

# Face SDK

Facial recognition, face analytic and attribute rating library for server, mobile and embedded solutions requiring image and streaming video processing

# Key features



## 01 / Unique face recognition technology

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Face SDK recognizes faces in photos and video streams with high accuracy. According to NIST FRVT, 1:1 recognition accuracy reaches 99.62%.

## 02 / Compatibility with small power equipment – Edge AI Support

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Face SDK is undemanding to computation power and supports mobile devices, single-board computers, portable electronics, IoT.

## 03 / GPU acceleration

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Face SDK improves app performance by up to 55 times for heavy workloads and other use cases that require high performance.

## 04 / Simple integration

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A complete set of resources to accelerate the app development based on Face SDK (detailed documentation, code samples, technical support via messenger).



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# Face Detector

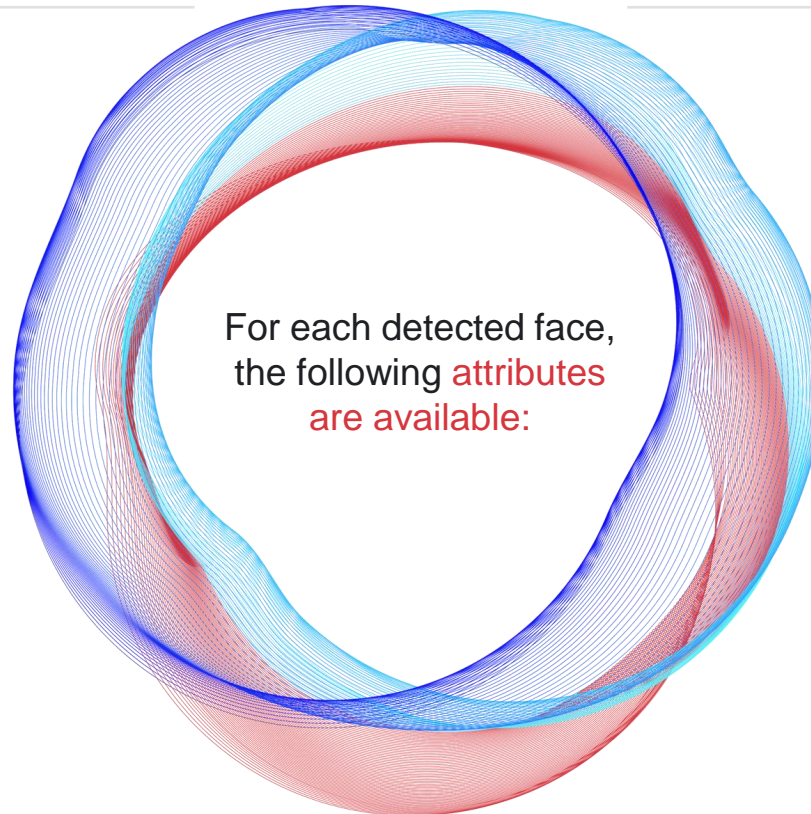
Face Detector is a component for detecting faces in images. The result of the component's work is a list of detected faces.

**Bounding Box** — position and size of the face in the original image.

**Iris Landmarks** — coordinates of 40 points of the eyes (pupils and eyelids).

**Face Landmarks** — 2D coordinates of the anthropometric points of the face.

**Face Mesh** — 3D coordinates of 470 anthropometric points of the face.



For each detected face, the following **attributes** are available:

**Head Rotation Angles**



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# Attributes Estimators

Face SDK provides a set of tools for estimating images of faces received from the Face Detector component

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Attribute

Accuracy

Gender

97%

Age

Average error  
+/-4 years

## Gender-Age Estimator

is used for estimating the gender and age of people by using their face images.

# Emotions Estimator

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Attribute

Accuracy

Emotions

80%

## Emotions Estimator

is used for estimating the prevailing emotional state of a person:



Happy



Neutral



Disgusted



Surprised



Angry



Sad



Scared

# Quality Estimator

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## Quality Estimator

provides an appraisal of face image quality as a single number or a set of separated appraisals of quality parameters:

01 /



uniformity of illumination

02 /



intensity dynamic range

03 /



sharpness level

04 /



flare level

05 /



noise level



# Mask Estimator

## Mask Estimator

determines the presence/absence of a mask on the face.

Attribute

Accuracy

## Eyes Openness Estimator

is used for estimating the eyes' state on the face image. This component provides the verdict "open" or "closed" for the right and left eye.

Face  
without a mask

99%

Face  
with a mask

97%

# Face Recognition

Face SDK provides components and algorithms to recognize and compare faces. This functionality is based on the operations with a biometric face template.

A biometric face template is

a unique set of biometric features extracted from a face image. Templates are used to compare two face images and to determine a degree of similarity.

