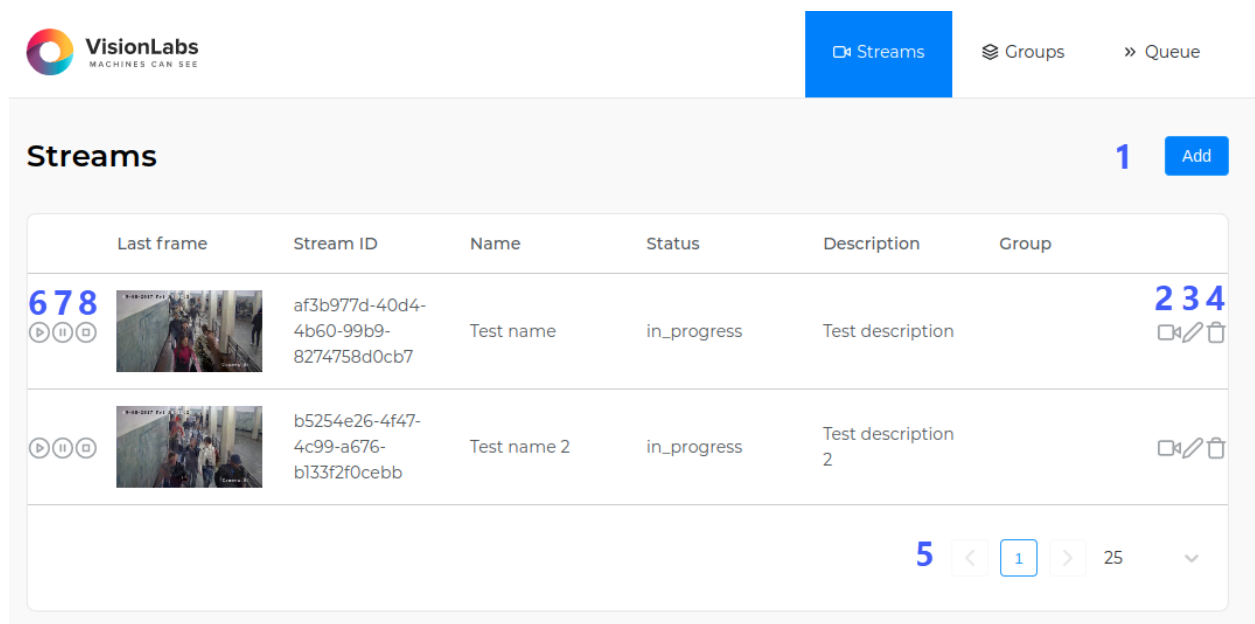


Figure 23: General view of the “Streams” tab

The “Streams” tab contains the following elements:

- “Add” — button to add a stream (1);
- list of streams:
 - “Last frame” — last frame of the video stream (preview);
 - “Stream ID” — ID of the video stream;
 - “Name” — name of the video stream;
 - “Status” — current status of the video stream;
 - “Description” — additional information about the video stream;
 - “Group” — name of the group to which the video stream is linked. You can link a video stream to a group or untie it from it in the “Groups” section;
 - button for viewing the video stream (2);
 - button for editing the video stream parameters (3);
 - button for deleting the video stream (4);
 - number of streams displayed on the page is set by a switch in the lower right corner of the page. In total there can be 10, 25, 50 or 100 video streams on one page (5);
 - buttons to control the processing of the stream:
 - * “Play” button to start processing the stream (6) (sends the request for processing the stream, the stream is distributed to a certain FaceStream instance and that starts processing it);
 - * “Pause” button to pause the processing of the stream, for example, to save resources (7) (suspends the processing of the stream, but the stream remains assigned to the same FaceStream instance);

- * “Stop” button to stop processing the stream (8) (stops the process of processing the stream, the stream is no longer assigned to the same FaceStream instance).

8.1.1 Stream creating

To create a stream, click on the “Add” button, after which the “Create stream” form opens to specify parameters.

