High level Content-based image retrieval

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Introduction

Development of an application to do image retrieval by extracting high level information from the images.

The application is divided in two parts:

- Indexing set of images
- Search by image /test to get the results
- Rank the results

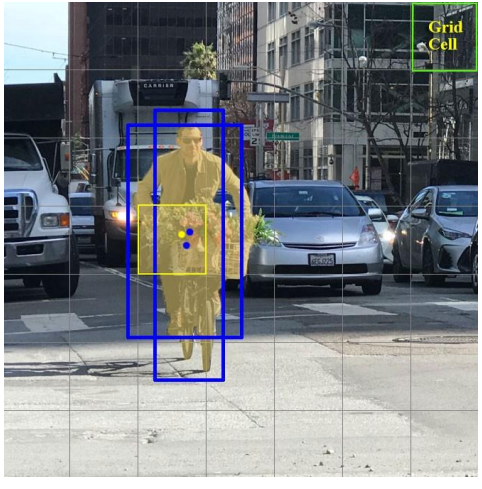
What do we use to score images?

- Object detection
- Visual Saliency
- Face recognition
- Object Character recognition

Yolov3

YOLO (You Only Look Once) is a state of the art object recognition algorithm.

- Divides the image in grid cells and applies a CNN classifier to each, each grid cell has a maximum of objects it can predict.

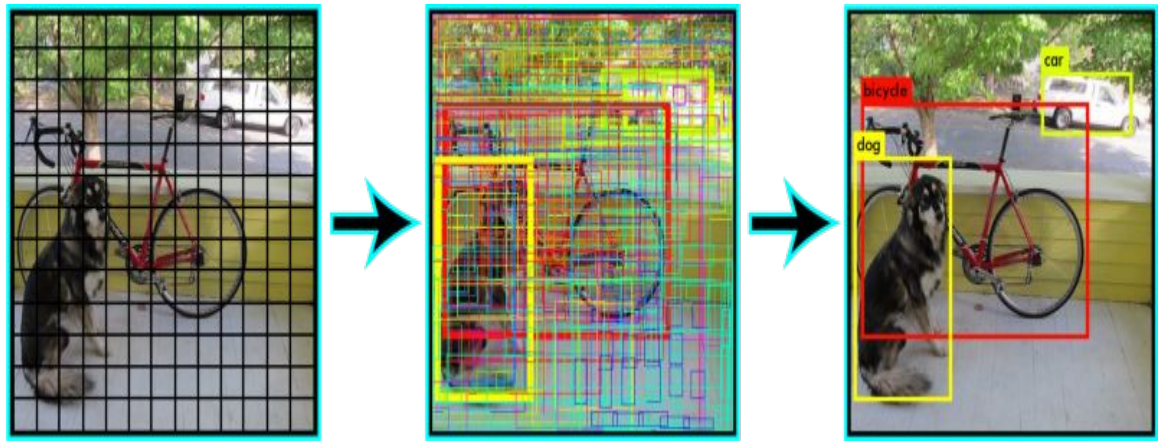


$$\hat{y} = \begin{bmatrix} P_c \\ b_x \\ b_y \\ b_y \\ c_1 \\ c_2 \\ \dots \\ c_n \\ P_c \\ b_x \\ b_y \\ b_y \\ c_1 \\ c_2 \\ \dots \\ c_n \end{bmatrix}$$

1 anchor box

Non-max suppression

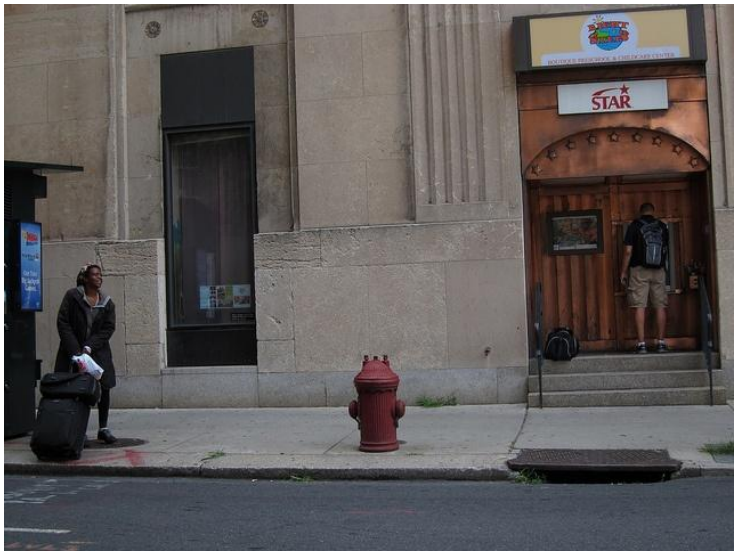
$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$