A biometric face template has the following key characteristics:

01 /

It does not contain personal data



02 /

It cannot be used to restore face image



03 /

It can be serialized and saved to file, database, or sent over a network



04 /

It can be indexed

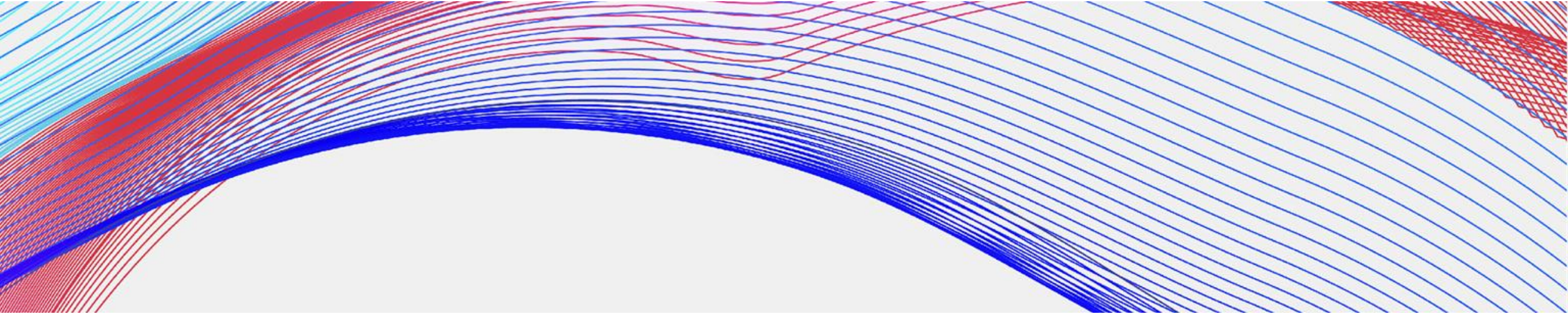
That helps accelerate face template matching process by using a special index for face template batch.





# Encoder

extracts biometric face template from a face image received from Face Detector.



## Face SDK has several algorithms

with different characteristics of speed and accuracy for all possible use cases - from low-powered embedded devices to expert face recognition systems.

## Extracting a biometric template

is one of the most computation-heavy operations, so Face SDK provides the ability to use a GPU accelerator to increase performance.

# Matcher

allows performing the following comparison operations with templates created by Encoder:

## Verification 1:1

comparing of two biometric templates (faces) between each other, estimating of coincidence.

When comparing face templates, **Matcher calculates the difference between biometric features of faces**. The calculations result in a measure of the correspondence for the images of faces and the probability of belonging to one person.

Templates, extracted using different algorithms, have different properties and cannot be compared with each other.

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NIST Face Recognition  
Vendor Test (FRVT) 1:1

Score

VISA, True Acceptance  
Rate (@FAR 1E-6)

99,9965%

MUGSHOT, True Acceptance  
Rate (@FAR 1E-6)

99,9977%

VISA BORDER, True Acceptance  
Rate (@FAR: 1E-6)

99,9977%

Face SDK accuracy by NIST (28-10-2021)

# Liveness Estimators



The Liveness components are used to assess whether the face detected in the image or in video is real or fake. These components protect against malicious actions (spoofing attacks) using a photo or video image instead of a real face.

01 /

## Active Liveness Estimator

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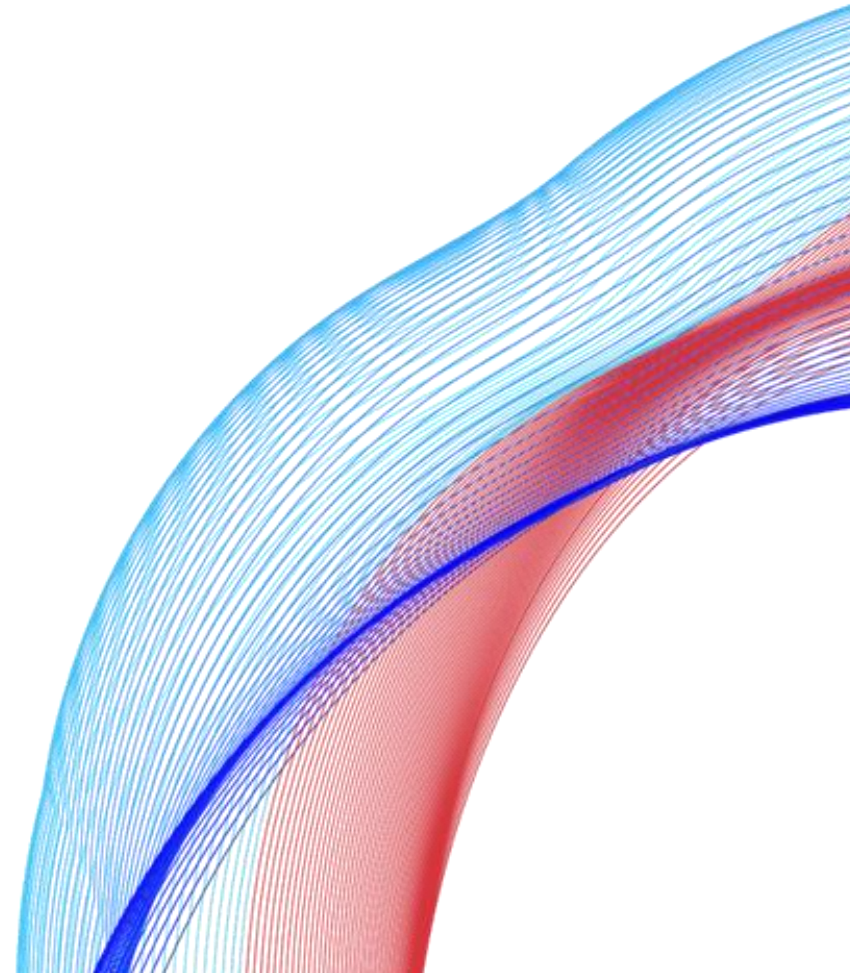
analyzes certain human actions according to the check script, for example: “blink”, “smile”, “turn your head” in order to distinguish a real live face from video or photo image.

