

A simple
detector for
crowd
counting using
OpenCV and
Python

Martí Gelabert
Gómez

Background
Removal

CLAHE

Background Image

Gaussian Blur

Subtraction

Binarization

Masking

Dilation

Find contours

Results

Outputs

Conclusions

A simple detector for crowd counting using OpenCV and Python

Martí Gelabert Gómez

University of the Balearic Islands

November 29, 2022

Objective

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We need to generate an algorithm capable of **crowd counting**...

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We need to generate an algorithm capable of **crowd counting**...

So we need to :

- Have some kind of ground truth

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We need to generate an algorithm capable of **crowd counting**...

So we need to :

- Have some kind of ground truth
- An algorithm to Detect persons

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We need to generate an algorithm capable of **crowd counting**...

So we need to :

- Have some kind of ground truth
- An algorithm to Detect persons
- And be able to quantify our performance

Labeling

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First, we need to **label** our images and establish some kind of **criteria** to decide which persons to label.

Occlusions

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Compact information

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Masked areas

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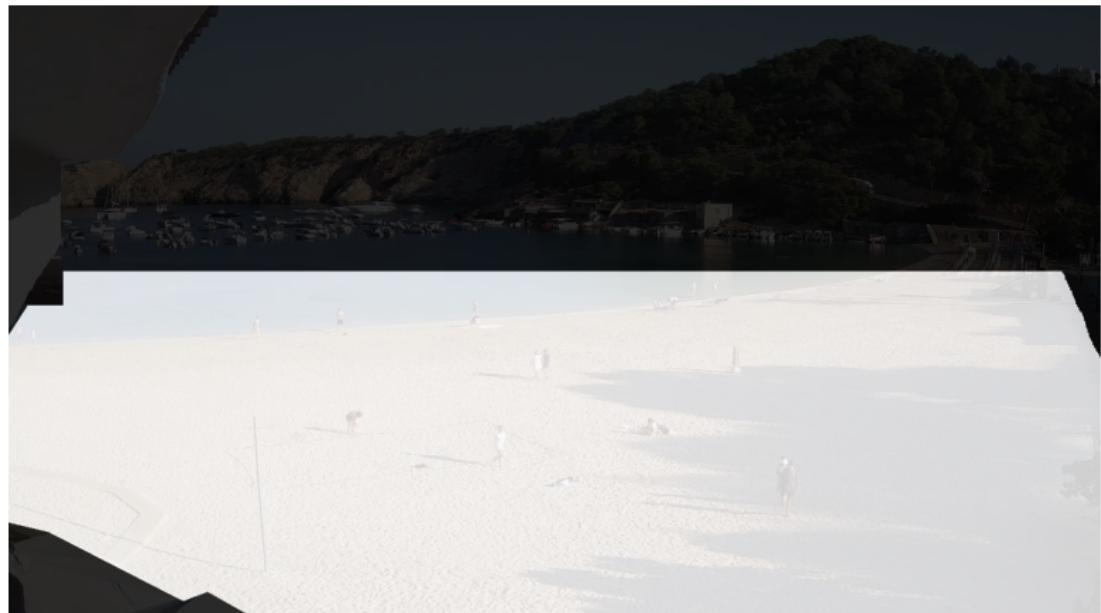
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Where do we start

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Then, we need a way for detecting people:

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Then, we need a way for detecting people:

- Gabor filtering X

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Then, we need a way for detecting people:

- Gabor filtering **X**
- Edge detector **X**

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Then, we need a way for detecting people:

- Gabor filtering **X**
- Edge detector **X**
- Applying derivatives **X**

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Then, we need a way for detecting people:

- Gabor filtering ✗
- Edge detector ✗
- Applying derivatives ✗
- Background removal ✓

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Background Removal

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We need to do something with the **illumination** of the images and improve the **contrast**.

