Face Recognition

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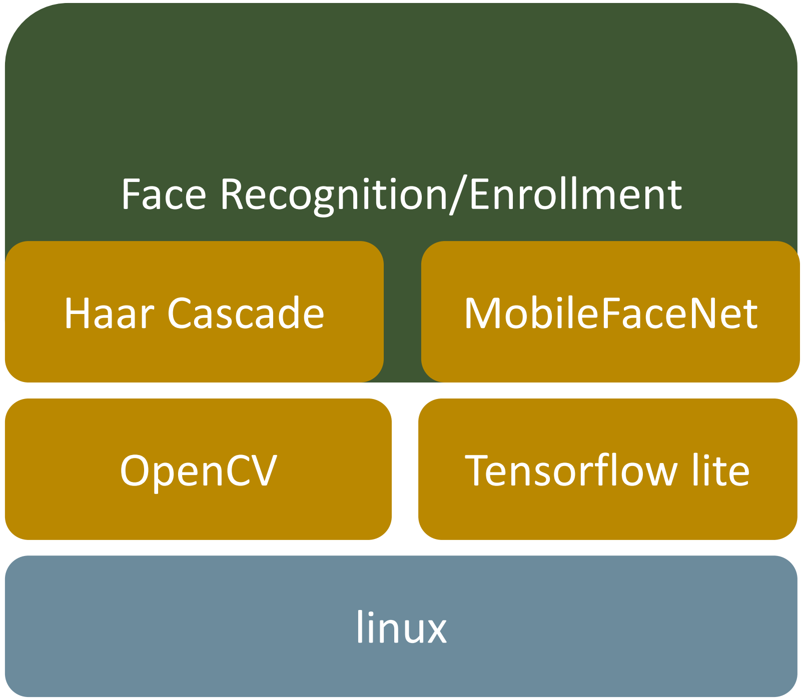
| Photo by Jeffery Cheng