Create stream Create

General stream parameters

Account ID

Stream name

Description

Group

Status

Stream data

Type

Full path to the source

ROI coordinates

DROI coordinates

Rotation angle of the image from the source

Frame width

Endless ☐

Sending parameters

Frame analysis period after which the best shot will be sent

Wait duration between track analysis periods

Track analysis and waiting period duration measure

Number of frames that the user sets to receive from the track or certain periods of this track

Send only full set ☐

Delete bestshot and detection data ☐

Use Primary Track ☐

Healthcheck parameters

Maximum number of stream errors to reconnect to the stream

Error count period duration (in seconds)

Time between reconnection attempts (in seconds)

Figure 24: Stream creating

You need to specify the values of the stream parameters and click the “Create” button in the upper right corner of the screen.

The tables below show the correspondence between the description in the user interface and the name of the corresponding parameters.

8.1.1.1 General stream parameters group

This group reflects the general parameters for creating a stream.

Table 16: “General stream parameters” group

| Parameter description | Name in settings |
|-----------------------|---|
| Account ID | Parameter “ account_id ” |
| Stream name | Parameter “ name ” |
| Description | Parameter “ description ” |
| Group | Parameter “ group ” |
| Status | Stream status |

8.1.1.2 Stream data group

This group reflects the main parameters for working with a video stream/video file/images.

Table 17: “Stream data” group

| Parameter description | Name in settings |
|---|--|
| Type | Parameter “ type ” |
| Full path to the source | Parameter “ reference ” |
| ROI coordinates | Parameter “ roi ” |
| DROI coordinates | Parameter “ droi ” |
| Rotation angle of the image from the source | Parameter “ rotation ” |
| Frame width | Parameter “ preferred_program_stream_frame_width ” |
| Endless | Parameter “ endless ” |
| Mask | Parameter “ mask ” |

8.1.1.3 Stream handler parameters group

This group of parameters defines the parameters of the handler created in the LUNA PLATFORM, with which the streams will be processed. Different handlers should be used for the face and body. The handler must be created in LP 5 in advance.

Table 18: “Stream handler parameters” group

| Parameter description | Name in settings |
|--|---|
| Handler URL | Parameter “ origin ” |
| API version | Parameter “ api_version ” |
| ID of the handler for the best frames | Parameter “ handler_id ” of the “ bestshot_handler ” section |
| ID of the handler for event detections | Parameter “ handler_id ” of the “ detection_handler ” section |
| Authorization (Token) | Token from “ authorization ” section |

8.1.1.4 Geoposition group

This group of parameters includes information about the location of the video stream source.

Table 19: Geoposition group

| Parameters | Name in settings |
|---|--------------------------------------|
| City, Area, District, Street, House number, Longitude (in degrees), Latitude (in degrees) | Section “ location ” |

8.1.1.5 Autorestart group

This group of parameters enables you to configure the automatic restart of the stream.

Table 20: Geoposition group

| Parameter description | Name in settings |
|--------------------------------|---|
| Autorestart | Parameter “ restart ” |
| Attempt count | Parameter “ attempt_count ” |
| Autorestart delay (in seconds) | Parameter “ delay ” |

8.1.1.6 Sending parameters group

In this group of parameters, the period during which the frame analysis will be carried out to select the bestshot is determined, as well as all parameters associated with compiling a collection of the bestshots are determined.

Table 21: Sending parameters group

| Parameter description | Name in settings |
|--|---|
| Frame analysis period after which the best shot will be sent | Parameter “time_period_of_searching” |
| Wait duration between track analysis periods | Parameter “silent_period” |
| Track analysis and waiting period duration measure | Parameter “type” |
| Number of frames that the user sets to receive from the track or certain periods of this track | Parameter “number_of_bestshots_to_send” |
| Send only full set | Parameter “send_only_full_set” |
| Delete bestshot and detection data | Parameter “delete_track_after_sending” |

8.1.1.7 Use Primary Track group

This group of parameters is designed to work with access control systems (ACS, turnstiles at the entrances) to simplify the control and implementation of facial recognition technology at the entrance to the protected area. This group of parameters is used only for working with faces.

