>shirazlug_

شیرازلاگ

نشست ۱۶۰ ۱۶:۳۰ - ۱۸:۳۰ ۱۳۹۷/۱۰/۱۹

بینایی ماشین

ارائه‌دهنده : مهندس مریم بهزادی

سرفصل ها :

معرفی و کاربردها

معرفی کتابخانه های پر کابرد

نحوه استفاده از opencv

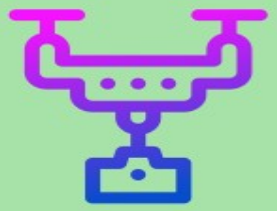
محل برگزاری :

بلوار مدرس،

رو به روی فضل آباد،

دانشگاه صنعتی شیراز

خانه فرهنگ



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Computer Vision

by Maryam Behzadi

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mariebehzadi

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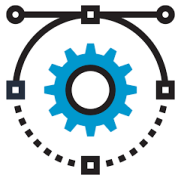
What is Computer Vision?



What are its applications?

Why is it important?

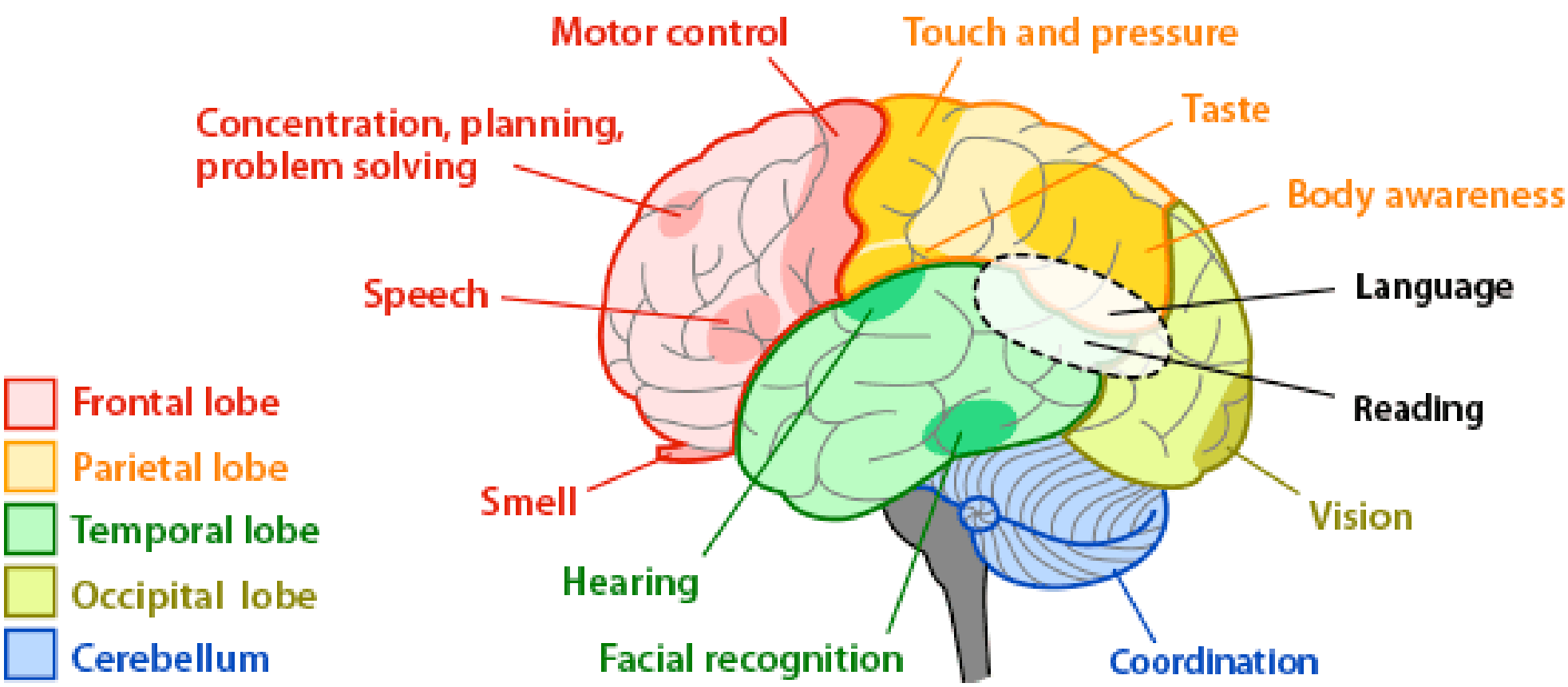
How is it used?

What`s the Fuss About OpenCV Library?

What is Computer Vision?