Architecture

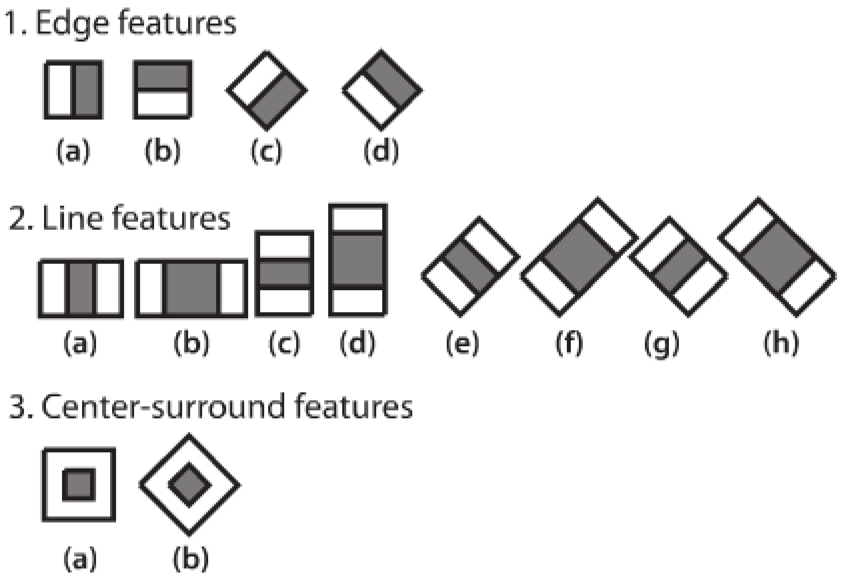


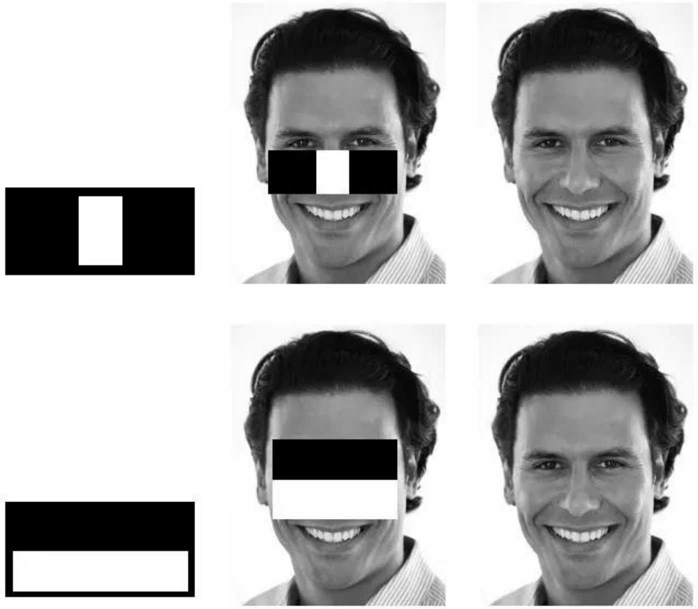
OpenCV

- Open source computer vision library
- C++, C, Python and Java interfaces
- Supports Windows, Linux, Mac OS, iOS and Android
- Support Neon intrinsics
- Component
  - Core functionality – basic building blocks of the library
  - Image processing – image processing functions
  - Application utils – application utils (GUI, image/video input/output)
  - Camera calibration and 3D reconstruction – extract 3D world information form 2D images
  - 2D features framework – feature detectors, descriptors and matching framework
  - Deep neural networks – infer neural network using built-in dnn module

Haar Cascade

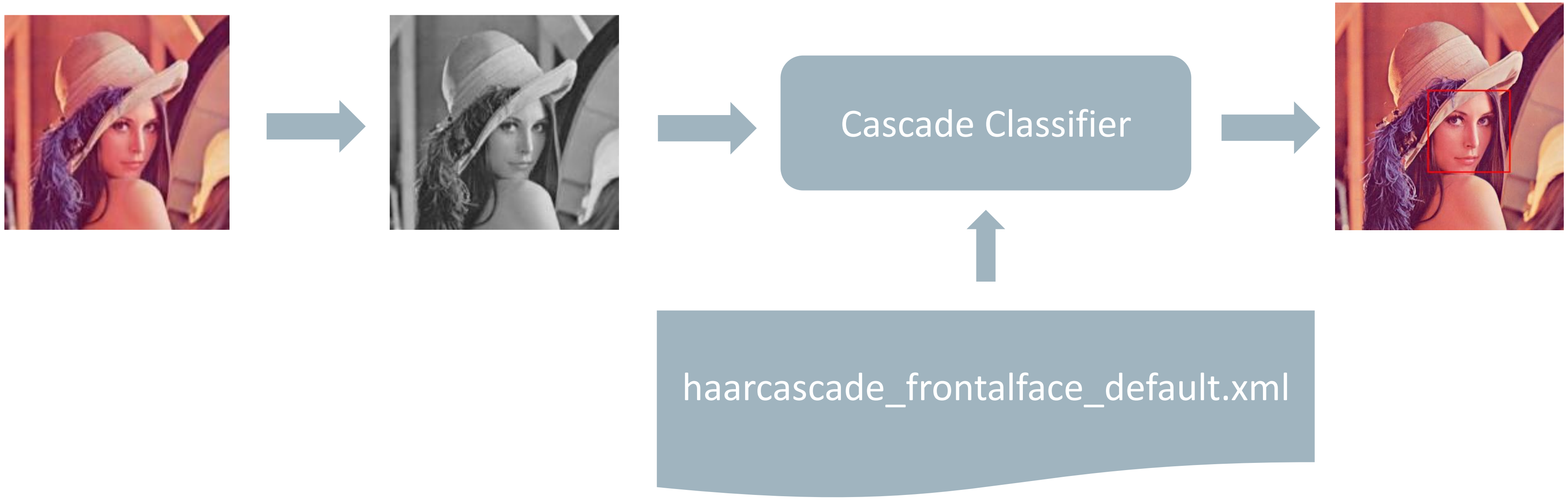
- Haar-like features
  - Digital image features used in object recognition





