



VisionLabs
MACHINES CAN SEE

Configuration Guide

written for LUNA SDK Mobile iOS version 5.21.0

Contents

Configuration Guide	3
Configuration file location	3
Settings	4
System settings	4
Descriptor factory settings	5
FaceDetV2 detector settings	6
LNet	7
HeadPoseEstimator settings	8
EyeEstimator settings	9
Medical mask estimator settings	10
Quality estimator settings	12
GlassesEstimator settings	13
LivenessOneShotRGBEstimator settings	14
Runtime settings	16

Configuration Guide

Configuration options are specified via `faceengine.conf` file which is basically an XML document with special tag formatting. The document itself is not required to exist, in this case FSDK will fall back to some default settings, which, however, may not be suitable for several tasks.

WARNING! By changing any configuration settings from default ones it is assumed that user understands what these settings do and how they will affect performance and output results of their application. The rule of thumb is this: DO NOT change anything in configuration file unless you really have to.

Always remember that incorrect config may huck the things up very badly. Pay attention to what you configure and how. Always double-check what you deploy.

Some configuration settings may be omitted due to their obscurity and research use case only.

The location where the config file is found varies across different systems but tries to be as consistent as possible.

The config file format is optimized for deserialization of several FSDK types:

- Int1 - scalar 32 bit integral numeric type
- Int2 - 2-d 32 bit integral numeric type (aka Vector2i, Size)
- Int3 - 3-d 32 bit integral numeric type
- Int4 - 4-d 32 bit integral numeric type (aka Rect)
- Float1 - scalar 32 bit floating point numeric type
- Float2 - 2-d 32 bit floating point numeric type (aka Vector2f)
- Float3 - 3-d 32 bit floating point numeric type
- Float4 - 4-d 32 bit floating point numeric type
- String - short null-terminated string (max. 16 characters including the null-terminator)

Configuration file location

The location where the config file is found varies across different systems but tries to be as consistent as possible. Path resolution is the following:

Mobile platforms

- Look for “`data/faceengine.conf`” in current working directory.

Settings

System settings

Parameter	Description	Type	Default value
verboseLogging	Level of log verbosity. 1 - Errors, 2 - Warnings, 3 - Info, 4 - Debug.	"Value::Int1"	2

Verbosity level sets the upper limit of what type of messages may be printed out by the Luna SDK. For example, if user set verboseLogging to 3, it means that Errors, Warnings and Info messages will be printed out to the console. Verbose level of 0 indicates that there are no logging messages printed out at all.

Example:

```
<section name="system">  
  <param name="verboseLogging" type="Value::Int1" x="0" />  
</section>
```

Descriptor factory settings

Descriptor factory is a facility that creates descriptor extractors and matchers. Both of them utilize algorithms that require a number of coefficients (“weights”) to operate properly.

Parameter	Description	Type	Default value
model	CNN face descriptor version. Possible values: 59	"Value::Int1"	59
useMobileNet	MobileNet is faster but less accurate. Possible values: 0 - don't use mobile net version, 1 - use mobile net version.	"Value::Int1"	1
distance	Distance between descriptors on matching. L1 faster, L2 make better precision. Possible values: L1, L2. Model 59 supports just L2 distance.	"Value::String"	"L2"
descriptorCountWarningLevel	Threshold, that limits the ratio of created descriptors to the amount, defined by your license. When the threshold is exceeded, FSDK prints the warning.	"Value::Float1"	0.9
calcSimilarity	Enable similarity calculation during matching process. Possible values: 1 - enable, 0 - disable.	"Value::Int1"	1
calcDistanceSqrt	Enable calculation of the square root of distance. Possible values: 1 - enable, 0 - disable	"Value::Int1"	1

Example:

```
<section name="DescriptorFactory::Settings">
  <param name="model" type="Value::Int1" x="59" />
  <param name="useMobileNet" type="Value::Int1" x="1" />
  <param name="distance" type="Value::String" text="L2" />
  <param name="descriptorCountWarningLevel" type="Value::Float1" x="0.9" />
  <param name="calcSimilarity" type="Value::Int1" x="1" />
  <param name="calcDistanceSqrt" type="Value::Int1" x="1" />
</section>
```

FaceDetV2 detector settings

Parameter	Description	Type	Default value
FirstThreshold	1-st threshold in [0..1] range.	"Value::Float1"	0.6
SecondThreshold	2-nd threshold in [0..1] range.	"Value::Float1"	0.7
ThirdThreshold	3-d threshold in [0..1] range.	"Value::Float1"	0.6
minFaceSize	Minimum face size in pixels.	"Value::Int1"	50
scaleFactor	Image scale factor.	"Value::Float1"	0.7
paddings	Extension of rectangle. Do not change.	"Value::Float4"	see below
redetectTolerance	Redetection threshold.	"Value::Int1"	0
useLNet	Whether to use LNet or not.	"Value::Int"	1

“MinSize” and “scaleFactor” accelerate face detection at the cost of lower recall for smaller faces.