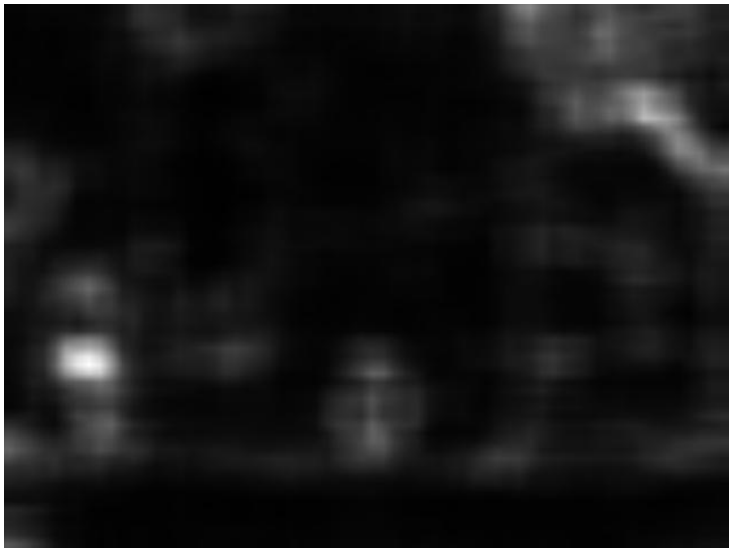


Tunable parameters

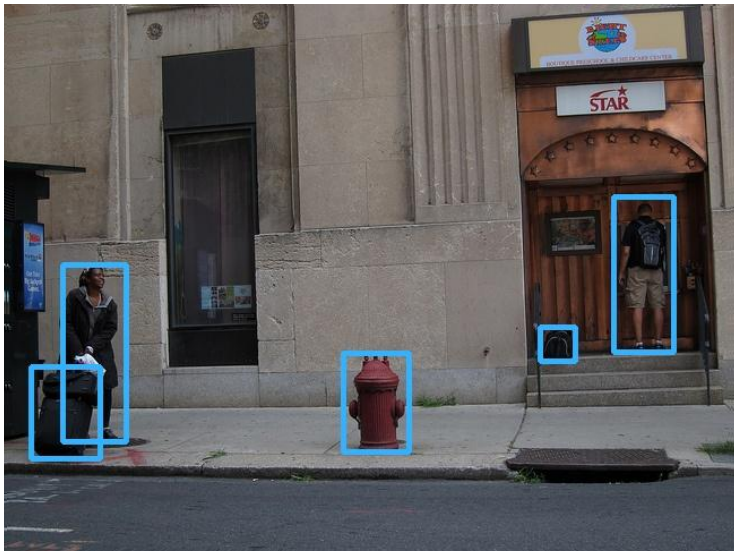
- Confidence threshold
- Non-max suppression threshold (IoU)
- Max number of objects in a cell grid