Haar Cascade

- Face detection flow



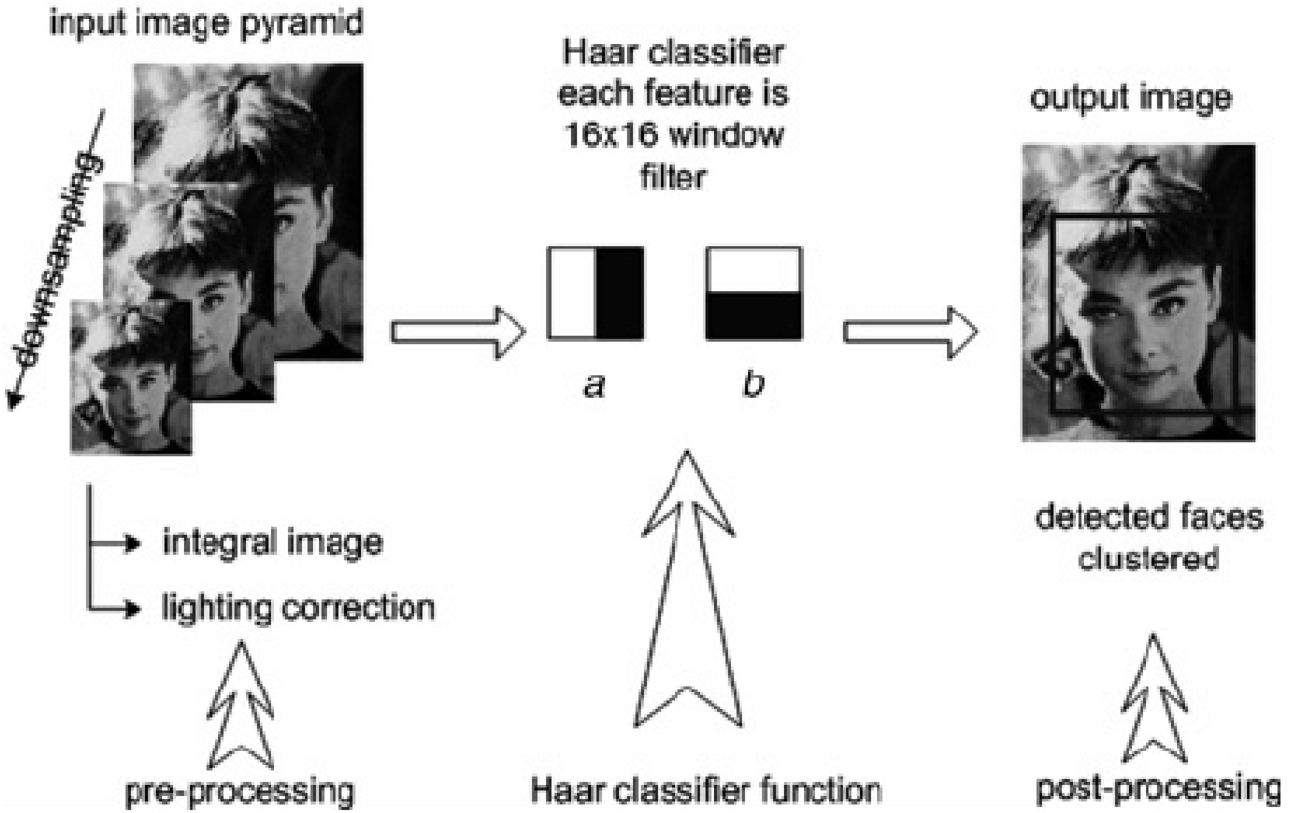
Cascade Classifier

haarcascade_frontalface_default.xml

haarcascade_frontalface_default.xml: Pre-trained classifier data file from OpenCV