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Background Image

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Average image X

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Gaussian Blur

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```
cv2.threshold(subtracted, 100, 255, cv2.THRESH_BINARY)
```

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Masking

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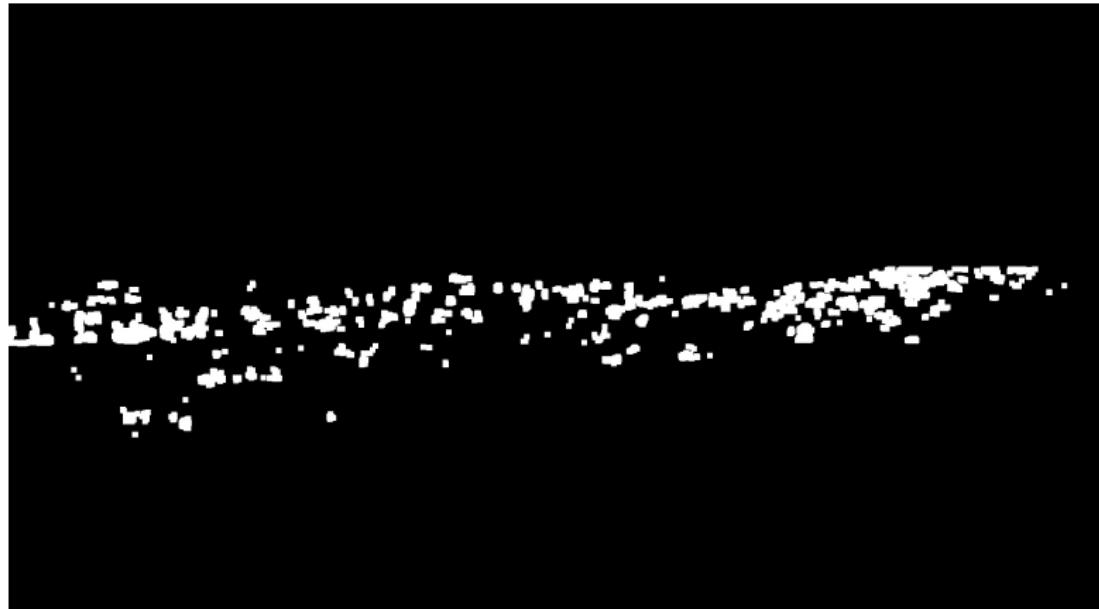
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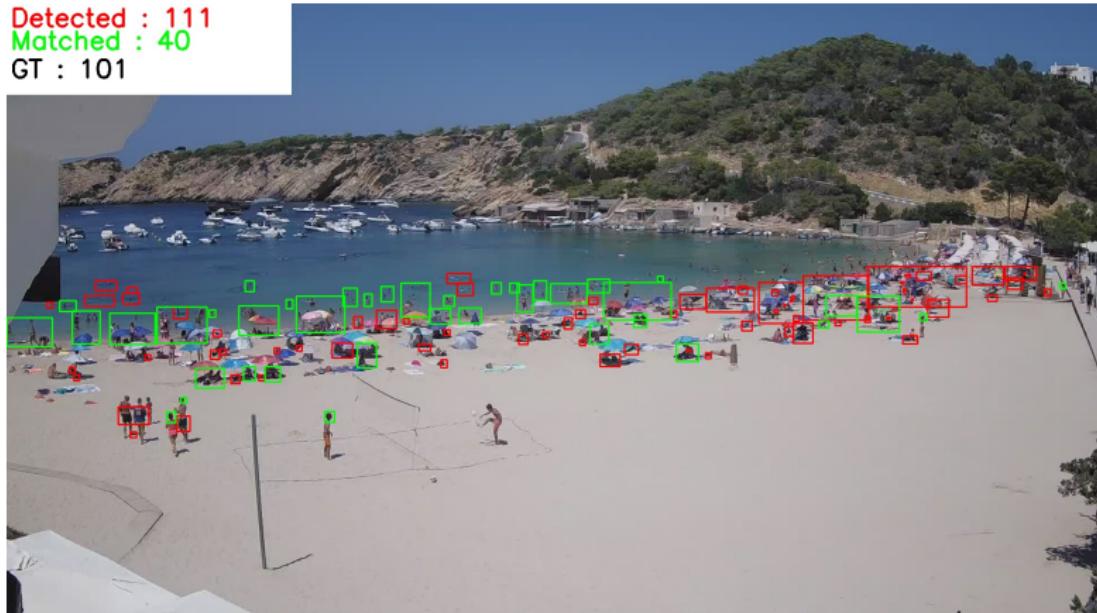
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Detected : 111
Matched : 40
GT : 101



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- If detection contains more than one person it will count as only one detection.
- In the case we would have a massive region we will discharge that detection.
- For checking the dimensionality of the bounding box, we would assume that width or height higher than a third of the image will not be acceptable.
