

Computer Vision

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- 01 Introduction
- 02 what is computer vision
- 03 Face detection
- 04 code

Computer Vision



Tools

- Sage Math cloud

Introduction



<https://cloud.sagemath.com>

Computer Vision

Tools

- Sage Math cloud
- Jupyter Notebook

Introduction



Computer Vision

Tools

- Sage Math cloud
- Jupyter Notebook
- Python

Introduction



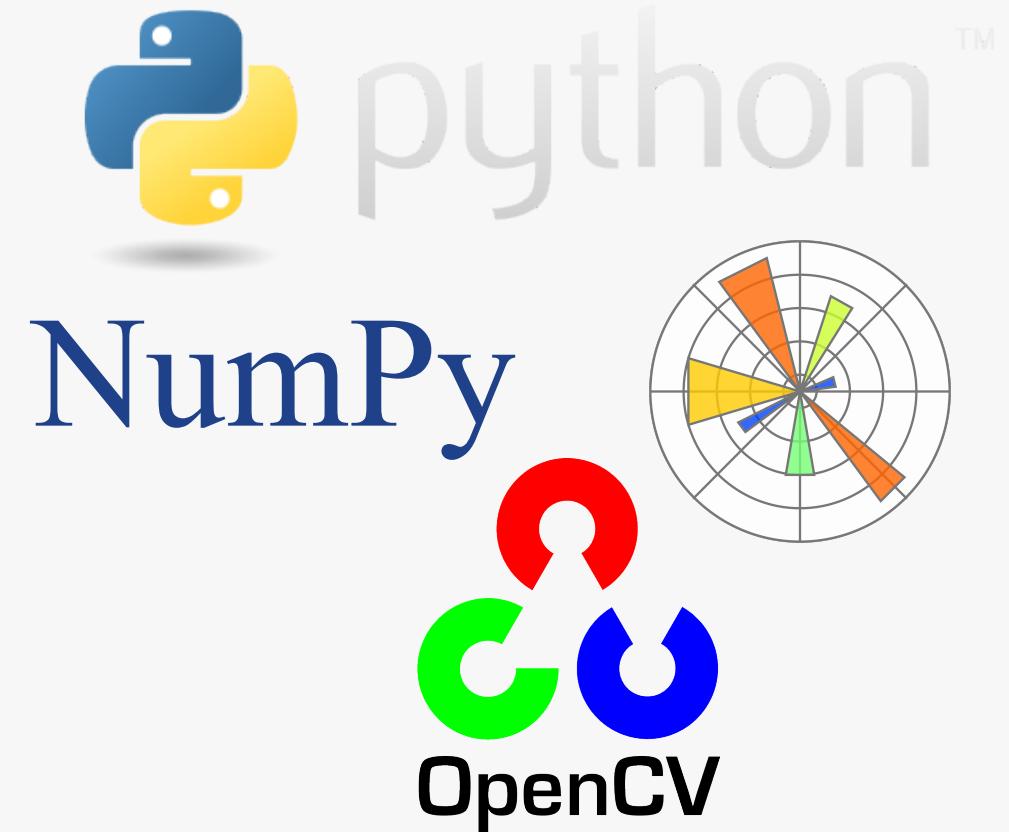
Computer Vision

Tools

- Sage Math cloud
- Jupyter Notebook
- Python
- Numpy
- Matplotlib
- OpenCV

Computer Vision

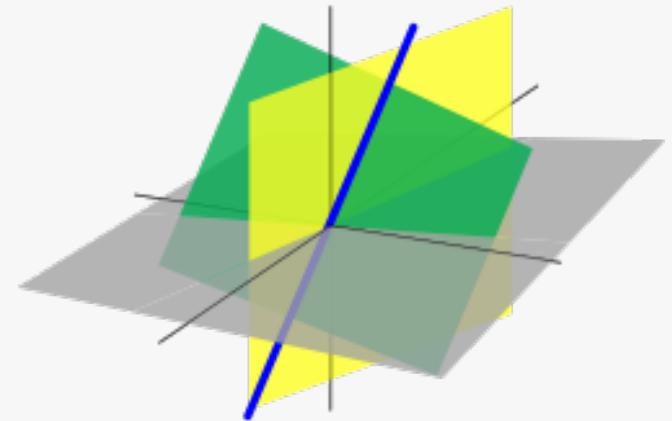
Introduction



Good to know

- Basic Linear Algebra

Introduction



Computer Vision

Good to know

- Basic Linear Algebra
- Object Oriented Programming

Introduction



BJECT



RIENTED



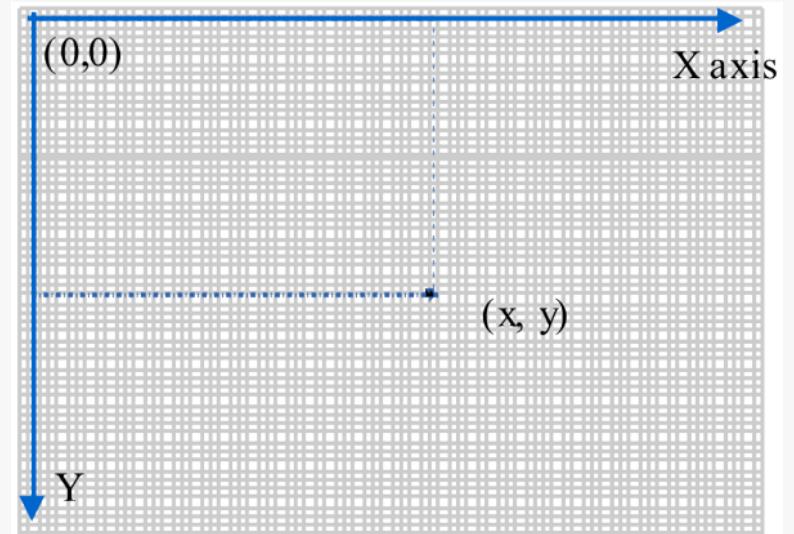
ROGRAMMING

Computer Vision

Good to know

- Basic Linear Algebra
- Object Oriented Programming
- Computer Graphics

Introduction



Computer Vision

About : NOT

Introduction

- What this workshop is NOT
 - CS 6476 : Introduction to Computer Vision
 - Machine learning basics
 - Cascade Classifier Training

Computer Vision

About : IS

Introduction

- What this workshop **IS**
 - Basic understanding of computer vision
 - How a computer can detect faces
 - Code it all up..