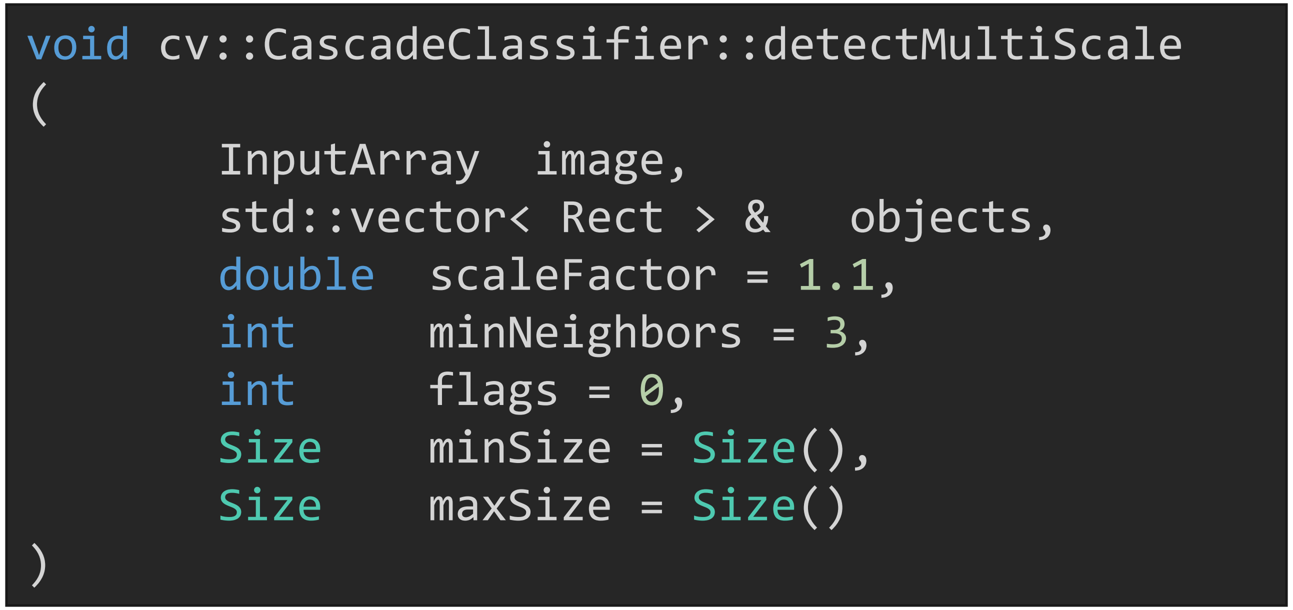
Haar Cascade

- Cascade classifier



Haar Cascade

- OpenCV API



```
void cv::CascadeClassifier::detectMultiScale
(
        InputArray  image,
        std::vector< Rect > &   objects,
        double  scaleFactor = 1.1,
        int     minNeighbors = 3,
        int     flags = 0,
        Size    minSize = Size(),
        Size    maxSize = Size()
)
```

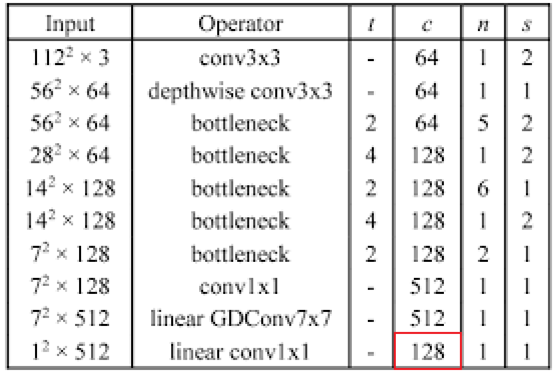
  - scaleFactor: Increasing this factor. speed up detection process, but high miss rate.
  - minSize: Minimum possible object size. Objects smaller than that are ignored
  - maxSize: Maximum possible object size. Objects larger than that are ignored. If maxSize == minSize model is evaluated on single scale.

Tensorflow Lite

- A set of tools that helping developer run their models on mobile, embedded, and IoT devices
- Features
  - Multiple platform support. Android and iOS devices, embedded linux, and microcontroller.
  - Java, Swift, Objective-C, C++ and Python interfaces
  - XNNPACK: A highly optimized library of floating-point neural network inference operators.
    - ARM64
    - ARMv7 (with neon)
    - x86 and x86-64