Table 22: Use Primary Track group

| Parameter description | Name in settings |
|---|--------------------------------------|
| Use Primary Track | Parameter “use_primary_track_policy” |
| Minimum detection size for Primary Track mode | Parameter “best_shot_min_size” |
| Size of detection for the main track | Parameter “best_shot_proper_size” |

8.1.1.8 Healthcheck parameters group

In this group, you can set parameters for reconnecting to the stream if there are errors in playing the stream.

Table 23: Healthcheck parameters group

| Parameter description | Name in settings |
|--|---|
| Maximum number of stream errors to reconnect to the stream | Parameter “ max_error_count ” |
| Error count period duration (in seconds) | Parameter “ period ” |
| Time between reconnection attempts (in seconds) | Parameter “ retry_delay ” |

8.1.1.9 Liveness parameters group

This group of parameters is used to check for Liveness, i.e. to check whether a person in the frame is real and prevents fraud when printed photos or images on the phone are used to pass the Liveness check.

Table 24: Liveness parameters group

| Parameter description | Name in settings |
|--|--|
| Check Head&Shoulders Liveness | Parameter “ use_shoulders_liveness_filtration ” |
| Check RGB ACS Liveness | Parameter “ use_mask_liveness_filtration ” |
| Check FlyingFaces Liveness | Parameter “ use_flying_faces_liveness_filtration ” |
| Which track frames will be checked for Liveness | Parameter “ liveness_mode ” |
| Number of frames in the track for Liveness check when liveness-mode is enabled | Parameter “ number_of_liveness_checks ” |
| Threshold value at which the system will consider that there is a real person in the frame | Parameter “ liveness_threshold ” |
| Livenesses weights (Head&Shoulders, RGB ACS, FlyingFaces) | Parameter “ liveness_weights ” |
| Number of background frames that are used for the corresponding checks | Parameter “ mask_backgrounds_count ” |

8.1.1.10 Filtering parameters group

This group of parameters describes the objects of image filtering and sending the resulting bestshots.

Table 25: Liveness parameters group

| Parameter description | Name in settings |
|---|--|
| Threshold value to filter detections | Parameter <code>"min_score"</code> |
| Head rotation angle threshold (to the left or right, yaw) | Parameter <code>"detection_yaw_threshold"</code> |
| Head tilt angle threshold (up or down, pitch) | Parameter <code>"detection_pitch_threshold"</code> |
| Head tilt angle threshold (to the left or right, roll) | Parameter <code>"detection_roll_threshold"</code> |
| Number of frames used to filter photo images by the angle of tilt of the head | Parameter <code>"yaw_number"</code> |
| Number of frames the system must collect to analyze head yaw angle | Parameter <code>"yaw_collection_mode"</code> |
| Mouth overlap threshold (minimum mouth visibility) | Parameter <code>"mouth_occlusion_threshold"</code> |
| Minimum body detection size | Parameter <code>"min_body_size_threshold"</code> |

8.1.1.11 Additional parameters group

This group of parameters is intended for detailed configuration of video stream processing.

Table 26: Liveness parameters group

| Parameter description | Name in settings |
|--------------------------------------|--|
| Frame processing | Parameter <code>"frame_processing_mode"</code> |
| Number of threads for video decoding | Parameter <code>"ffmpeg_threads_number"</code> |
| Maximum FPS for video processing | Parameter <code>"real_time_mode_fps"</code> |

After saving the settings for the newly created stream, the message Source `<stream_id>` was successfully created will appear.

8.1.2 Stream editing

To edit the stream parameters, click the “Edit” button.

The form of editing the stream is similar to the form of creating the stream.

Change the necessary parameters and click the “Save” button in the upper right corner of the form.

After saving the settings of the stream parameters, the message Source <stream_id> was successfully updated will appear.

8.1.3 Stream deleting

To delete the stream, click the “Delete” button or in the form of editing the stream, click the “Delete” button in the “Streams” tab.

In the pop—up window, you need to confirm the action - click the “Delete” button or cancel the action via the “Cancel” button.

After clicking the “Delete” button, a message about deleting the stream will appear.

