(Open Source **C**omputer **V**ision)

Outline

- Overview and practical issues.
- A selection of OpenCV functionality:
  - Image enhancement
  - Object classification and tracking
  - Face detection and recognition
- Conclusion and further resources.

Overview: Capabilities

Image processing

•General Image Processing

Transforms

Fitting

Optical Flow

Segmentation

Video, Stereo, and 3D

Camera Calibration

Pose estimation

Features

Depth Maps

Object detection

Overview: License

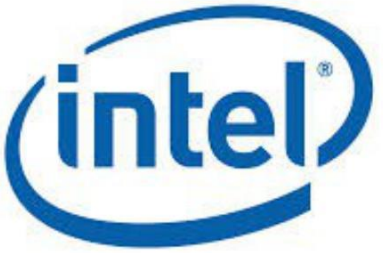
- BSD Licensed (free and open source)
- May be used in commercial software.
- No requirement to publish the source!
- Must acknowledge OpenCV was used in the documentation by including its copyright notice.

Note: There is a C#/.NET wrapper for OpenCV called "**Emgu CV**" that may be commercially licensed.

Overview: Patents

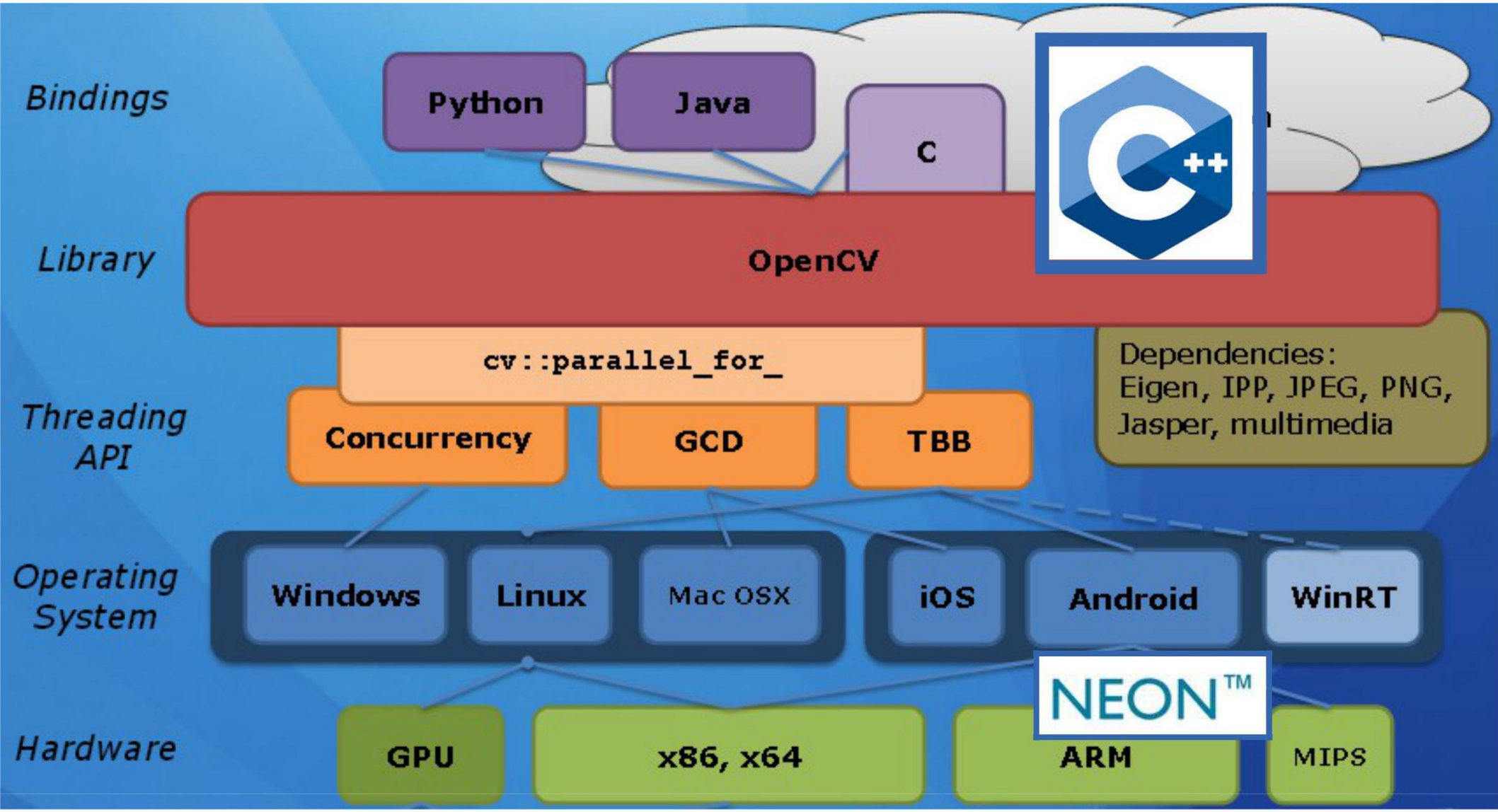
- **Note:** A couple of algorithms (SIFT and SURF) that are implemented are patented.
  - You can't accidentally use them because they are in a separate module called “nonfree”.