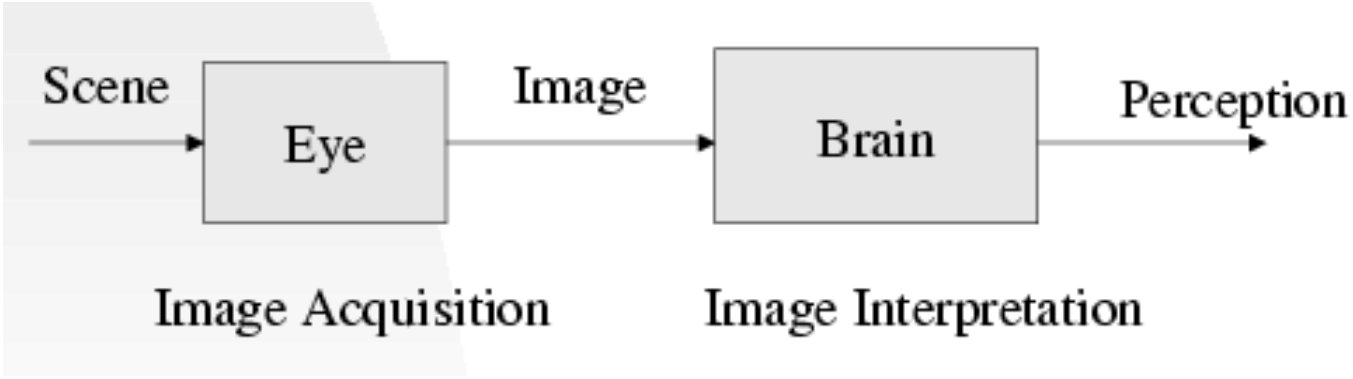
What is Computer Vision?

Vision


Motor control
Touch and pressure
Concentration, planning, problem solving
Taste
Body awareness
Speech
Language
Reading
Smell
Vision
Hearing
Facial recognition
Coordination
Frontal lobe
Parietal lobe
Temporal lobe
Occipital lobe
Cerebellum

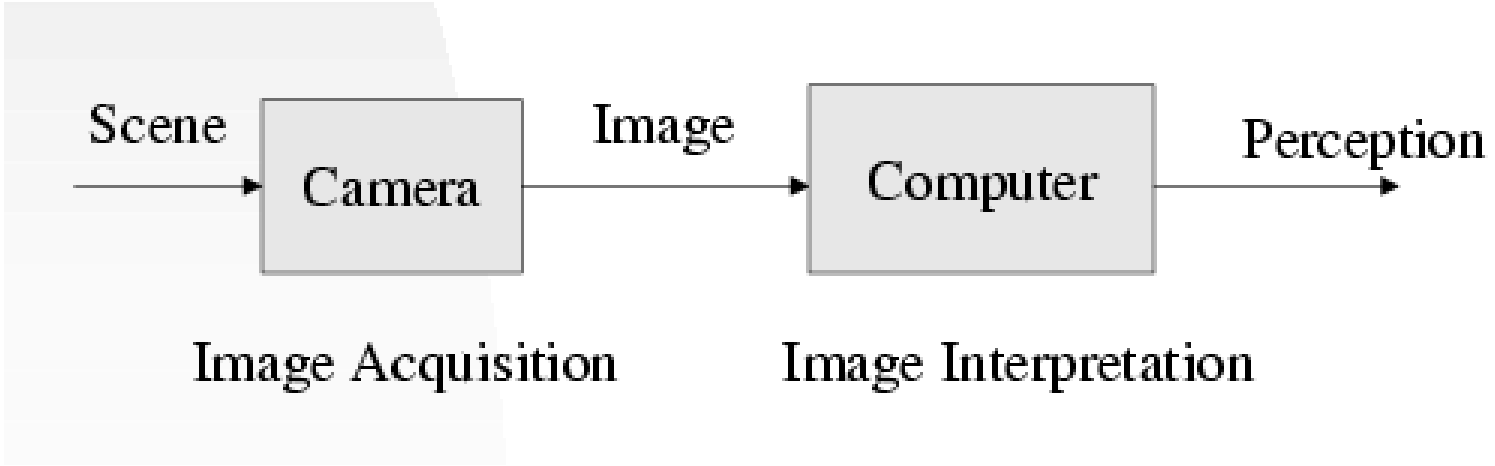
Vision

- Vision is the process of discovering what is present in the world and where it is by looking.