Computer Vision

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Definitions

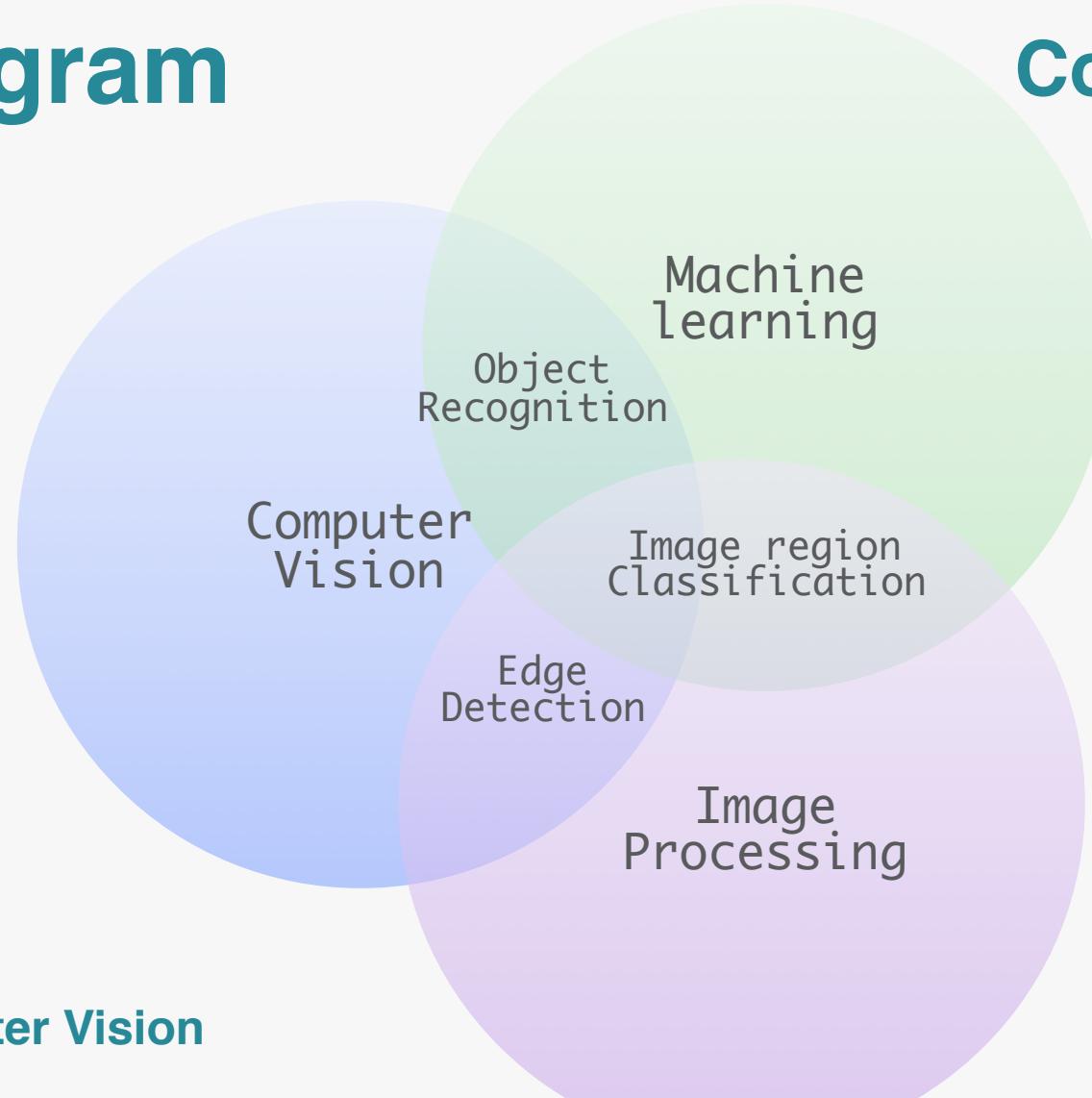
Computer Vision

- Computer Vision
 - extract meaningful information from images/videos.
- Image Processing
 - enhance or compress images/videos
- Machine learning:
 - optimize differentiable parameters so that a certain loss/cost function is minimized.

Computer Vision

Diagram

Computer Vision



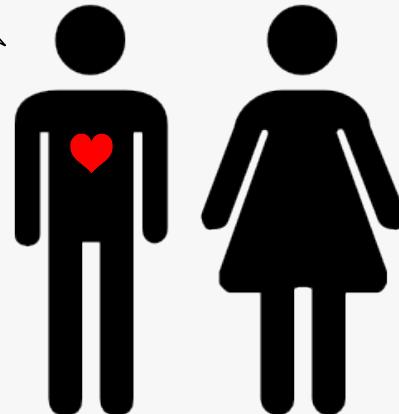
