



南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

开源计算机视觉库OpenCV 开发与社区建设

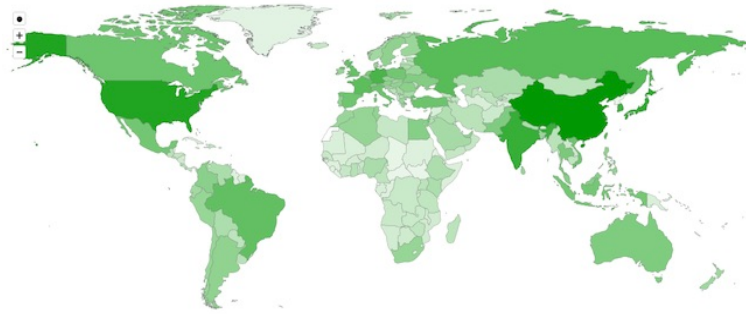
于仕琪

南方科技大学



OpenCV is ...

- Open-source Computer Vision Library: <http://opencv.org>
- Mature (**2000 – present**)
- Very popular: downloaded **21M** times from Source Forge; **10K** times/week from <http://github/opencv> ; 57K+ ★ on GitHub (5th most popular C++ project)
- Downloads from China: 40%+



- **Apache 2** license. Free for research and commercial use.
- Implemented in **C/C++** with automatically generated bindings for **Python, Java, Javascript, Swift, Julia**
- Big, but modular: **>1M** lines of code; **70+** modules (**opencv + opencv_contrib**)
- Very robust and efficient, thanks to our CI system





OpenCV History



(1) 2000-2008, Intel: OpenCV 1.x

single-threaded C library of classical CV algorithms,
developed solely at Intel.

(2) 2008-2016, Itseez & co: OpenCV 2.x-3.x

C++ API, Python bindings, Android & iOS support.

GPU & SIMD acceleration.

Migration to Github, OpenCV CI created. GSoC programs



Google
Summer of Code



OpenCL



(3) 2016-2020, Intel & co: OpenCV 4.x

Deep Learning Module

C++ 11, Javascript & Swift support, Graph API

(4) Since 2020, World-wide: OpenCV 5.x, 6.x

Distributed Development Team

Deep Learning & AI Era

3D & Robotics

Deep Revision of the Library





OpenCV China Team



南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

- Founded in 2019
- A non-profit team for OpenCV development and promotion
- Mainly supported by Southern University of Science and Technology(南方科技大学), former supporter: AIRS in Shenzhen.
- We need engineers, welcome to join



Developers and Contributors



南方科技大学

USA, Bay Area



Google

Google Summer
of Code



Open Source Vision
Foundation ([OSVF](https://osvf.org));
[OpenCV.org](https://opencv.org)

Shenzhen, China



AIRS

SHENZHEN INSTITUTE
of ARTIFICIAL INTELLIGENCE AND ROBOTICS for SOCIETY
深圳市人工智能与机器人研究院

OPEN AI LAB
开放智能



[OpenCV.org.cn](https://opencv.org.cn)
(since 2019 Dec)

ISCAS 中国科学院软件研究所
Institute of Software Chinese Academy of Sciences
华中科技大学
HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY



Russia, Ni.No



Core OpenCV team
@ Intel Russia

OpenVINO™



XPERIENCE.AI



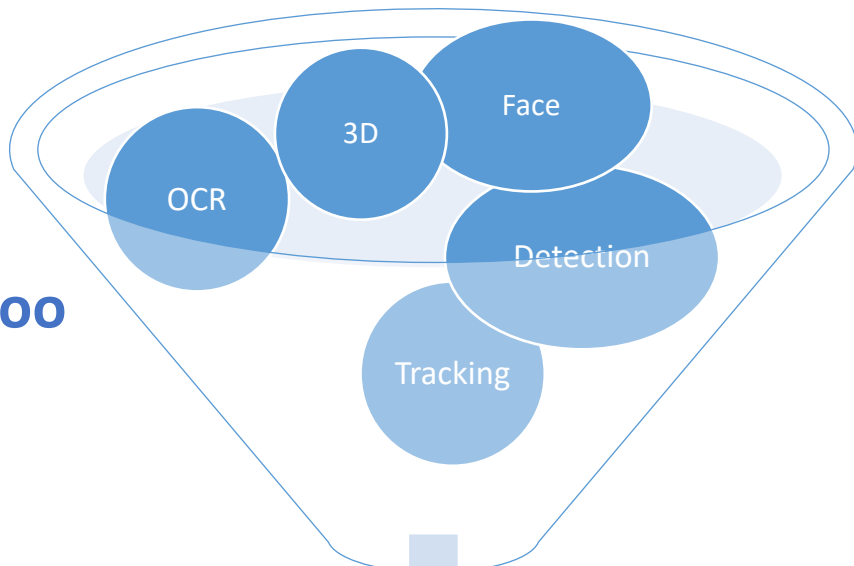
Community

2-3 patches per day
via github.com





OpenCV



OpenCV Model Zoo (ONNX)