MobileFaceNet

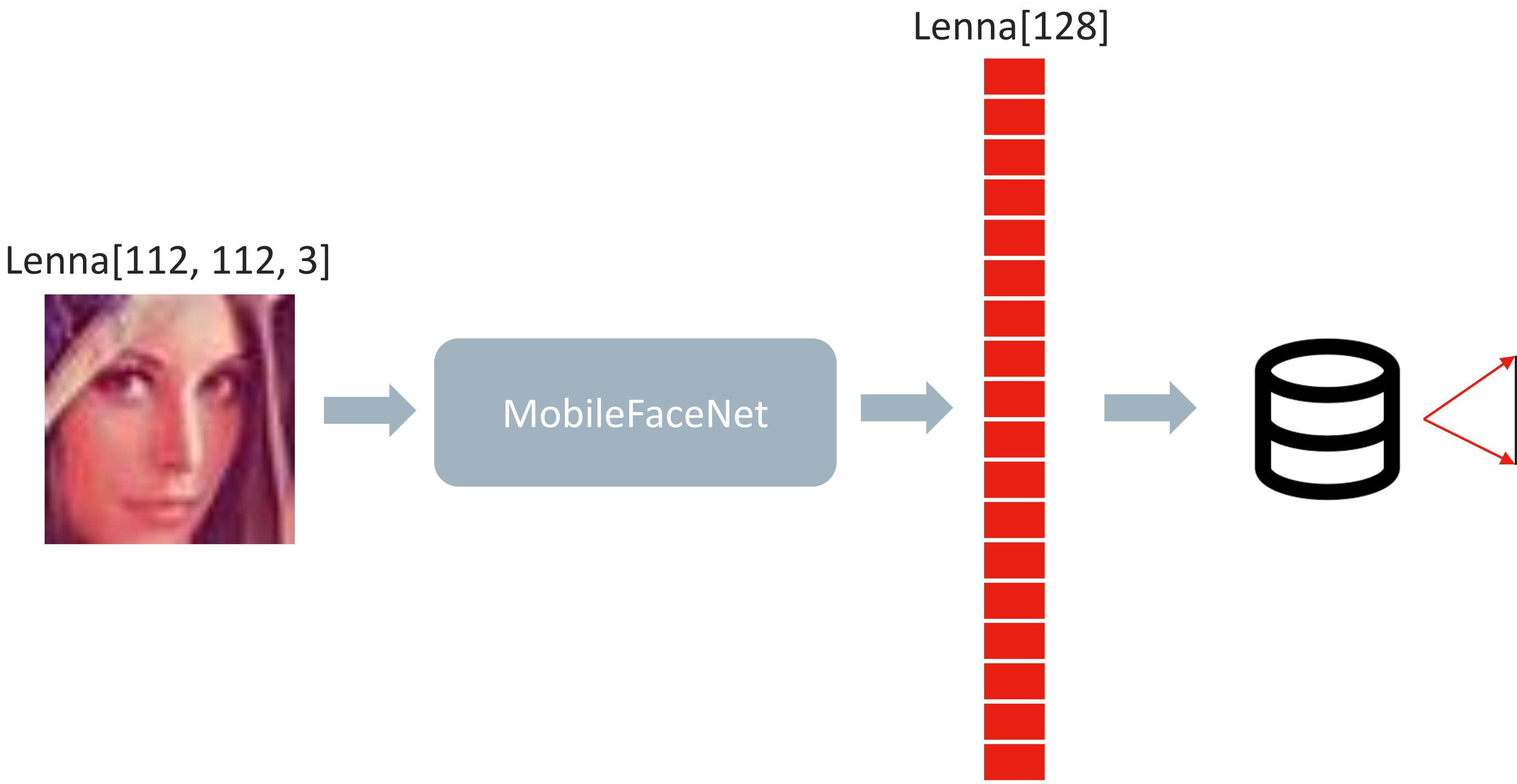
- MobileNet V2 enhance version. Used for face recognition on mobile device
- Model implement source
  - ◦ https://github.com/sirius-ai/MobileFaceNet_TF
  - ◦ https://github.com/leondgarse/Keras_insightface



Input	Operator	t	c	n	s
$112^2 \times 3$	conv3x3	-	64	1	2
$56^2 \times 64$	depthwise conv3x3	-	64	1	1
$56^2 \times 64$	bottleneck	2	64	5	2
$28^2 \times 64$	bottleneck	4	128	1	2
$14^2 \times 128$	bottleneck	2	128	6	1
$14^2 \times 128$	bottleneck	4	128	1	2
$7^2 \times 128$	bottleneck	2	128	2	1
$7^2 \times 128$	conv1x1	-	512	1	1
$7^2 \times 512$	linear GDConv7x7	-	512	1	1
$1^2 \times 512$	linear conv1x1	-	128	1	1

feature embedding

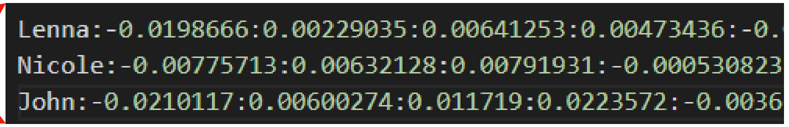
Face Enrollment



Lenna[128]

Lenna[112, 112, 3]