Computer Vision

But how..?

- Image
- Female
- Grammy-winning singer/songwriter
Taylor Swift

Computer Vision

Humans



Computer Vision



But how..?



Computer



Computer Vision

Computer Vision



But how..?

#hot

Computer

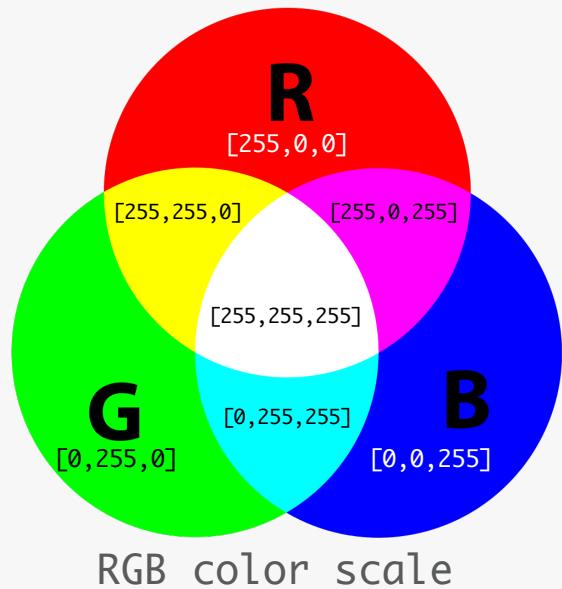
Computer Vision

Computer Vision

```
[[ 50  70 105 141 137 130]
 [ 57  79 111 140 140 135]
 [ 67  92 116 137 139 139]
 [167 139 124  94  94  83]
 [179 148 123  92  92  84]
 [185 162 135  91  90  84]]
```