OpenCV (C++ & Python Interface)



Default cross-
platform
backend

`parallel_for()`

Univ. intrin

High-speed
inference on
Intel CPUs,
GPUs, VPUs

OpenVINO™

For GPUs,
including
mobile



High-speed
inference on
ARM



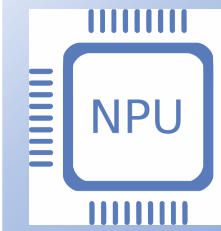
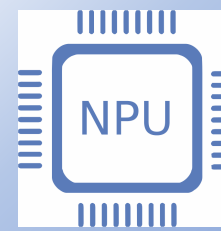
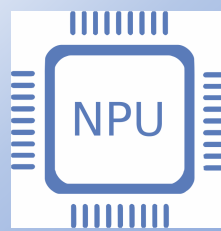
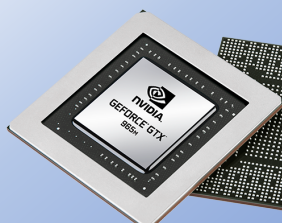
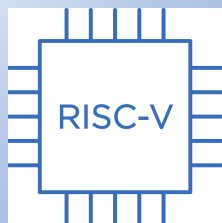
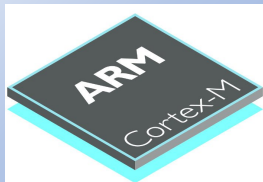
High-speed
inference on
Nvidia GPUs
via cuDNN



OpenVX cross
platform
acceleration
NPU



...



...



OpenCV DNN Module

- cv.dnn.DNN_BACKEND_INFERENCE_ENGINE for 

装载人脸检测ONNX模型

```
detector = cv.FaceDetectorYN.create(
    "face_detection_yunet_2021dec-quantized.onnx",
    "",
    (w, h), # 设置检测器处理的图像大小
    score_threshold=0.99, # 阈值, 应<1, 越大误检测越少
    backend_id=cv.dnn.DNN_BACKEND_TIMVX, # 使用TIMVX后端
    target_id=cv.dnn.DNN_TARGET_NPU # 使用NPU
)
```

循环, 碰到按键盘就退出

```
while cv.waitKey(1) < 0:
```

读一帧图像

```
hasFrame, frame = cap.read()
```

if not hasFrame: # 如果读数据失败

```
    print('No frames grabbed!')
```

```
    break
```

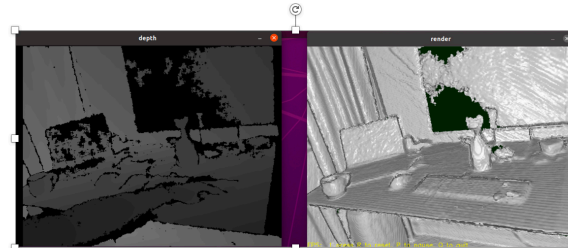
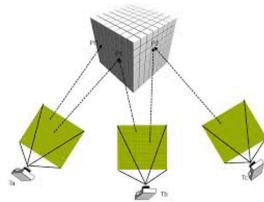
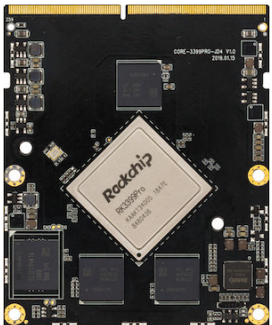
检测人脸

```
faces = detector.detect(frame)
```



OpenCV Key Directions

- **Better performance on edge devices**
 - Optimization for **ARM** & **RISC-V**
 - Extended CI to test OpenCV on ARM & RISC-V
- **Advance Deep Learning Functionality**
 - More efficient, FP16/INT8 inference w. automatic quantization
 - Support for specialized ML accelerators (NPU, VPU, TPU ect.)
 - Model Zoo; OpenCV Deep Learning benchmark
 - Audio, speech support
- **Build first-class 3D vision functionality for Robotics, AR etc.**
 - 3D & SLAM modules
 - Support for various 3D sensors





OpenCV Model Zoo

- A collection of high-quality free models
- ONNX or TF format, INT8 or FP32.
- Python examples to illustrate the use of models
- Organizations are invited to collaborate

https://github.com/opencv/opencv_zoo

opencv / opencv_zoo Public

Unwatch 16 Fork 7 Starred 64

Code Issues 3 Pull requests Projects 3 Security Insights Settings

master 1 branch 0 tags Go to file Add file Code

fengyuentau Add hardware: Khadas VIM3 & update b... 2fe27c0 on 10 Jan 28 commits

benchmark	Add hardware: Khadas VIM3 & update benchmarks...	2 months ago
models	SFace: allow bbox to be none for aligned images as... SFace: allow bbox to be none for aligned images as input (#38)	2 months ago
tools/quantize	Add tools for quantization and quantized m...	
.gitattributes	first commit:	6 months ago
.gitignore	Benchmark framework implementation and 3 mode...	6 months ago
LICENSE	first commit:	6 months ago
README.md	Add hardware: Khadas VIM3 & update benchmarks...	2 months ago