02 /

## 2D / RGB Liveness Estimator

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assesses the liveness of a face in an RGB image. To perform the check, the appearance of the face in the field of view of the camera is sufficient.





# Video Engine

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is used for real-time processing of video streams.

This component solves the following tasks:

01 /

Face detection and tracking

02 /

Face recognition (optional)

03 /

Liveness checking (optional)

04 /

Determination of age, gender, and emotions (optional)

## Video Engine works in a multi-stream mode

Each stream is a sequence of images (frames) obtained from one source (for example, a camera or video).

## All streams are processed by Video Engine at the same time

Streams, frames, and detected faces in the frame are assigned their own identifiers. During face tracking, a track of this face is formed on the sequence of stream images, which is also indicated by its own ID.

## The set of identifiers allows you to accurately trace the generated events for each stream

To handle the events, Video Engine implements a callback interface that provides event data and allows you to define application behavior.





## Body Detector

The body detector is used to detect human bodies on an image, which increases the possibility of detecting people in the frame even when the faces are not visible.



## Object Detector

Object Detector is used to detect multiple various objects on an image, for example: body, bicycle, car, motorcycle, bus, train, truck, traffic\_light, fire\_hydrant, stop\_sign, bird, cat, dog, horse, sheep, cow, bear, backpack, umbrella, handbag, suitcase, sports\_ball, baseball\_bat, skateboard, tennis\_racket, bottle, wine\_glass, cup, fork, knife, laptop, phone, book, scissors.



## Licensing

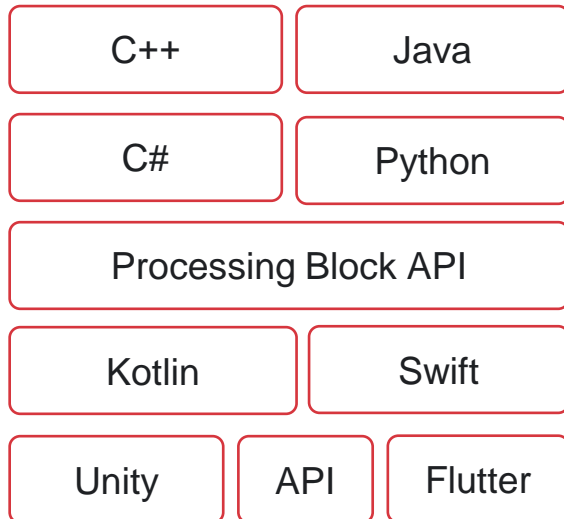
3DiVi Face SDK supports all major platforms and is available on flexible license terms. Platform licensing or fine-grained licensing of individual features is possible upon request.



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# Executable files of the demo samples

Face SDK includes a set of samples that show how to work with:

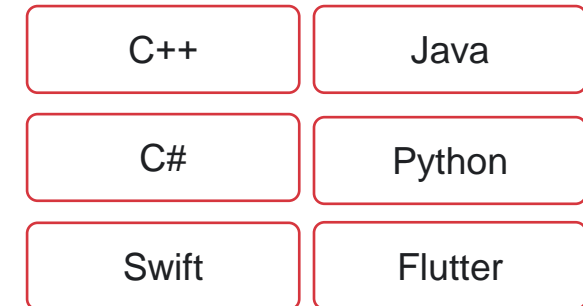


The pre-built samples are located in the bin.



...directories.