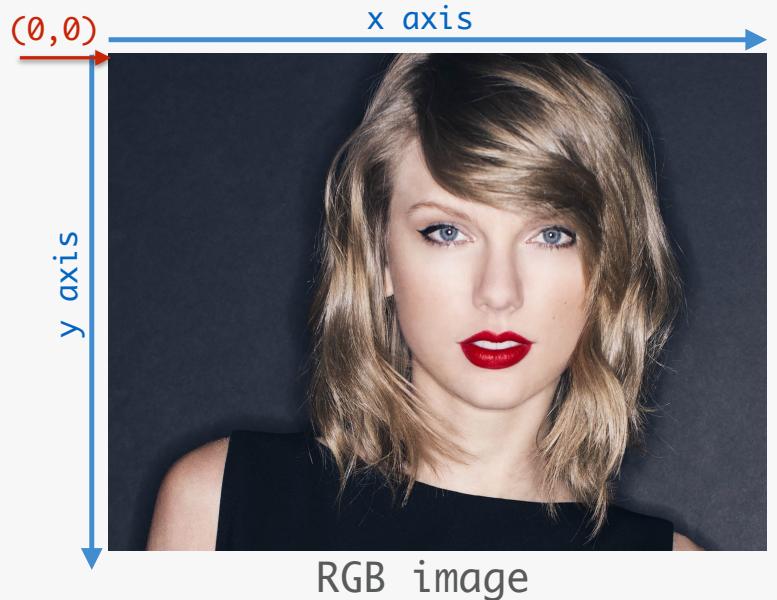


numbers?



[0-255, 0-255, 0-255]

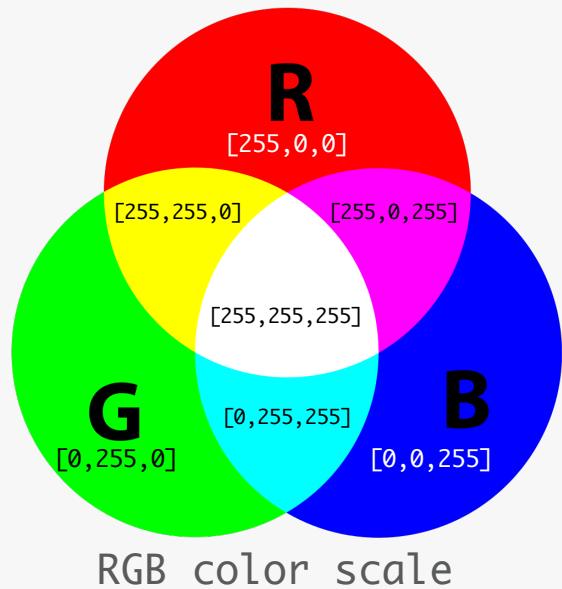
Computer Vision



location(0,0) = [31,39,52]
Red = 31
Green = 39
Blue = 52

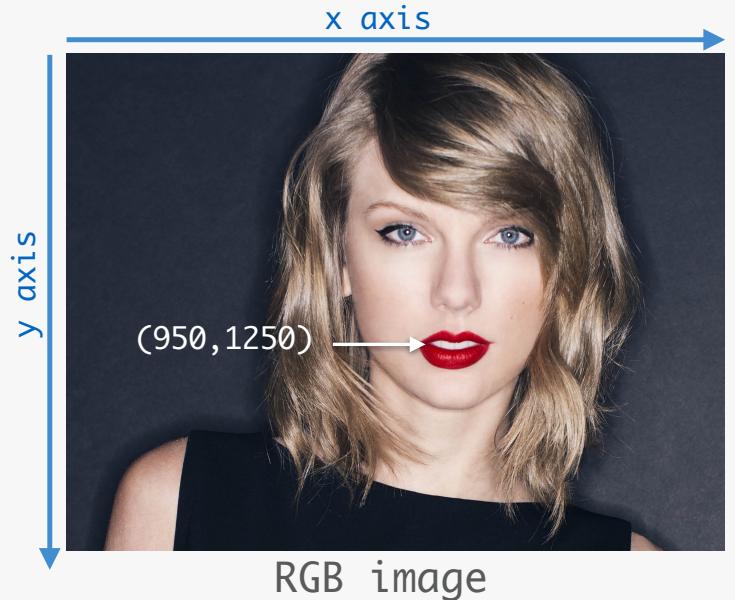
Computer Vision

numbers?



[0-255, 0-255, 0-255]

Computer Vision



RGB image

location(950,1250) = [151,1,15]