Example:

```
<section name="FaceDetV2::Settings">
  <param name="FirstThreshold" type="Value::Float1" x="0.51385"/>
  <param name="SecondThreshold" type="Value::Float1" x="0.248"/>
  <param name="ThirdThreshold" type="Value::Float1" x="0.76"/>
  <param name="minFaceSize" type="Value::Int1" x="50" />
  <param name="scaleFactor" type="Value::Float1" x="0.7" />
  <param name="paddings" type="Value::Float4" x="-0.20099958" y="
    0.10210337" z="0.20363552" w="0.08490226" />
  <param name="redetectTolerance" type="Value::Int1" x="0" />
  <param name="useLNet" type="Value::Int1" x="0" />
</section>
```

LNet

This group of parameters is non-public. Do not change any of the parameters.

HeadPoseEstimator settings

In mobile mode, HeadPose estimator is able to compute head pose angles using raw input image data only.

Default configuration settings enables estimation method by image.

Parameter	Type	Default value
useEstimationByImage	"Value::Int1"	1
useEstimationByLandmarks	"Value::Int1"	0

Example:

```
<section name="HeadPoseEstimator::Settings">
  <param name="useEstimationByImage" type="Value::Int1" x="1"/>
  <param name="useEstimationByLandmarks" type="Value::Int1" x="0"/>
</section>
```


EyeEstimator settings

This estimator aims to determine:

- Eye state: Open, Closed, Occluded;
- Precise eye iris location as an array of landmarks;
- Precise eyelid location as an array of landmarks.

To determine more exact eye state additional auxiliary model `eye_status_estimation_flwr*.plan` is used. You can enable this auxiliary model through config (`faceengine.conf`).

Parameter	Description	Type	Default value
useStatusPlan	0 - Off, 1 - On	"Value::Int1"	1

Example:

```
<section name="EyeEstimator::Settings">
  <param name="useStatusPlan" type="Value::Int1" x="1"/>
</section>
```

Medical mask estimator settings

Medical mask estimator predicts predominant mask features.

Estimator accuracy depends on thresholds listed below.

If accuracy (low FPR) is more important, TPR could be sacrificed by heightening the threshold.

Corresponding FPR and TPR values are also listed below.

Thresholds for MedicalMaskEstimation

The below parameters specify parameter thresholds in the [0..1] range and are of the "Value::Float1" type.

Parameter	Threshold range	Default threshold	FPR range	TPR range
maskThreshold	0.65 - 0.9	0.65	0.014 - 0.01	0.976 - 0.886
noMaskThreshold	0.65 - 0.79	0.65	0.01 - 0.005	0.94 - 0.903
occludedFaceThresh	0.5 - 0.602	0.5	0.016 - 0.01	0.924 - 0.881

Thresholds for MedicalMaskEstimationExtended

The below parameters specify parameter thresholds in the [0..1] range and are of the "Value::Float1" type.

Parameter	Threshold range	Default threshold	FPR range	TPR range
maskExtendedThreshold	0.65 - 0.784	0.65	0.013 - 0.01	0.923 - 0.894
noMaskExtendedThreshold	0.65 - 0.79	0.65	0.01 - 0.005	0.94 - 0.903
maskNotInPlaceExtendedThr	0.65 - 0.85	0.65	0.009 - 0.005	0.918 - 0.833
occludedFaceExtendedThresh	0.5 - 0.602	0.5	0.016 - 0.01	0.924 - 0.881

Example:

```
<section name="MedicalMaskEstimatorV3::Settings">  
  <param name="maskExtendedThreshold" type="Value::Float1" x="0.65"/>  
</section>
```

```
<param name="noMaskExtendedThreshold" type="Value::Float1" x="0.65"
/>
<param name="maskNotInPlaceExtendedThreshold" type="Value::Float1" x
="0.65"/>
<param name="occludedFaceExtendedThreshold" type="Value::Float1" x="
0.5"/>
<param name="maskThreshold" type="Value::Float1" x="0.65"/>
<param name="noMaskThreshold" type="Value::Float1" x="0.65"/>
<param name="occludedFaceThreshold" type="Value::Float1" x="0.65"/>
</section>
```

Quality estimator settings

Quality estimator looks at several image parameters, like lightness (think overexposure), darkness (think underexposure), blurriness, illumination uniformity value, specularity value. Every float value is comparing with according threshold.

Parameter	Type	Default value
blurThreshold	"Value::Float1"	x="0.61"
lightThreshold	"Value::Float1"	x="0.57"
darknessThreshold	"Value::Float1"	x="0.50"
illuminationThreshold	"Value::Float1"	x="0.1"
specularityThreshold	"Value::Float1"	x="0.1"

Example:

```
<section name="QualityEstimator::Settings">
  <param name="blurThreshold" type="Value::Float1" x="0.61"/>
  <param name="lightThreshold" type="Value::Float1" x="0.57"/>
  <param name="darknessThreshold" type="Value::Float1" x="0.50"/>
  <param name="illuminationThreshold" type="Value::Float1" x="0.1"/>
  <param name="specularityThreshold" type="Value::Float1" x="0.1"/>
</section>
```

GlassesEstimator settings

Glasses estimator estimates what types of glasses, if any, person is currently wearing. Quality of estimation depends on threshold values listed below. These threshold values set to optimal by default.