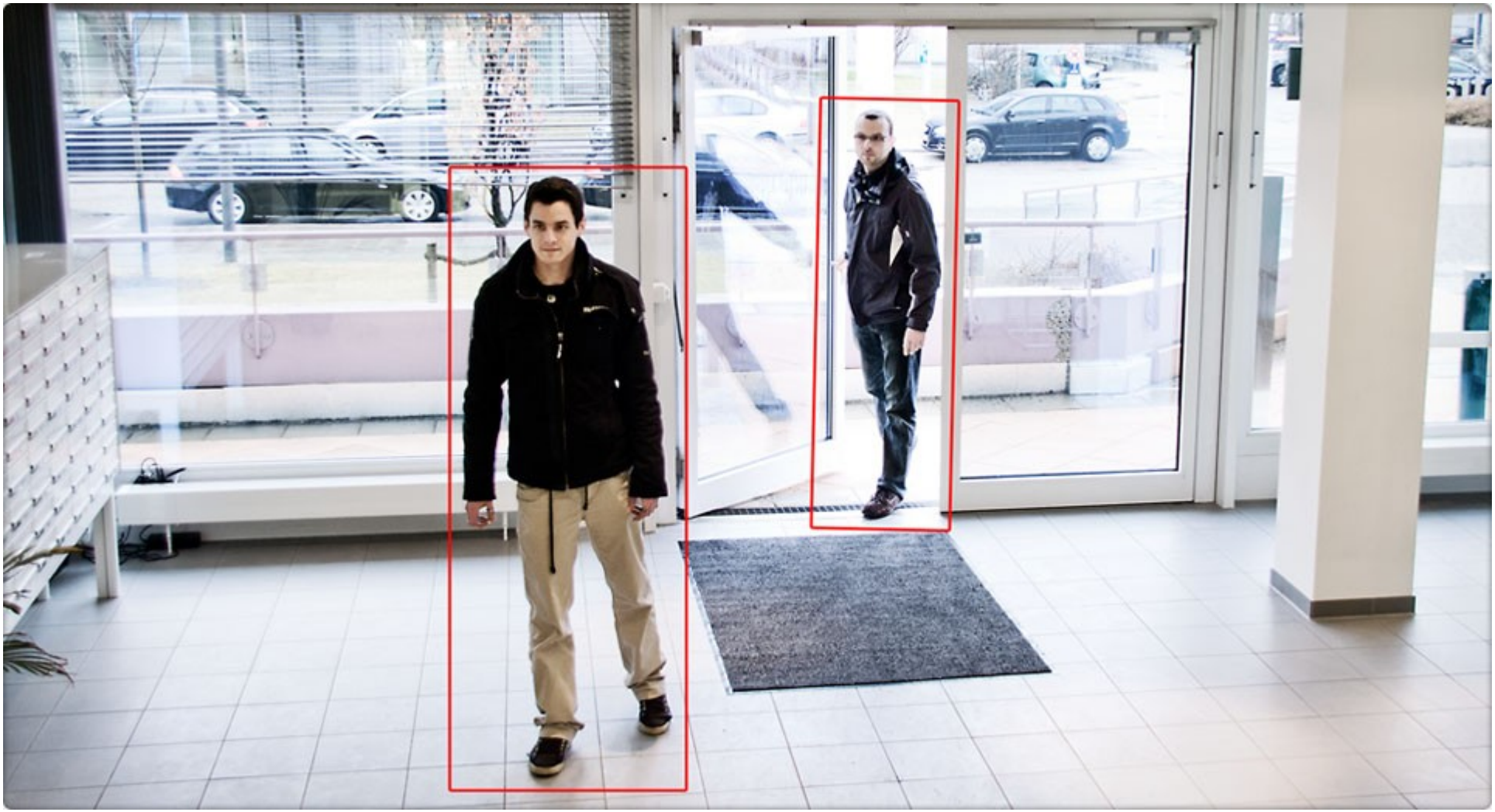
Computer Vision

- Computer Vision is the study of analysis of pictures and videos in order to achieve results similar to those as by people.



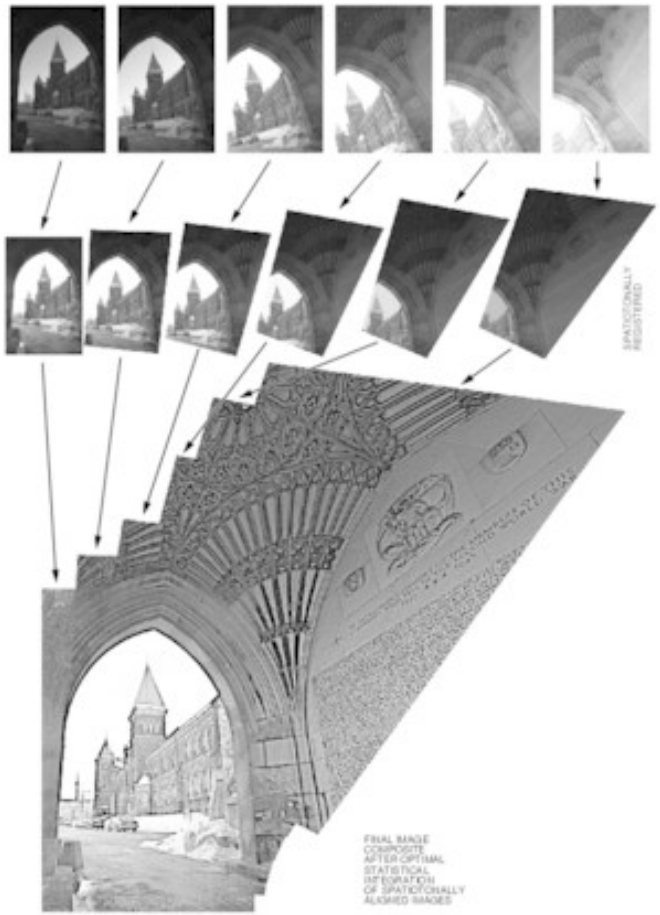
Computer Vision

The goal of computer vision is to recognize objects and their motion



Computer Vision and Nearby Fields

- Computational Photography: Images to Images
- Computer Graphics: Models to Images
- Computer Vision: Images to Models
- Machine Vision: Distinct Form of CV



Computer Vision and Nearby Fields

- Image Processing
- Scientific / medical imaging
- Pattern Recognition
- Learning
- Artificial Intelligence
- Visual Neuroscience
- Applied Mathematics
- ...

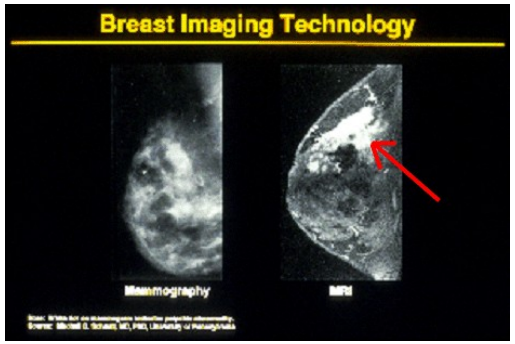
History

History

- 1966: Minsky assigns computer vision as an undergrad summer project
- 1960's: interpretation of synthetic worlds
- 1970's: some progress on interpreting selected images
- 1980's: ANNs come and go; shift toward geometry and increased mathematical rigor
- 1990's: face recognition; statistical analysis in vogue
- 2000's: broader recognition; large annotated datasets available; video processing starts

Why Computer Vision Matters?