Overview: Users



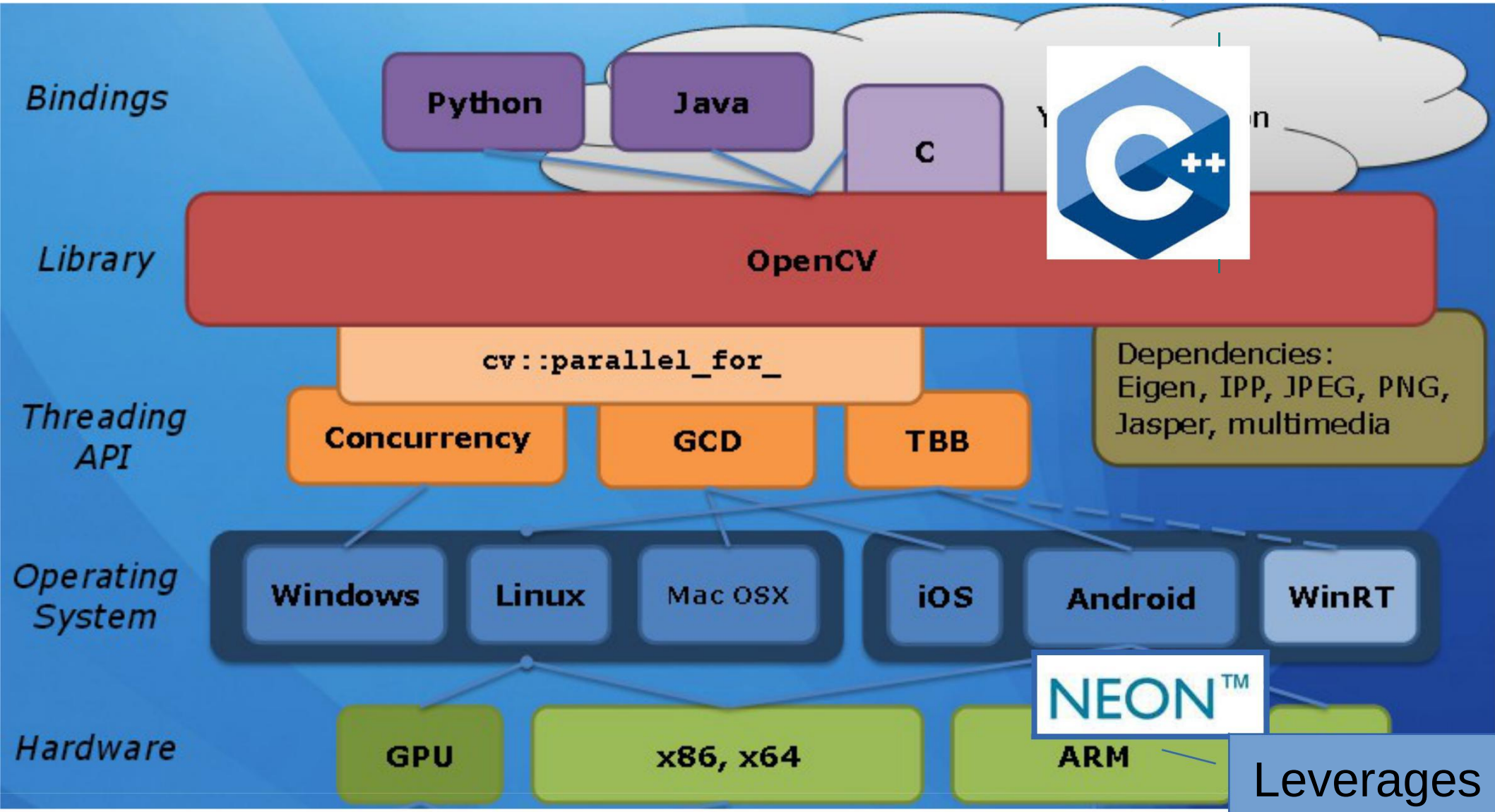
- Stitching street-view images together,
- Detecting intrusions in surveillance video in Israel
- Detection of swimming pool drowning accidents in Europe

Overview: Environment



Overview: Environment

Primary API is C++



Leverages ARM NEON

Overview: Installation

- **Ubuntu VM:**
  - **`sudo apt-get install libopencv-dev`**
- **Windows:**
  - Download latest version from http://opencv.org/

    For Python:
    - Also install Python from http://www.python.org/
    - Install `numpy` module
    - Copy the “cv2” module from OpenCV to `C:\Python27\Lib\site-packages`

Python: Display an image file

```
import cv2

image = cv2.imread("lena.bmp");
if image.empty():
     print "Could not load image"
     exit(1)

cv2.namedWindow("Image")
cv2.imshow("Image", image)
cv2.waitKey()
```

Similar structure and naming as C++ version means Python is good for prototyping.

A Selection of Functionality

- **Image enhancement**
  - Noise reduction, local contrast enhancement
- **Object classification and tracking**
  - Track the paths that objects take in a scene
  - Differentiating between cars and trucks
- **Face detection and recognition**
  - Identify faces seen in images or video.

Face detection

- ... or with special glasses containing IR LEDs.

(a) Near infrared LED not lit (detection successful)

(b) Near infrared LED lit (detection failed)

Conclusion

- OpenCV is for image/video processing and computer vision.
- Free and open source (BSD licensed)
- Cross-platform and actively developed (also downloaded over 3 million times)!
- This presentation covered just a few of the over 2,000 algorithms available in OpenCV.

More Information

- **Official Page:** http://opencv.org
- **Tutorials:** http://docs.opencv.org/doc/tutorials/tutorials.html
- **Books:**