8.2 Groups tab

Streams can be grouped. Grouping is designed to combine streams with multiple cameras into logical groups (for example, by territorial feature).

For more information, see [“Streams grouping”](#).

When creating a stream, it can only be added to one group.

The “Groups” tab contains a table that displays the name of groups, group IDs, descriptions, creation dates, account ID in LUNA PLATFORM and group settings.

The “Groups” tab is shown in the figure below:

Groups 1 [Add](#)

| Name | Group ID | Description | Date created | Account ID |
|-------------------|--------------------------------------|------------------------------|-----------------------|--|
| test_group_name_1 | 2dcf968b-af92-4602-8e23-48378c47f765 | test_group_descriptio n_1 | 3/22/2023, 4:45:27 PM | 5667a492-21d5-4c12- bbcf-5f98cd62bf72 |
| test_group_name_2 | d53371bb-6671-4545-a520-0be436c201f2 | test_group_descriptio n_2 | 3/22/2023, 4:47:41 PM | a667a492-21d5-4c12- bbcf-5f98cd62bf72 |

4 < 1 > 25 ▾

Figure 25: “Groups” tab

The “Groups” tab contains the following elements and group parameters:

- “Add” — the button to create a group (1);
- list of groups and their parameters:
 - “Name” — the name of the group;
 - “Group ID” — group ID assigned by LUNA Streams;
 - “Description” — additional user information about the group;
 - “Date created” — date and time of the group creation;
 - “Account ID” — account ID in LUNA PLATFORM 5;
- group edit button (2);
- group delete button (3);
- number of groups displayed on the page is set by the radio button in the lower right corner of the page. There can be 10, 25, 50 or 100 groups on one page (4).

The process of creating, editing, and deleting a group is similar to the processes described above for a stream.

8.2.1 Linking stream to group

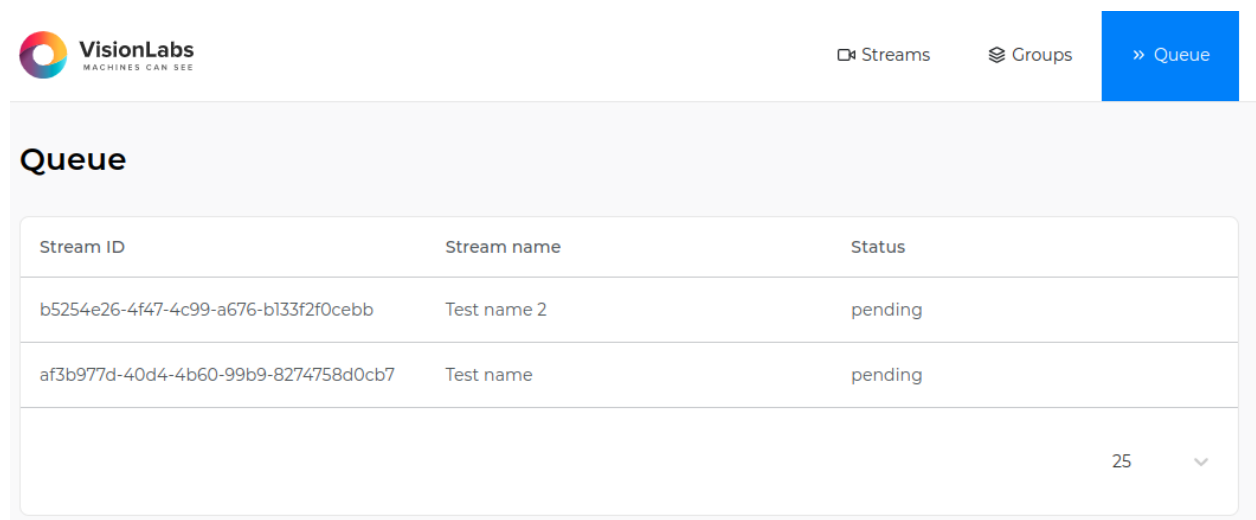
To link a stream to a group, in the “Streams” section in the stream line, click the button to edit the parameters. In the edit form, in the main stream parameters, specify a value for the “Group” parameter from the available drop-down list. The stream will be linked to the selected group. Click the “Save” button in the upper right corner of the form.