Safety

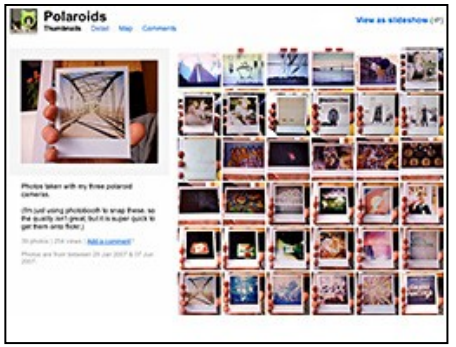


Health

Security

Comfort

Fun



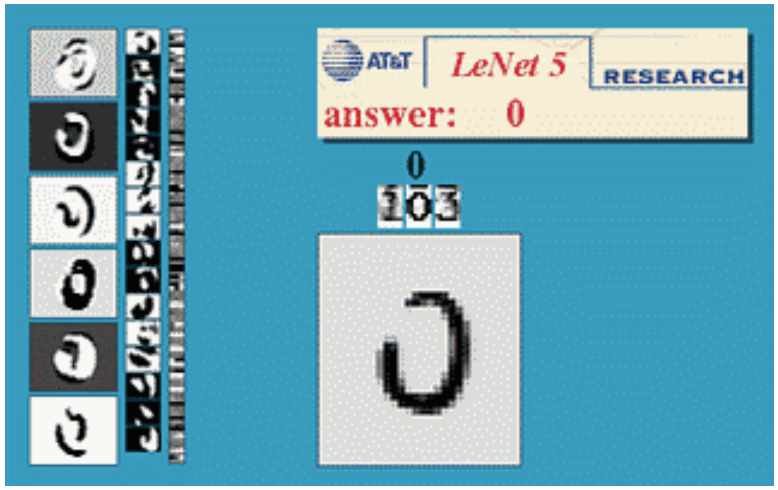
Access

Interesting applications of Computer Vision

Optical character recognition (OCR)

Technology to convert scanned docs to text

- If you have a scanner, it probably came with OCR software



Digit recognition, AT&T labs
http://www.research.att.com/~yann/

License plate readers
http://en.wikipedia.org/wiki/Automatic_number_plate_recognition

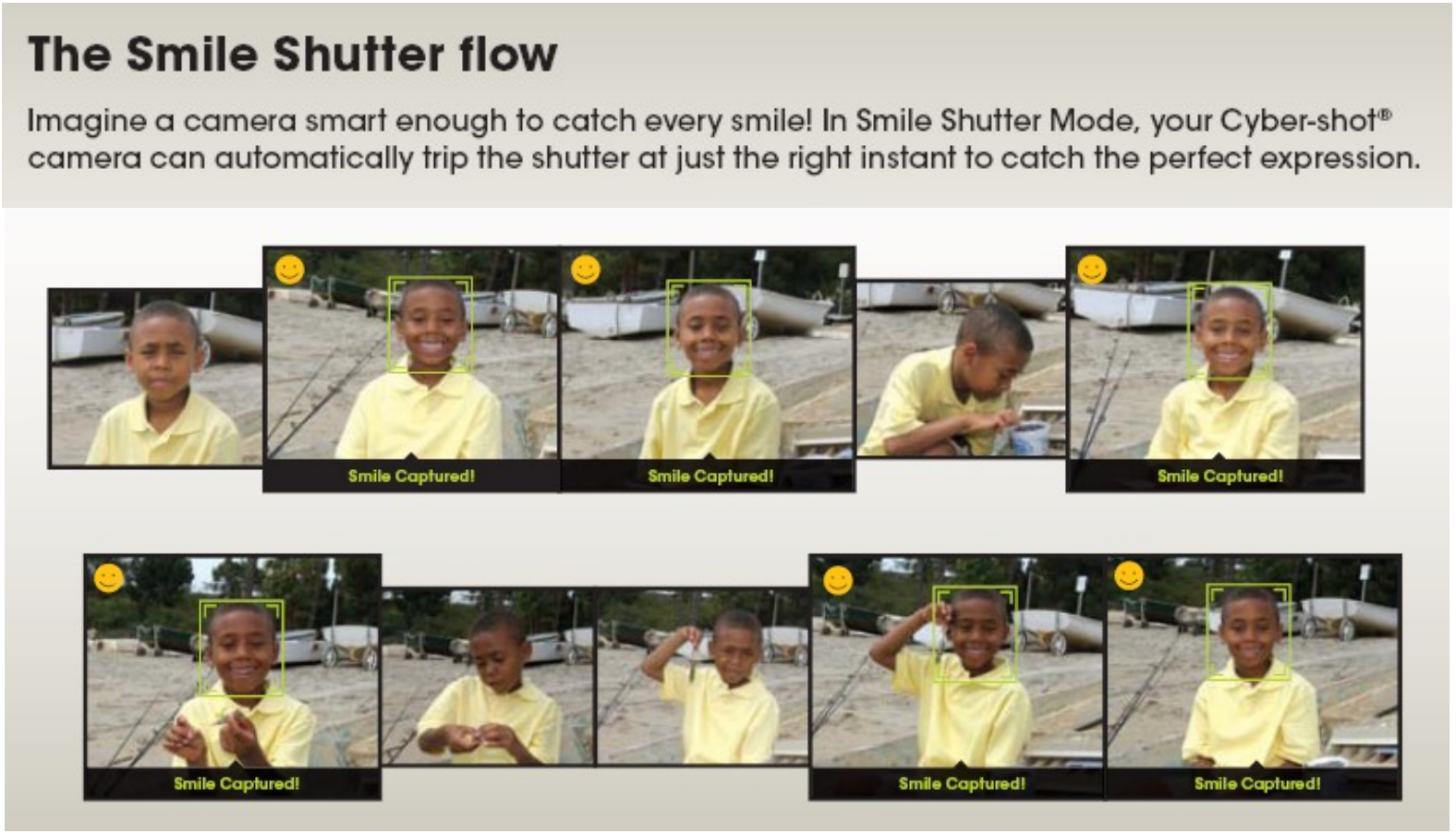
Interesting applications of Computer Vision