Parameter	Description	Type	Default value
noGlassesThreshold	noGlasses threshold in [0..1] range.	"Value::Float1"	0.986
eyeGlassesThreshold	eyeGlasses threshold in [0..1] range.	"Value::Float1"	0.57
sunGlassesThreshold	sunGlasses threshold in [0..1] range.	"Value::Float1"	0.506

Example:

```
<section name="GlassesEstimator::Settings">
  <param name="noGlassesThreshold" type="Value::Float1" x="0.986"/>
  <param name="eyeGlassesThreshold" type="Value::Float1" x="0.57"/>
  <param name="sunGlassesThreshold" type="Value::Float1" x="0.506"/>
</section>
```

LivenessOneShotRGBEstimator settings

This estimator tells whether the person's face is real or fake (photo, printed image). Thresholds are listed below.

Liveness protects from presentation attacks - when user tries to cheat biometric system by demonstrating fake face to the face capturing camera, but not from image substitution attacks - when fake image is sent directly to the system, bypassing the camera.

LivenessOneShotRGBEstimator supports images, which are captured on Mobile devices or Webcam (PC or laptop). Correct working of the estimator with other source images is not guaranteed.

Supported shooting mode: cooperative, which means that user must interact with the camera and look at it.

User scenarios examples: authentication in mobile application, confirmation of transactions with biometric facial verification.

Image resolution minimum requirements:

- Mobile devices - 720 × 960 px
- Webcam (PC or laptop) - 1280 x 720 px

Parameter	Description	Type	Default value
netType	NET version.	"Value::Int1"	0
realThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5
qualityThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5
calibrationCoeff	Coefficient in [0..1] range.	"Value::Float1"	0.805
mobileRealThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5
mobileQualityThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5
mobileCalibrationCoeff	Coefficient in [0..1] range.	"Value::Float1"	0.98
liteRealThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5
liteQualityThreshold	Threshold in [0..1] range.	"Value::Float1"	0.5

Parameter	Description	Type	Default value
liteCalibrationCoeff	Coefficient in [0..1] range.	"Value::Float1" "	0.993

```

<section name="LivenessOneShotRGBEstimator::Settings">
  <param name="netType" type="Value::Int1" x="0" />
  <!--Parameters for backend version (netType == 0) -->
  <param name="realThreshold" type="Value::Float1" x="0.5"/>
  <param name="qualityThreshold" type="Value::Float1" x="0.5" />
  <param name="calibrationCoeff" type="Value::Float1" x="0.805"/>
  <!--Parameters for mobile version (netType == 1) -->
  <param name="mobileRealThreshold" type="Value::Float1" x="0.5"/>
  <param name="mobileQualityThreshold" type="Value::Float1" x="0.5" />
  <param name="mobileCalibrationCoeff" type="Value::Float1" x="0.98"/>
  <!--Parameters for lite version (netType == 2) -->
  <param name="liteRealThreshold" type="Value::Float1" x="0.5"/>
  <param name="liteQualityThreshold" type="Value::Float1" x="0.5" />
  <param name="liteCalibrationCoeff" type="Value::Float1" x="0.993"/>
</section>

```

Runtime settings

Runtime configuration file provides parameters that user can tweak to achieve optimal performance of their app.

Note: The setting `<param name="numThreads" type="Value::Int1" x="-1"/>` means that will be taken the maximum number of available threads. This number of threads is equal to according number of available processor cores.

The name of runtime configuration file is `runtime.conf` and its placed in data directory. Its settings are described below:

Parameter	Description	Type	Default value
<code>cpuClass</code>	Class of cpu by supported instructions - cpu, arm, auto.	"Value::String"	"auto"
<code>deviceClass</code>	Execution device type - cpu, gpu.	"Value::String"	"cpu"
<code>numThreads</code>	Number of worker threads. Default: number of CPU logical cores.	"Value::Int1"	-1
<code>verboseLogging</code>	Level of log verbosity. 1 - Errors, 2 - Warnings, 3 - Info, 4 - Debug.	"Value::Int1"	0
<code>programCacheSize</code>	Maximum number of Program objects in cache. Should be less than 10000.	"Value::Int1"	128

Verbosity level sets the upper limit of what type of messages may be printed out. For example, if user set `verboseLogging` to 3, it means that Errors, Warnings and Info messages will be printed out to the console. Verbose level of 0 indicates that there are no logging messages printed out at all.

Increasing the `programCacheSize` increases memory usage and potentially improves performance. Be careful, too large a value of this parameter can lead to a crash due to insufficient memory.

Example:

```
<section name="Runtime">
  <param name="cpuClass" type="Value::String" text="auto" />
  <param name="deviceClass" type="Value::String" text="cpu" />
  <param name="numThreads" type="Value::Int1" x="-1" />
  <param name="verboseLogging" type="Value::Int1" x="0" />
  <param name="programCacheSize" type="Value::Int1" x="128" />
</section>
```