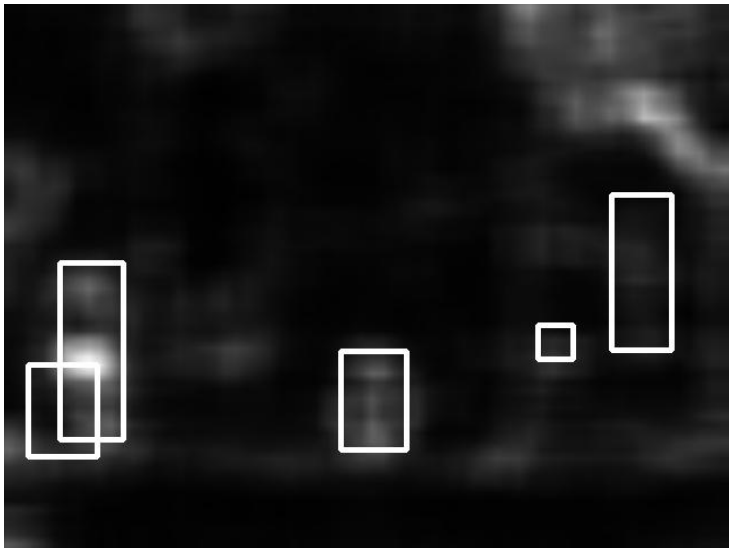
Visual Saliency



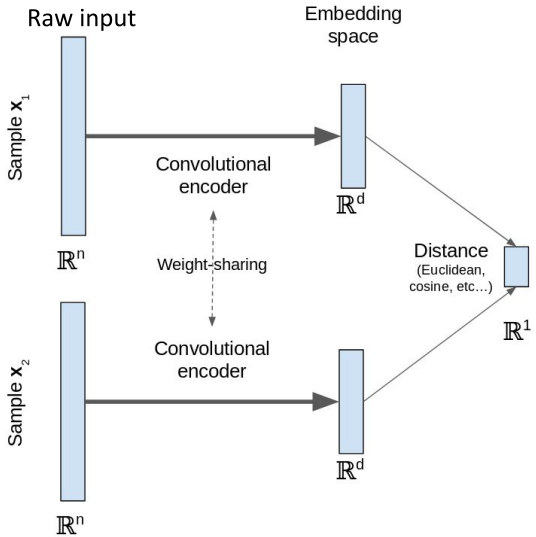


Relevance Calculation



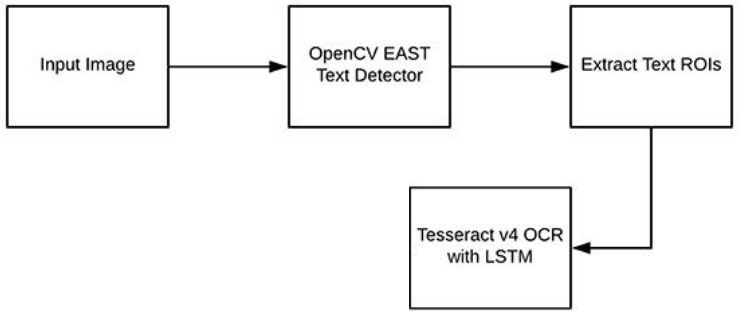


One Shoot Face Recognition

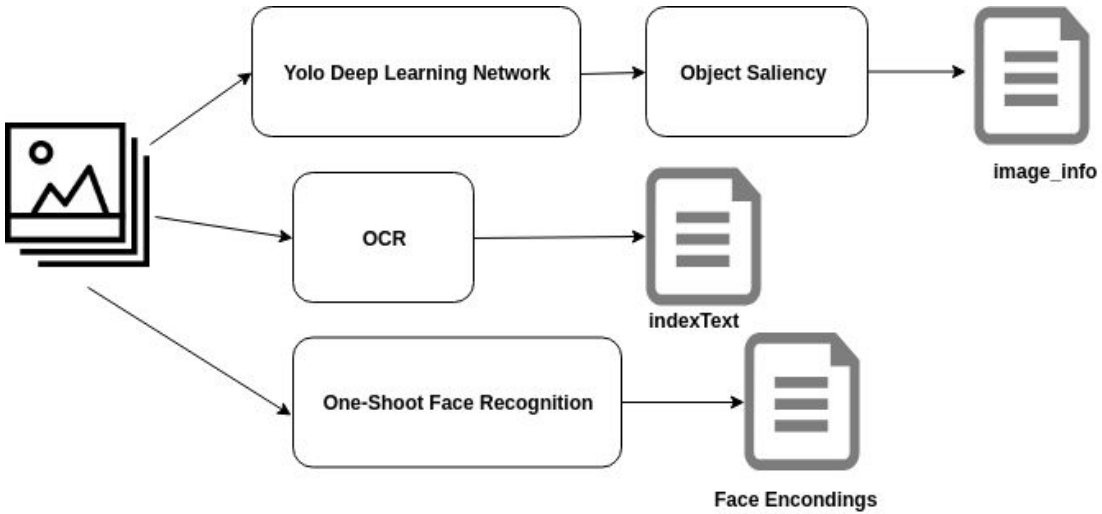


OCR (optical character recognition)