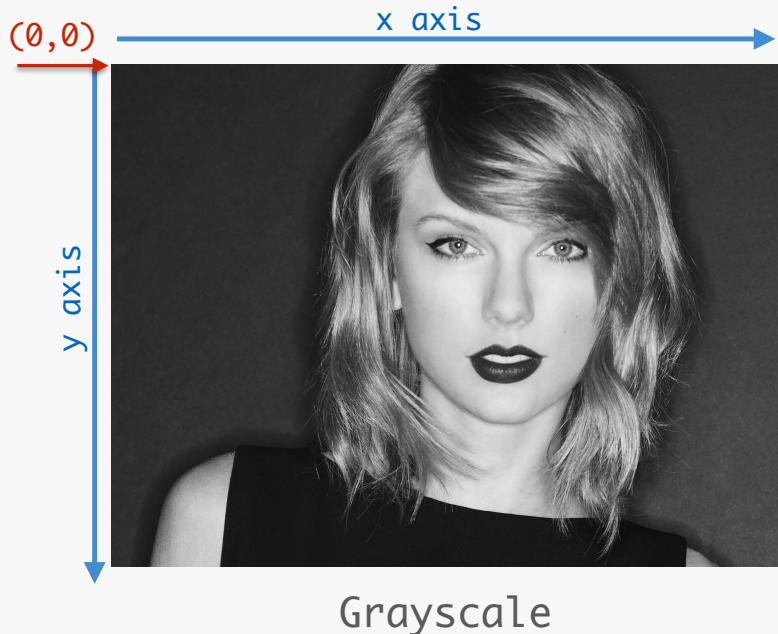
Red = 151

Green = 1

Blue = 15

Computer Vision

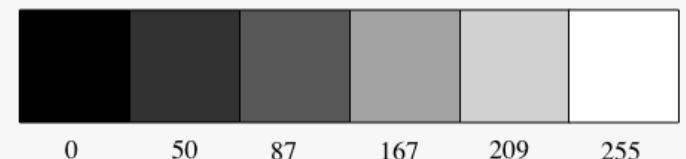
numbers?



$\text{location}(0,0) = [42]$
Intensity = 42

Computer Vision

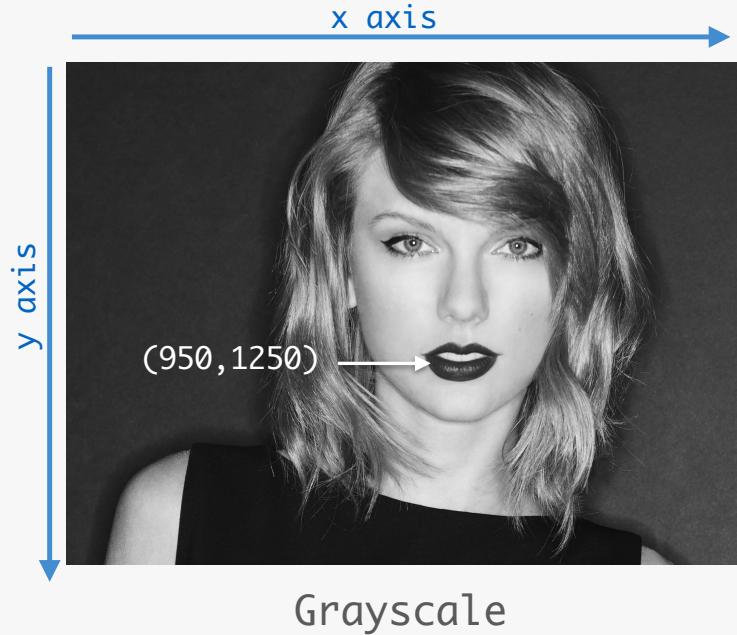
[0-255]



Grayscale intensity

Computer Vision

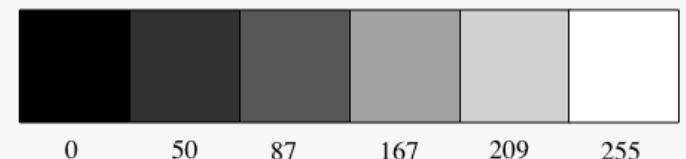
numbers?



`location(950,1250) = [23]`
`Intensity = 23`

Computer Vision

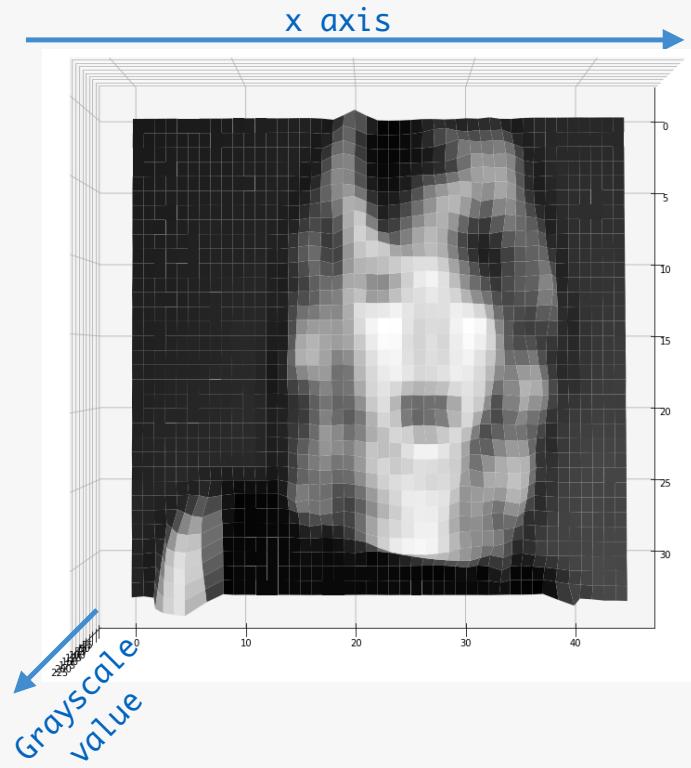
[0-255]