Face detection

- Many new digital cameras now detect faces
  - Canon, Sony, Fuji, …

Interesting applications of Computer Vision

Smile detection



Interesting applications of Computer Vision

3D Modeling from thousands of images

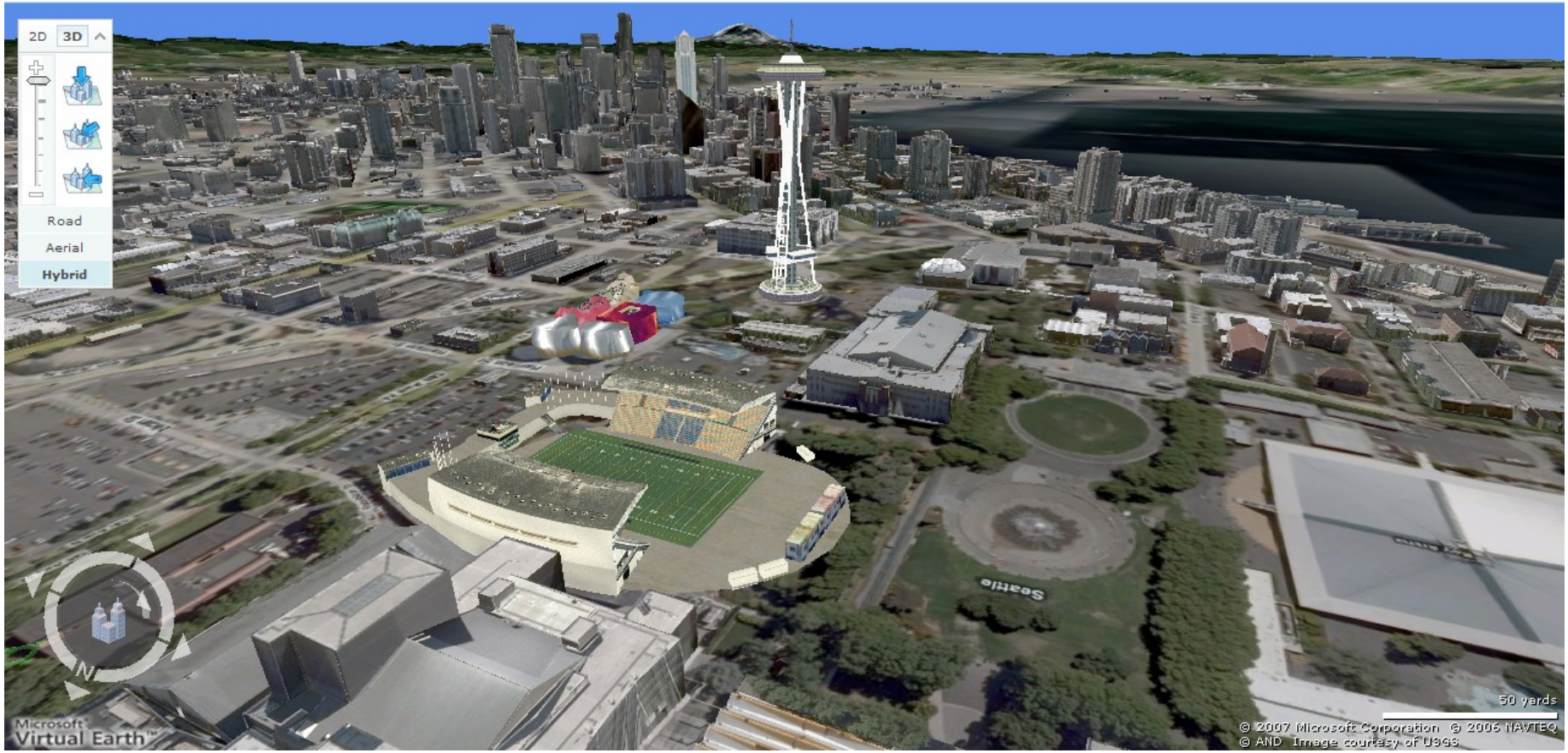
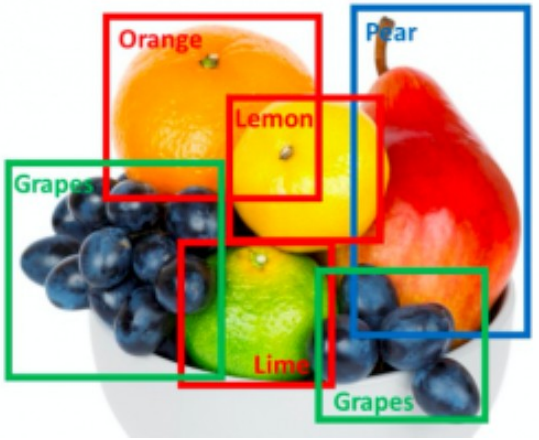