8.3 Queue tab

By default, a new stream is created with the status “pending” and immediately enters the processing queue. Processing of the stream can be postponed by specifying the status “pause” when creating. As soon as a free FaceStream worker of a stream with a pool request from the queue appears, the stream is accepted for processing and the status “in_progress” is assigned to it.

For more information, see “[Stream processing queue](#)” section.

The “Queue” tab is informational and is designed to display all the streams in the queue for processing, their IDs and statuses.



| Stream ID | Stream name | Status |
|--------------------------------------|-------------|---------|
| b5254e26-4f47-4c99-a676-b133f2f0cebb | Test name 2 | pending |
| af3b977d-40d4-4b60-99b9-8274758d0cb7 | Test name | pending |

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Figure 26: Queue tab

The “Queue” section contains the following elements and stream parameters:

- list of streams:
 - “Stream ID” — ID of the video stream in LUNA Streams, generated when creating the stream;
 - “Stream name” — the name of the video stream;
 - “Status” — the current status of the video stream;
- number of streams displayed on the page is set by a switch in the lower right corner of the page. There can be 10, 25, 50 or 100 threads on a single page.

9 Monitoring

Monitoring is implemented as sending data to InfluxDB. Monitoring for LUNA Streams is enabled by default. Monitoring for FaceStream is disabled by default. To enable FaceStream monitoring, you need to enable the “[send_data](#)” setting and set additional settings from the “[monitoring](#)” section.

Monitoring for LUNA Streams works similarly to monitoring of LUNA PLATFORM services. This document describes FaceStream monitoring information. See additional information on monitoring LUNA Streams in the “Monitoring” section of the LUNA PLATFORM administrator manual.

The following data is sent to InfluxDB:

- measurement element. It is equal to the value of `fs-requests`.
- tag set:
 - `fs_ip` - IP address where FaceStream is deployed
 - `source` - the “[name](#)” field set when creating a stream in LUNA Streams (optional)
 - `stream_id` - stream ID
- field set:
 - `track_id` - track ID
 - `event_id` - event ID
 - `request_id` - external ID for communication with monitoring of LUNA PLATFORM services
 - `track_start_time` - track start time
 - `track_best_shot_time` - the time when the frame with the bestshot being sent appeared in the system
 - `track_best_shot_min_size_time` (optional) - the time when the detection size reached the value specified in the “[best_shot_min_size](#)” parameter
 - `track_best_shot_proper_size_time` (optional) - time when the detection size reached the value specified in the “[best_shot_proper_size](#)” parameter
 - `liveness_start_time` (optional) - Liveness start time
 - `liveness_end_time` (optional) - Liveness end time
 - `bestshot_count` - the number of bestshots sent
 - `time_from_first_frame_to_send` - the time that passed from the appearance of the first frame in FS to sending to LP
 - `track_send_count` - the number of tracks sent

Tags containing time are sent as UTC with microsecond precision.

- `<timestamp>` element. Is the time the bestshot(s) was(were) sent in microseconds.

There may be several bestshots, because sending from one track at a time counts as one measurement. To save this measurement, InfluxDB uses the last bestshot data from the bestshots group. Data that is unique for each best shot (`track_best_shot_time`, `liveness_start_time`, `liveness_end_time`) will be lost for all bestshots except the last one if sent this way.

If there are no optional fields, the data of these fields will not be sent to the Influxdb.

During normal monitoring operation, no additional information is output to the FaceStream logs. If an error is detected during monitoring, the corresponding message will appear in the FaceStream logs.

9.1 InfluxDB OSS 2

For InfluxDB OSS 2 usage, you should:

- Install the DB. See the “InfluxDB OSS 2 container launch” in the installation without LP manual.
- Register in the DB. InfluxDB has a user interface where you can register. You should visit `<server_ip>:<influx_port>`.
- Configure the display of monitoring information in the GUI. It is not described in this documentation.

10 Outputting information to logs

This section describes additional information that can help you when working with FaceStream logs or the logs of the services required for it.