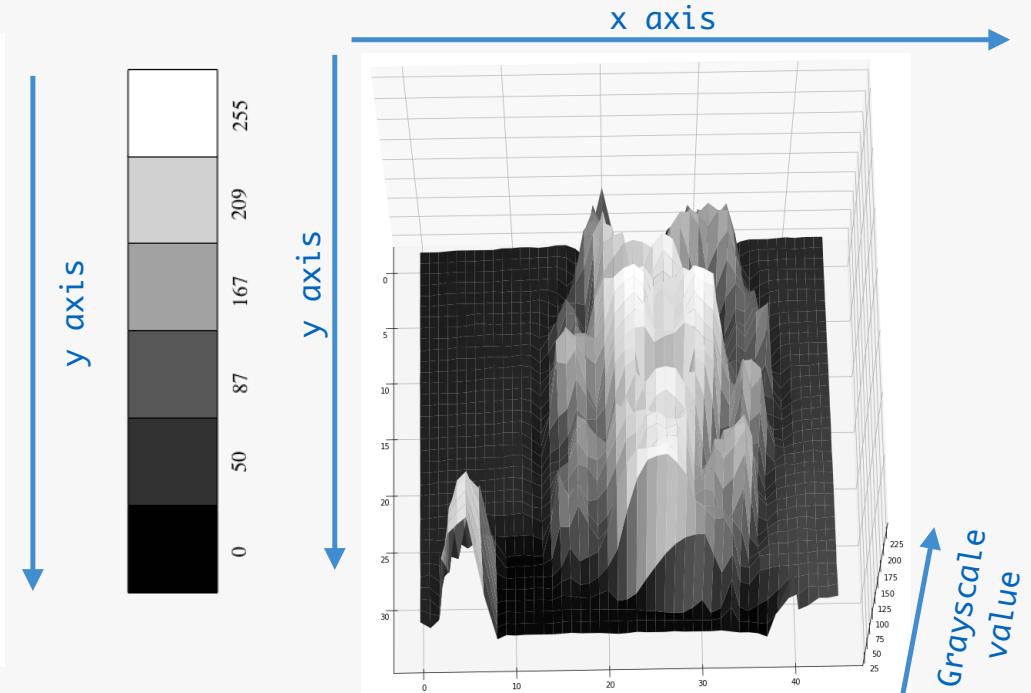
Grayscale intensity

Computer Vision

But how.. Pixels!



Computer Vision



(x,y) are pixel location
 $z = \text{grayscale value}$

Computer Vision

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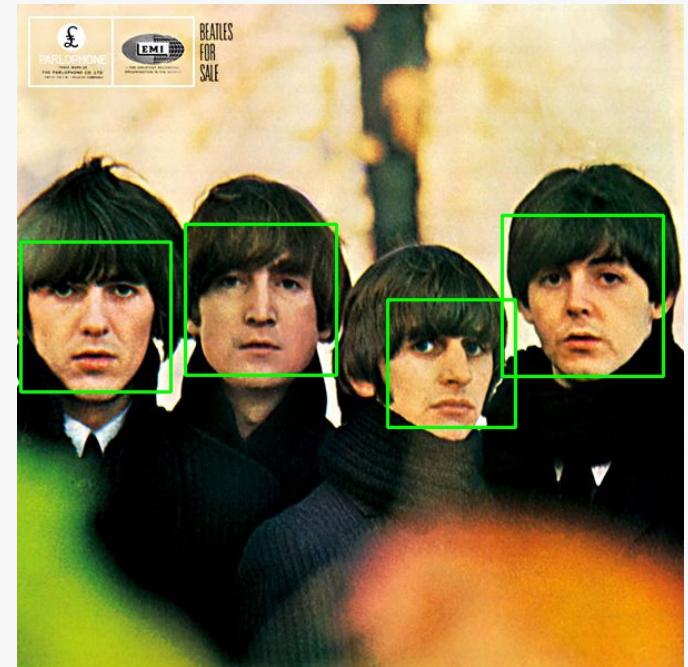
Computer Vision



Definitions

- Facial Detection:
 - Where is the face.