About

Model Zoo For OpenCV DNN and Benchmarks.

opencv benchmark deep-learning model-zoo

Readme

64 stars

16 watching

7 forks

Languages

Benchmark

- The pain points of AI
- More and more robotics applications
- How to choose models/algorithms
- How to choose hardware/platforms

Model1					
Model2					
Model 3					
Model 4			Time		
...					
Model n					
	Hardware 1	Hardware 2	Hardware 3	...	Hardware 3

https://github.com/opencv/opencv_zoo#models--benchmarks

Models & Benchmark Results

Model	Input Size	INTEL-CPU (ms)	RPI-CPU (ms)	JETSON-GPU (ms)	KV3-NPU (ms)	D1-CPU (ms)
YuNet	160x120	1.45	6.22	12.18	4.04	86.69
SFace	112x112	8.65	99.20	24.88	46.25	---
DB-IC15	640x480	142.91	2835.91	208.41	---	---
DB-TD500	640x480	142.91	2841.71	210.51	---	---
CRNN-EN	100x32	50.21	234.32	196.15	125.30	---
CRNN-CN	100x32	73.52	322.16	239.76	166.79	---
PP-ResNet	224x224	56.05	602.58	98.64	75.45	---
PP-HumanSeg	192x192	19.92	105.32	67.97	74.77	---
WeChatQRCode	100x100	7.04	37.68	---	---	---
DaSiamRPN	1280x720	36.15	705.48	76.82	---	---
YoutuRelD	128x256	35.81	521.98	90.07	44.61	---

More chips will come.

Hardware Setup:

- INTEL-CPU : [Intel Core i7-5930K](#) @ 3.50GHz, 6 cores, 12 threads.
- RPI-CPU : [Raspberry Pi 4B](#), Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz.
- JETSON-GPU : [NVIDIA Jetson Nano B01](#), 128-core NVIDIA Maxwell GPU.
- KV3-NPU : [Khadas VIM3](#), 5TOPS Performance. Benchmarks are done using **quantized** models. [TIM-VX backend and NPU target support for OpenCV](#) is under reievw. You will need to compile OpenCV with TIM-VX following [this guide](#) to run benchmarks.
- D1-CPU : [Allwinner D1](#), [Xuantie C906 CPU](#) (RISC-V, RVV 0.7.1) @ 1.0GHz, 1 core. YuNet is supported for now. Visit [here](#) for more details.



OpenCV DNN: Plan in 5.x

- Better support various CPU and GPU/NPU/VPU/DPU.
- Easier to extend to new hardware
- Better graph
- Better support ONNX
- INT8/UINT8, FP16/BF16 support
- ...

OpenCV Community

How to contribute to OpenCV



OpenCV Membership

- **Platinum Membership**

- OpenCV was born At Intel
- Supported by Intel in the past 20+ years



- **Gold Membership**



Google
Summer of Code



OpenCV Development Partnership

Development Partners



Amazing Khadas, Always Amazes You!



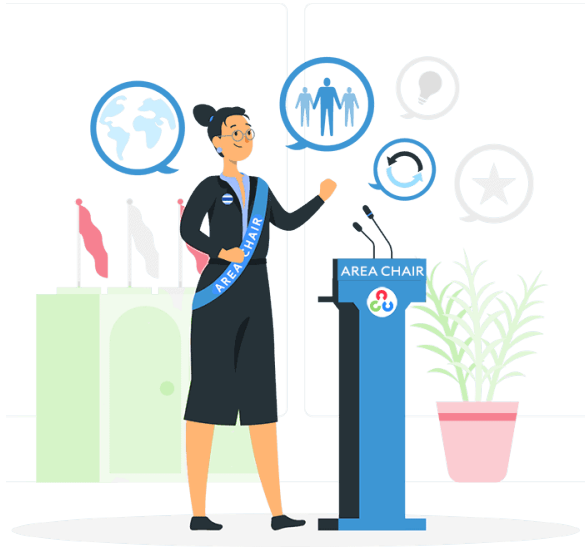
Intelligent computing for everyone everywhere

Previous Partners



Open edge AI industry application empowerment
platform

OpenCV Area Chairs



- Implement state-of-the-art algorithms on various topics.
- The first-round application: Jan. 31, 2022
- Welcome to apply

RISC-V



Mingjie Xing

Institute of Software, Chinese Academy of Sciences

www.github.com/plctlab

Face Recognition and Analysis



Weihong Deng

Beijing University of Posts and Telecommunications

www.whdeng.cn

Shape Detection



Qi Jia

Dalian University of Technology

www.faculty.dlut.edu.cn/guqi

Person Detection



Andrea Pennisi

University of Antwerp

www.andreapennisi.com

Image Enhancement



Zhangyang "Atlas" Wang

The University of Texas at Austin

www.vita-group.github.io



Welcome to support OpenCV

- Membership
- Development Partnership
- Area Chairs
- Google Summer of Code
- Source code contributor
- Document contributor