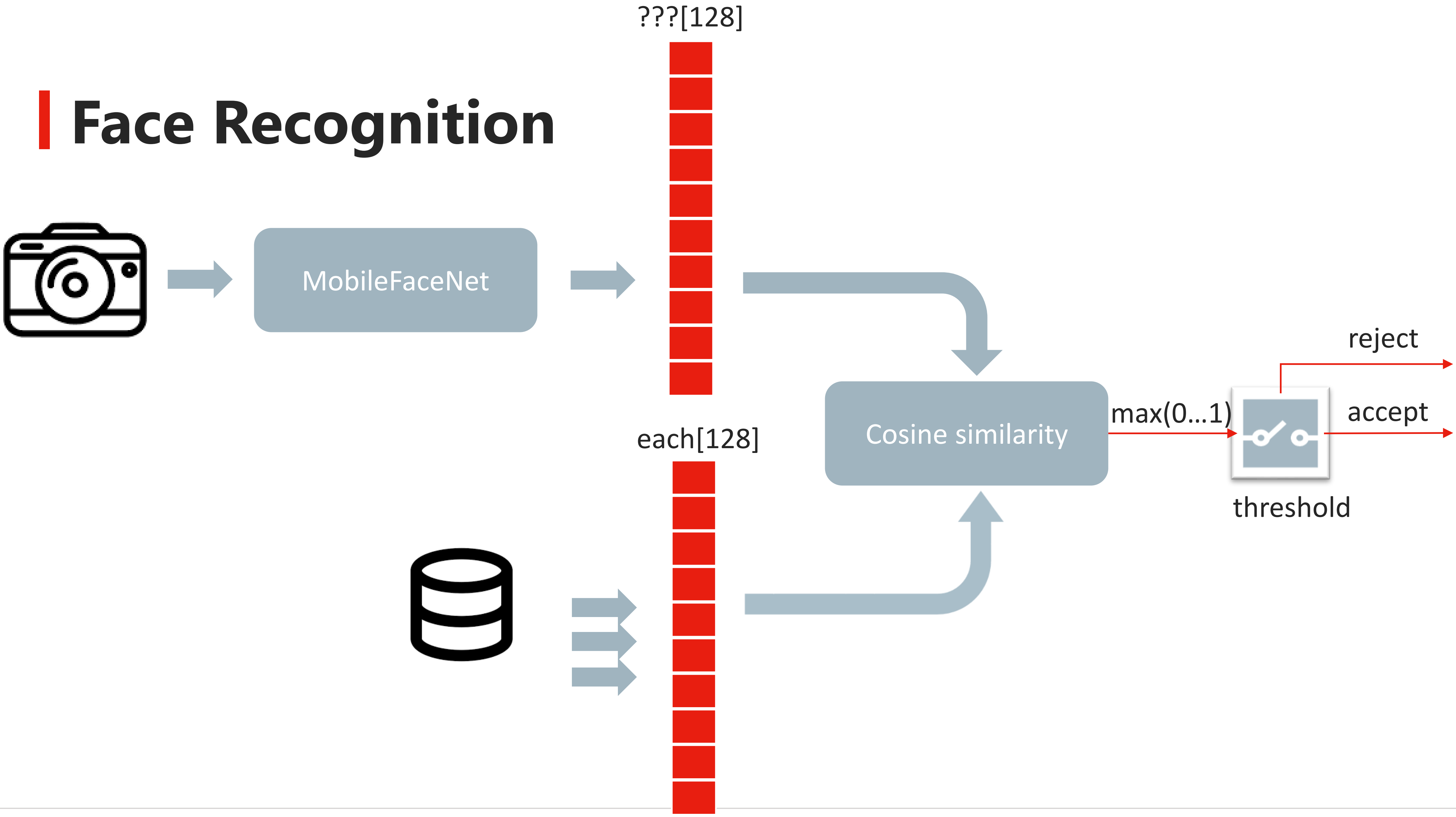
MobileFaceNet



```
Lenna:-0.0198666:0.00229035:0.00641253:0.00473436:-0.
Nicole:-0.00775713:0.00632128:0.00791931:-0.000530823
John:-0.0210117:0.00600274:0.011719:0.0223572:-0.0036
```

Joy of innovation
nuvoton

Face Recognition



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Thank You

Danke

Merci

ありがとう

Gracias

Kiitos

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