You can find the source code in the examples directory



# Processing Block Sample



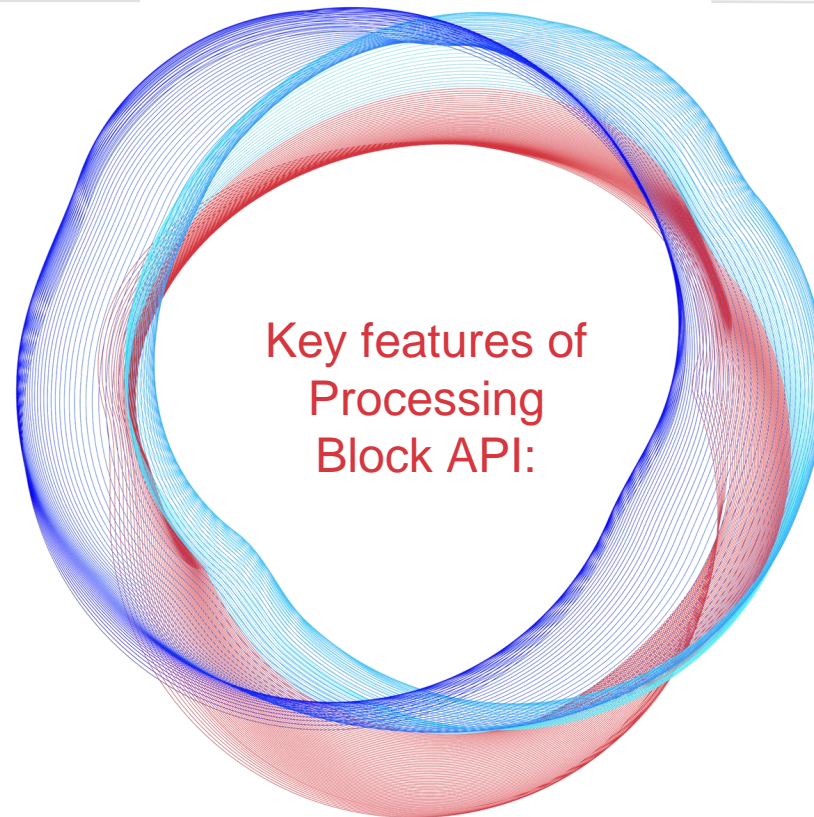
The processing\_block\_demo sample demonstrates the usage of Processing Block API and compatible components.

Combining many components into a single integration

Rapid implementation

Simplicity and ease of learning

Long term support and updates



## The Processing Block AP

is an alternative, scalable interface that replaces existing APIs for easier integration of SDK capabilities into your application.



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# Set of Processing Blocs



## Face Detector

is a component used to detect human faces on an image. The detection result is a bounding rectangle (a frame) around the detected face.



## Human Body Detector

is a component used to detect human bodies on an image. The detection result is a bounding rectangle (a frame) around the detected body.



## Object Detector

is a component used to detect multiple objects on an image. The detection result is a bounding rectangle (a frame) around the detected object with classification name.



## Human Pose Estimator

is a component used to estimate human body skeleton keypoints on an image. The detection result is a list of keypoints with their coordinates and confidence score of the detected human body.



## Emotion Estimator

is a component used to estimate human emotions from the cropped face image. The estimator result is a confidence for every emotion estimated.



## Age Estimator

is a component used to estimate a human age from the cropped image with a face. The estimator result is a human age.



## Gender Estimator

is a component used to estimate a human gender from the cropped image with a face. The estimator result is a verdict about gender identity.



## Quality Assessment Estimator

is a component used to assess the quality of a face in an image for identification tasks on a single colored image. The detection result is a list of the detected human faces with a verbose quality score.



# Technical Specifications

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## Accuracy of Face Attributes Detection

Detection Attributes	Accuracy Rate
Gender	95%
Emotion	80%
Age	3.95 y/o (mean Average Error)



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# Performance Data



The tables in this section show the speed measurements for Face SDK modules using CPU and GPU.

## Timing Characteristics of Detectors\*

Detector	GPU (NVIDIA GTX 1080 Ti)	CPU (Core i7-7700K 4.4GHz)
ULD	22 ms	38 ms
BLF	11 ms	13 ms
SSYV	26 ms	94 ms

\* Speed is indicated for 4 faces in an image with a resolution of 1280x720.

# Identification Timing Characteristics



## Desktop

Method	GPU (NVIDIA GTX 1070)	CPU (Core i5-9400 4.0 GHz)
12v1000	47 ms	442 ms
12v100	8 ms	49 ms
12v50	6 ms	21 ms
12v30	5 ms	12 ms

## Mobile

Method	CPU (Qualcomm Snapdragon 845)
12v1000	7968 ms
12v100	801 ms
12v50	270 ms

Note: The speed test was performed using Google Pixel 3.



Demo Face  
SDK →



Demo Image Quality  
Rating →



# Contact Us

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