Image from Microsoft's Virtual Earth
(see also: Google Earth)

Interesting applications of Computer Vision

Object recognition



LaneHawk by EvolutionRobotics

"A smart camera is flush-mounted in the checkout lane, continuously watching for items. When an item is detected and recognized, the cashier verifies the quantity of items that were found under the basket, and continues to close the transaction. The item can remain under the basket, and with LaneHawk,you are assured to get paid for it… "

Interesting applications of Computer Vision

Login without a password…

Fingerprint scanners
on many new laptops,

other devices

Face recognition systems now
beginning to appear more widely
http://www.sensiblevision.com/

Interesting applications of Computer Vision

Special effects

shape capture

The Matrix movies, ESC Entertainment, XYZRGB, NRC

Interesting applications of Computer Vision

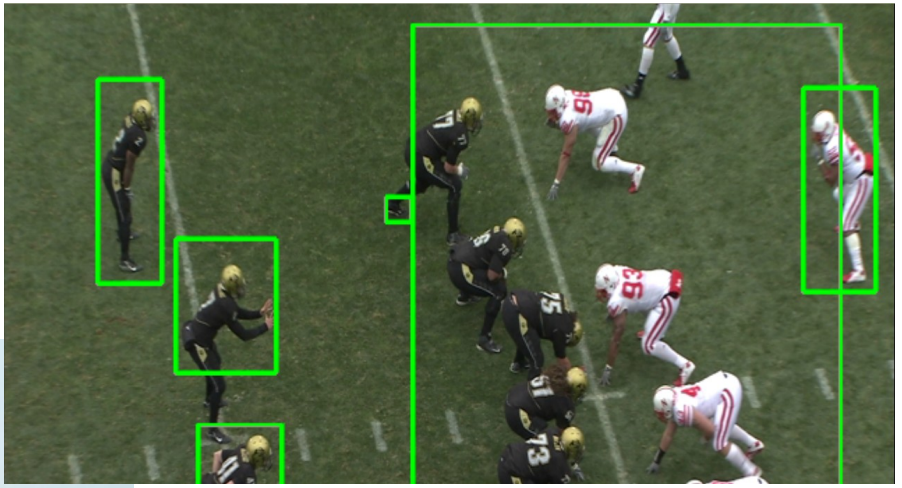
Pirates of the Carribean, Industrial Light and Magic

Special effects

motion capture

Interesting applications of Computer Vision

Sports



Interesting applications of Computer Vision

Smart cars

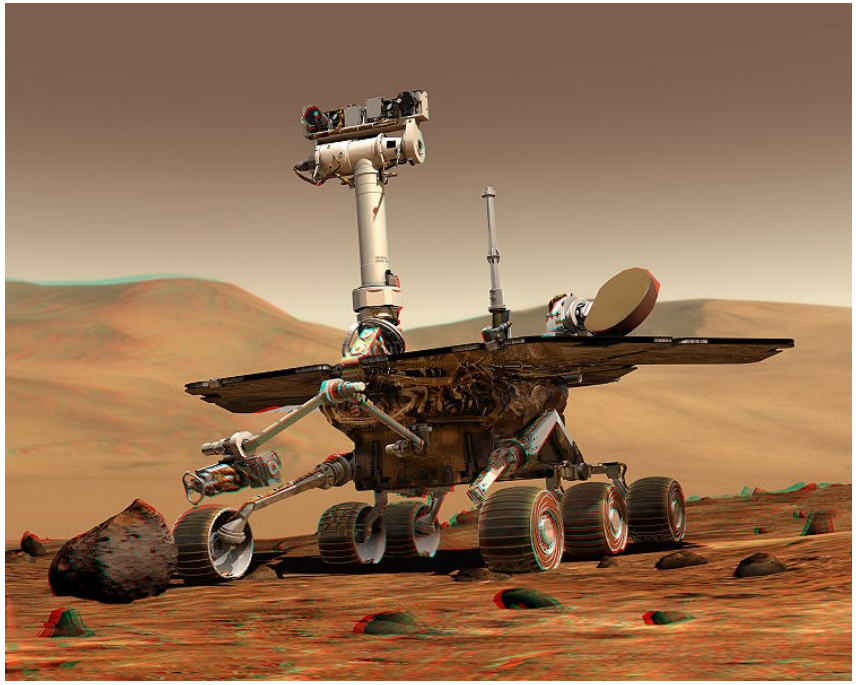
Mobileye

- Vision systems currently in high-end BMW, GM, Volvo models
- By 2010: 70% of car manufacturers.