Face Detection

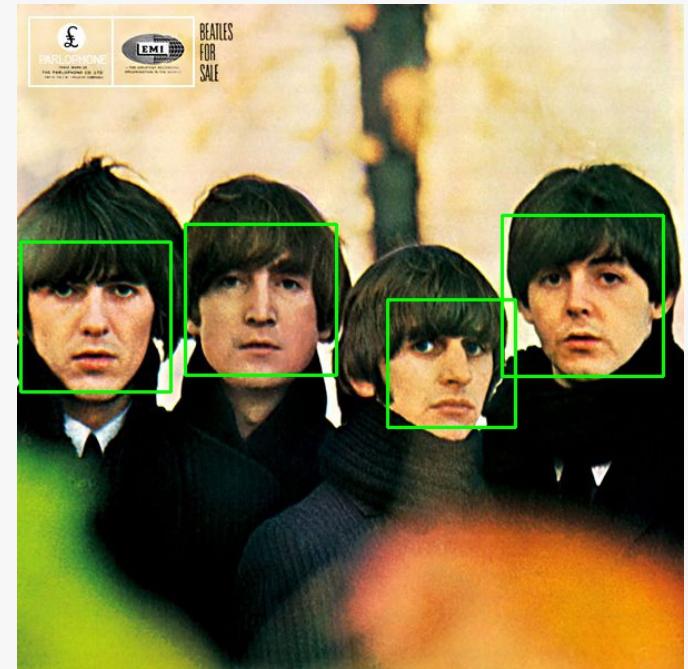


Computer Vision

Definitions

- Facial Detection:
 - Where is the face.
- Image Recognition:
 - Who is this?

Face Detection



Beatles

Computer Vision

Viola-Jones

Face Detection

- Viola–Jones object detection framework
- Based on Haar-Cascades (apearance based model)
- What is a “Haar-Cascade”?
 - Cascade is a series of “Haar-like features” combined to form a classifier.
- What is a “haar-like feature”?

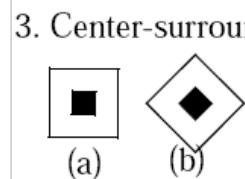
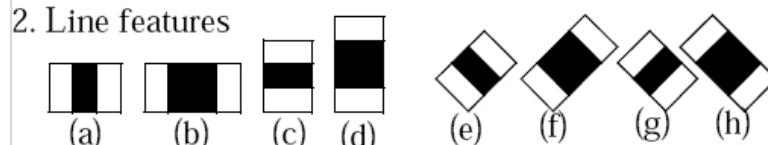
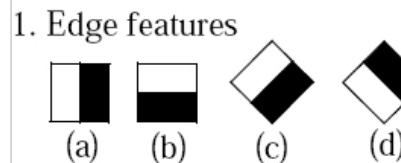
**Attention
Broad & vague!**