10.1 FaceStream log output format

FaceStream logs have the following format:

```
[I0317 16:27:07.375125 57 LunaBaseClient.cpp:45] [client] Request
```

Where:

- I0317:
 - I - logging level. 4 levels can be displayed in the logs - I (Info), W (Warning), E (Error), F (Fatal). If necessary, you can set the logging level (see [“severity” parameter](#));
 - 0317 - day and month, i.e. March 17.
- 16:27:07.375125 - timestamp.
- 57 - process PID ID.
- LunaBaseClient.cpp - file name that caused this log line to occur.
- 45 - log string.
- [client] - tag associated with logging the relevant information (see [“tags” parameter](#)).
- Request - description of the log string.

FaceStream errors are not covered in this section.

10.2 LUNA Streams service errors

This section describes the errors returned by the LUNA Streams service. Each of the errors has a unique code. It is convenient to use it to find an error.

The errors can have different reasons.

In case of “Internal server error” or any other unexpected error occurrence, it is recommended to check service logs to find out more information about the error.

When using LUNA Streams together with LUNA PLATFORM services, other LP services may experience errors. In this case, please refer to the LUNA PLATFORM documentation or visit the [online documentation](#) site for a complete list of errors returned by LUNA PLATFORM 5 services.

10.2.1 Code 39001 returned

Error Message:

Object not found Stream with id {value} not found

Error Source:

LUNA Streams service errors

Error Description:

The stream with the specified ID was not found. Make sure that the existing “steam_id” is set. You can get a list of existing “stream_id” by using a GET request to the “/streams” resource.

10.2.2 Code 39002 returned

Error Message:

Bad input data “{value}” is not valid stream status; permitted: {value}.

Error Source:

LUNA Streams service errors

Error Description:

When creating the stream, an incorrect status was entered in the “status” field. You can set only two statuses - “pause” and “pending”. The rest of the statuses can be obtained only at a certain point in time. The error description shows the expected status.

10.2.3 Code 39003 returned

Error Message:

Unable to stop processing Processing of stream with id “{value}” is already in progress and cannot be stopped.

Error Source:

LUNA Streams service errors

Error Description:

It is not possible to set the “pause” status for the specified “stream_id”, since processing has already started (relevant only for video files).

10.2.4 Code 39004 returned

Error Message:

Bad input data "{value}" is not valid stream log target; permitted: {}.

Error Source:

LUNA Streams service errors

Error Description:

A non-existent value of the "targets" parameter is specified in the "/streams/logs" request to receive logs.

10.2.5 Code 39005 returned

Error Message:

Unable to cancel processing Processing of stream with id "{value}" is finished and cannot be cancelled

Error Source:

LUNA Streams service errors

Error Description:

It is not possible to set the "cancel" status for the specified "stream_id", because processing has already been finished.

10.2.6 Code 39006 returned

Error Message:

Unique constraint error Group named {value} already exists

Error Source:

LUNA Streams service errors

Error Description:

Group with specified name already exist.

Enter another name or delete the existing group using the "remove group" request.

10.2.7 Code 39007 returned

Error Message:

Object not found Group named {value} not found

Error Source:

LUNA Streams service errors

Error Description:

Group with specified name was not found.

Check the entered group name.

You can get the list of all existing groups with their parameters using the “get groups” request.

10.2.8 Code 39008 returned

Error Message:

Object not found Group with id {value} not found”

Error Source:

LUNA Streams service errors

Error Description:

Group with specified ID was not found.

Check the entered group ID.

You can get the list of all existing groups with their parameters using the “get groups” request.

10.2.9 Code 39009 returned

Error Message:

Object not found. Not found “{value}” preview url for stream with id “{value}”.

Error Source:

LUNA Streams service errors

Error Description:

The specified preview url (live or last_frame) was not found for the specified stream_id.

Make sure the report contains the required url.

10.2.10 Code 39010 returned

Error Message:

Preview processing error, {value}

Error Source:

LUNA Streams service errors

Error Description:

Preview processing error.

The brackets indicate the error being reported from the stream source.