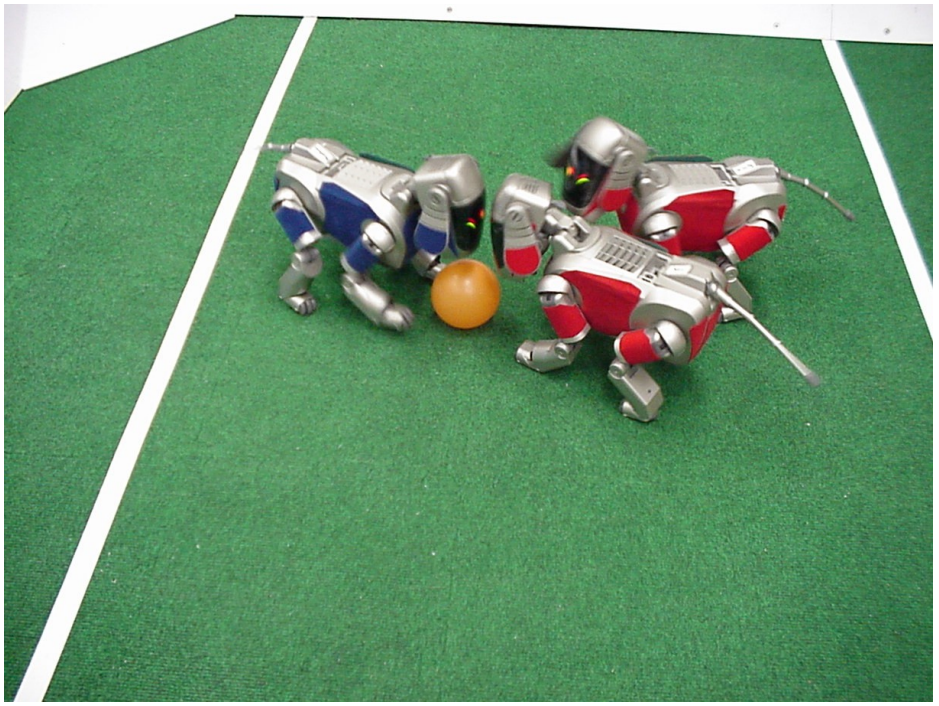
- Video demo

Interesting applications of Computer Vision

Robotics



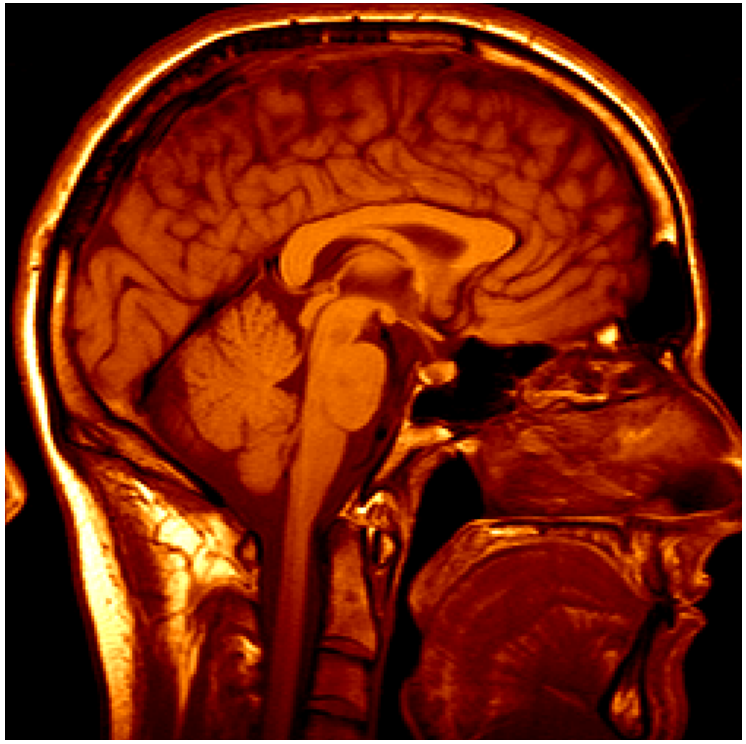
NASA's Mars Spirit Rover
http://en.wikipedia.org/wiki/Spirit_rover



http://www.robocup.org/

Interesting applications of Computer Vision

Medical imaging



3D imaging
MRI, CT

Image guided surgery
Grimson et al., MIT

Current State of the Art

You just saw examples of current systems.

- Many of these are less than 5 years old.

This is a very active research area, and rapidly changing.

- Many new applications in the next 5 years

To learn more about vision applications and companies.

- David Lowe maintains an excellent overview of vision companies
  - http://www.cs.ubc.ca/spider/lowe/vision.html

Tools

- Image Processing (OpenCV, BoofCV, SimpleCV)
- OCR (Tesseract)
- Machine Learning Tools (DLib, SciPy)
- Deep Learning Tools (TensorFlow, Theano, Torch, Keras)
- Segmentation (SLIC Superpixels)
- Multi-View Geometry (OpenMVG)
- Visual Odometry (LIBVISO)
- Scene Reconstruction (VisualSFM, MeshLab, Bundler)
- Video Tracking (OpenTL)
- Video Stabilization (Vid.stab)

OpenCV

- OpenCV (Open Source Computer Vision Library)
- open source computer vision and machine learning software library
- Originally developed by Intel
- free for any kind of use BSD-licensed product
- OpenCV is written natively in C/C++ (Fast, Portable)
- It has C++, Python, Java and MATLAB/Octave interfaces
- Wrappers in other languages such as C#, Perl,[14] Ch,[15] Haskell[16] and Ruby
- Cross-platform (Desktop and Mobile)
- more than 2500 optimized algorithms
- more than 47 thousand people of user community
- mainly aimed at real-time computer vision
- OpenCV 4.0 has been released (20 Nov 2018)