haar-like feature

Face Detection

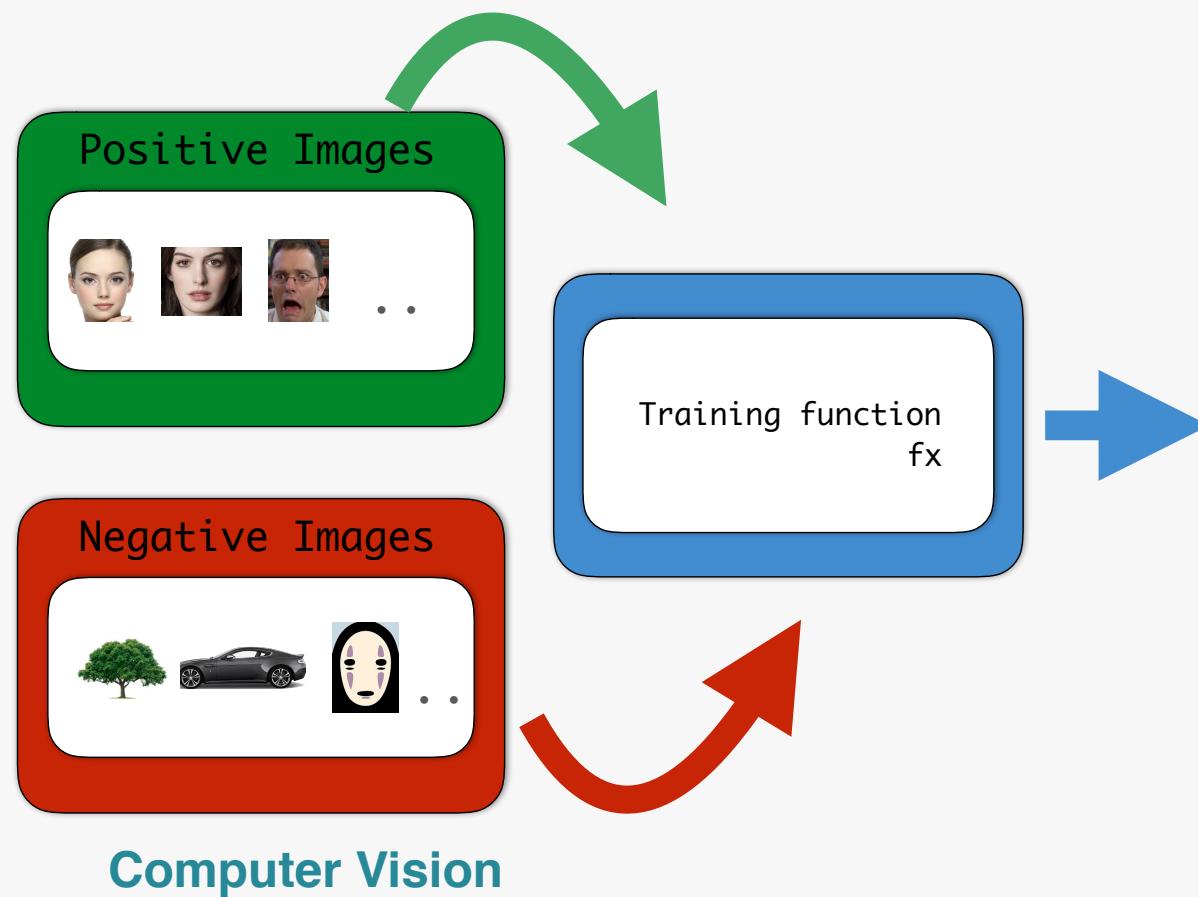


$$f_0(x) = B - A$$



Computer Vision

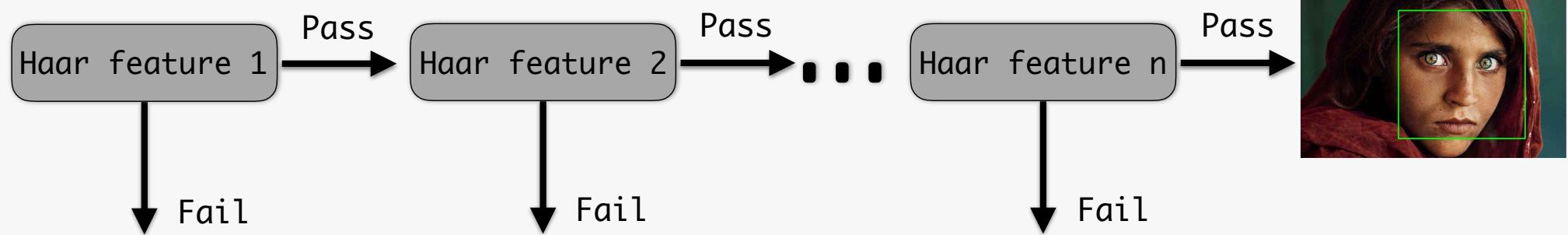
Cascade Classifier Training



Face Detection

cascade

Face Detection



NO FACE

Computer Vision

Action

Face Detection



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Computer Vision



Steps

Code

- https://github.com/franksalas/computer_vision_tux
- <https://cloud.sagemath.com/> **Use Chrome or Safari, NO firefox.**
- Create new project, name it cv_workshop
- Upload: computer_vision_tux-master.zip

Computer Vision

Sections

- Notebook tour
- Draw shapes using OpenCV
- Color scale
- Face detection using OpenCV
- Code challenge (*supa dupa eazy..*)

Code

Computer Vision

Load image

Code

In []:

```
import cv2      ← computer vision library  
import matplotlib.pyplot as plt ←
```

plotting library

In []:

```
img = cv2.imread('images/tswift.png') ←  
plt.imshow(img) ← plot image  
plt.show() ← show image      ← load image
```



T. Swift

Computer Vision

Sources

- A Practical Introduction to Computer Vision with OpenCV by Kenneth Dawson-Howe.
- http://docs.opencv.org/3.0-beta/doc/py_tutorials/py_tutorials.html
- Handbook of Face Recognition by Li, Stan Z., Jain, Anil.
- pyimagesearch.com.
- OpenCV with Python By Example by Prateek Joshi.

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