11 Additional information

11.1 Nuances of working with stream preview

In order to write the preview address of the stream (the `preview > live > url` field) to the LUNA Streams stream, FaceStream must determine its IP address. It determines its IP address in one of two ways:

- through connecting to the LUNA Streams service
- via the system environment variable `VL_FACE_HOST`. The environment variable can be set by executing the following command in the server terminal: `export VL_FACE_HOST=<your_ip_address>`.

If the IP address of the `VL_FACE_HOST` variable is set incorrectly, then LUNA Streams will delete streams with an incorrect address, and FaceStream will terminate with the following error `Failed to validate input json`.

Using an environment variable overrides the way you connect to the LUNA Streams service.

If the IP address of FaceStream is determined by connecting to the LUNA Streams service, then to determine its IP address, FaceStream must always start after LUNA Streams. If for some reason FaceStream started before LUNA Streams (for example, the server was restarted, where both FaceStream and LUNA Streams are running), then FaceStream may terminate with the error `Failed to get local IP address`. Reason. If the FaceStream IP address is determined through the system environment variable `VL_FACE_HOST`, then the above error will not occur.

11.2 Cameras Compatibility

Compatibility of the specified IP cameras with FaceStream is shown in the table below.

Table 27: cameras compatibility

| Camera model | Testing | FaceStream | Results |
|-----------------------------------|----------|------------|----------------------|
| | | Version | |
| Hikvision ds-2cd2822f | Internal | 3.2.2 | No problems detected |
| Hikvision DS-2CD7126G0-IZS | Partners | 3.2.2 | No problems detected |
| Dahua IPC-HDBW8630E-Z | Partners | 3.2.2 | No problems detected |
| WiseNet XNV 8040 WiseNet XNV 8030 | Partners | 3.2.2 | No problems detected |

| Camera model | Testing | FaceStream | |
|--|----------|------------|----------------------|
| | | Version | Results |
| AXIS Q3515-LV | Partners | 3.2.2 | No problems detected |
| Hikvision DS-2CD5126 | Partners | 3.2.2 | No problems detected |
| Vivotek cc8160 | Partners | 3.2.2 | No problems detected |
| Vivotek cc837 | Partners | 3.2.2 | No problems detected |
| ACTi E38 | Partners | 3.2.2 | No problems detected |
| ACTi A92 | Partners | 3.2.2 | No problems detected |
| ACTi E928 | Partners | 3.2.2 | No problems detected |
| Vivotek FD9365-EHTV | Partners | 3.2.2 | No problems detected |
| Vivotek IB9367-EHT | Partners | 3.2.2 | No problems detected |
| Bosch NDI-4502-A | Partners | 3.2.2 | No problems detected |
| Bosch NBN-50022-V3 (Use fisheye Lens 4mp 2.7-12mm Lens(DH-PLZ1040-D FOC 201706050010)) | Partners | 3.2.2 | No problems detected |
| Bosch NUC-21012-F2 | Partners | 3.2.2 | No problems detected |
| Dahua ipc-hdbw2220rp-vfs | Partners | 3.2.2 | No problems detected |
| Dahua ipc-hfw2221r-vfs-ire6 | Partners | 3.2.2 | No problems detected |
| Samsung XNV-8040RP | Partners | 3.2.2 | No problems detected |
| Samsung SNV-SNV-6013P | Partners | 3.2.2 | No problems detected |

| Camera model | Testing | FaceStream | |
|------------------------------------|----------|------------|----------------------|
| | | Version | Results |
| Hikvision DS-2CD2125FWD-IS | Partners | 3.2.2 | No problems detected |
| Hikvision DS-2CD2025FWD-I | Partners | 3.2.2 | No problems detected |
| Hikvision DS-2CD4525FWD-IZH | Partners | 3.2.2 | No problems detected |
| Mobotix MX-S16B (MX-O-SMA-S-6D041) | Partners | 3.2.3 | No problems detected |
| Panasonic WV-S6131/WV-S6130 | Partners | 3.2.3 | No problems detected |
| Panasonic WV-SC588A | Partners | 3.2.3 | No problems detected |