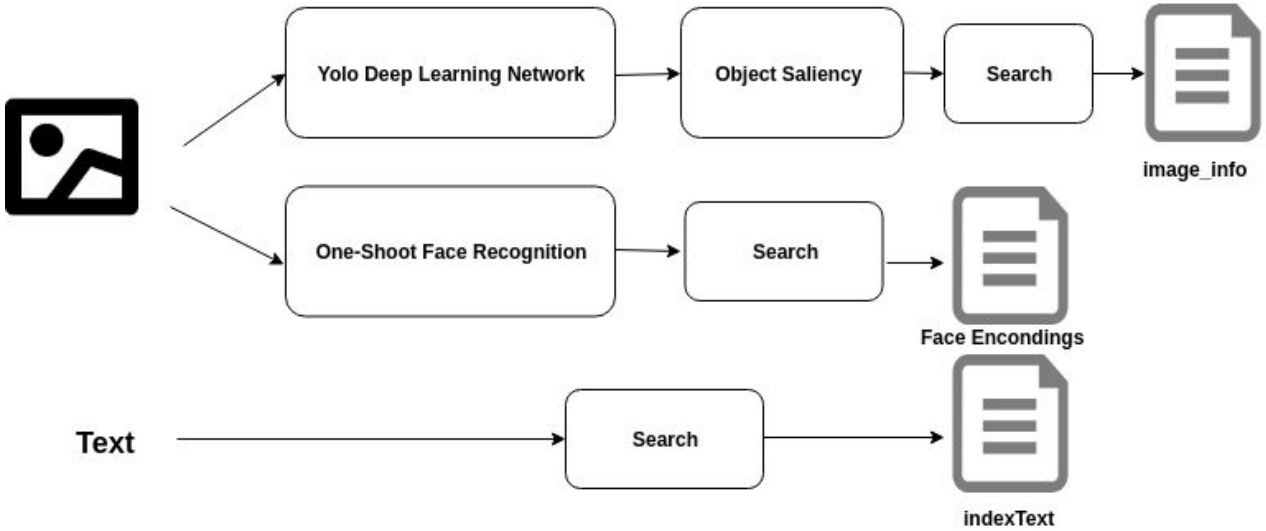
- The function verifyText() is called and it returns a list with the words detected in the given image;
- Verification if it was detected any text in the image;
- Removing Special Characters;
- Performing Stemming;



Indexing Data flow



Search Data flow



Ranking

TABLE I
OBJECT WEIGHT CALCULATION

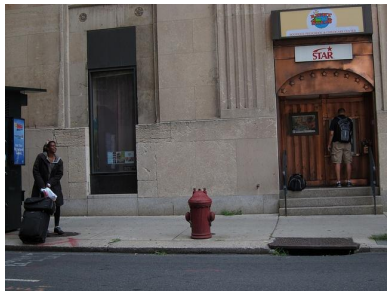
y	$\hat{y}$	cost
0	0	0
0	> 1	$log(1 + \hat{y}) * e^{rel(\hat{y})}$
> 1	0	$1 + log(y) * e^{rel(y)}$
> 1	> 1	$\lvert log(y) - log(\hat{y})\rvert * e^{\lvert rel(y) - rel(\hat{y})\rvert}$

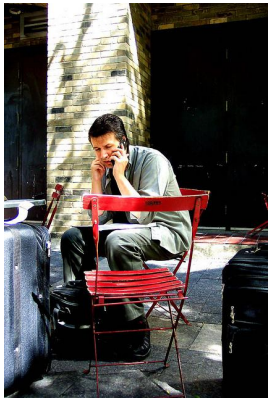
TABLE II
FACE DISCOUNT CALCULATION

$d <= 6$	-10
$0.6 < d < 1$	$min(log((d - 0.6) * 2.5)), -10)$
$d > 1$	0

Results

Query





Results

Query: “nokia”

Query