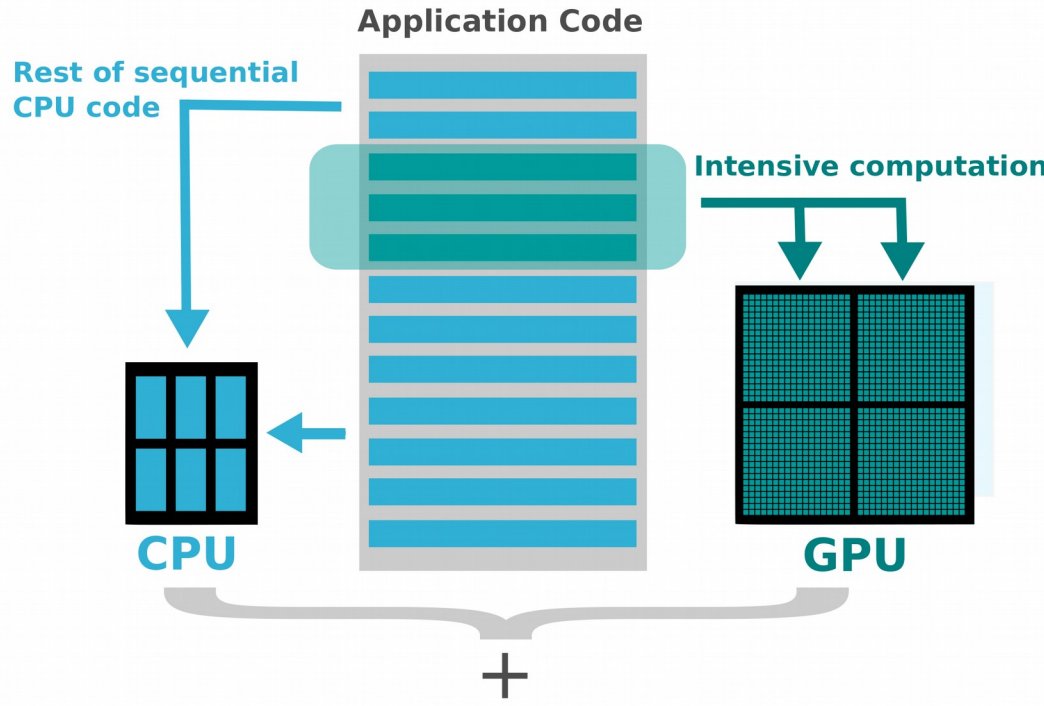
Why OpenCV?

- Open Source and Free to use
- Big community
- Huge optimized library
- Portability
- Fast and Real Time Processing
- Efficiency (Memory Management)
- Multi-Core Processing
- Enabled with OpenCL => hardware acceleration (GPU)
- Development Environment

NVIDIA Report

OpenCV is the leading open source library for computer vision, image processing and machine learning, and now features GPU acceleration for real-time operation.

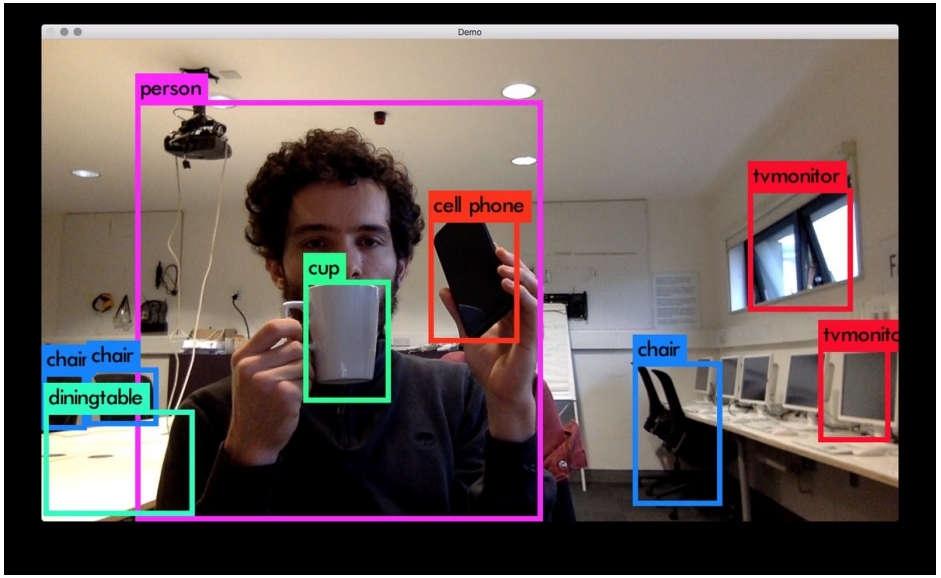
Over **250** functions have been ported to use CUDA delivering **5x to 100x** speed up.



State of the Art

OpenCV Applications

- Street view image stitching
- Automated inspection and surveillance
- Robot and driver-less car navigation and control
- Medical image analysis
- Video/image search and retrieval
- Movies - 3D structure from motion
- Interactive art installations



OpenCV Functionality

- Image/video I/O, processing, display (core, imgproc, highgui)
- Object/feature detection (objdetect, features2d, nonfree)
- Geometry-based monocular or stereo computer vision (calib3d, stitching, videostab)
- Computational photography (photo, video, superres)
- Machine learning & clustering (ml, flann)
- CUDA acceleration (gpu)

OpenCV in Python

Installation

- if you need only main modules
  - pip install opencv-python
- if you need both main and contrib modules
  - pip install opencv-contrib-python

Usage

```
>>> import cv2
>>> print cv2.__version__
```

Further Info

- https://opencv.org/
- https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_tutorials.html
- https://pypi.org/project/opencv-python/
- https://github.com/jbhuang0604/awesome-computer-vision
- Pattern Classification by Richard O. Duda
- Computer Vision: Theory and Application (Rick Szeliski 2010)

By the Way ...