- Regions minuscule will also be discarded.
- Some labels of the ground truth could be double checked.

Results

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files	precision	recall	f1 score	gt	detected	matched
1660309200.jpg	0.336	0.444	0.383	90	119	40
1660302000.jpg	0.292	0.369	0.326	103	130	38
1660294800.jpg	0.333	0.458	0.386	72	99	33
1660320000.jpg	0.363	0.363	0.363	135	135	49
1660287600.jpg	0.200	0.471	0.281	17	40	8
1660298400.jpg	0.347	0.311	0.328	106	95	33
1660305600.jpg	0.360	0.396	0.377	101	111	40
1660316400.jpg	0.358	0.345	0.352	139	134	48
1660291200.jpg	0.353	0.346	0.350	52	51	18

$$\text{MSE} = 341.666667$$

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Detected : 119
Matched : 40
GT : 90



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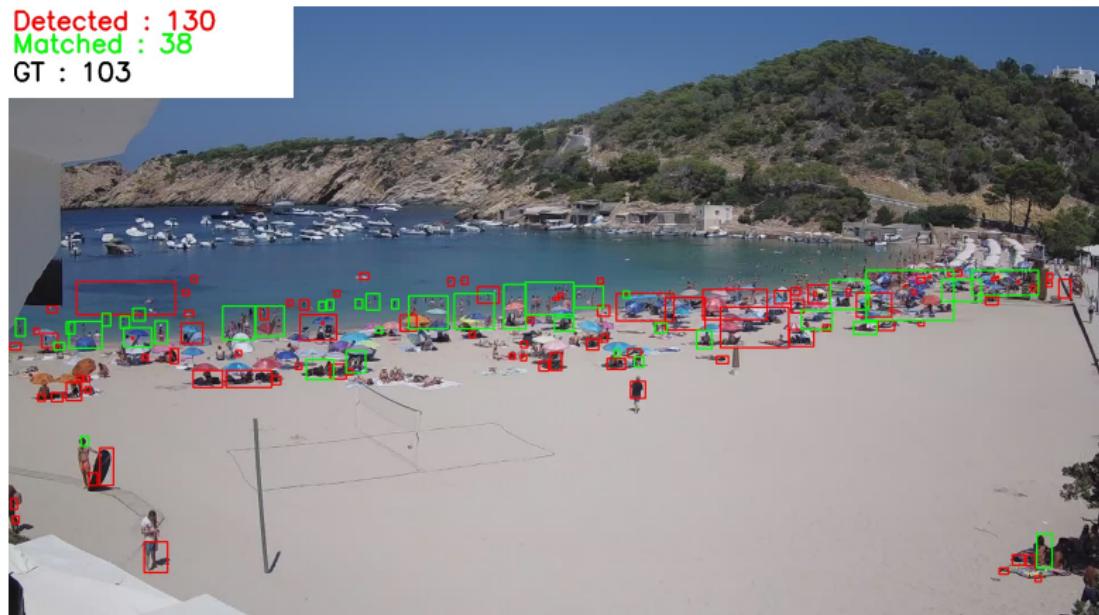
Find contours

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Detected : 130
Matched : 38
GT : 103



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Detected : 99
Matched : 33
GT : 72



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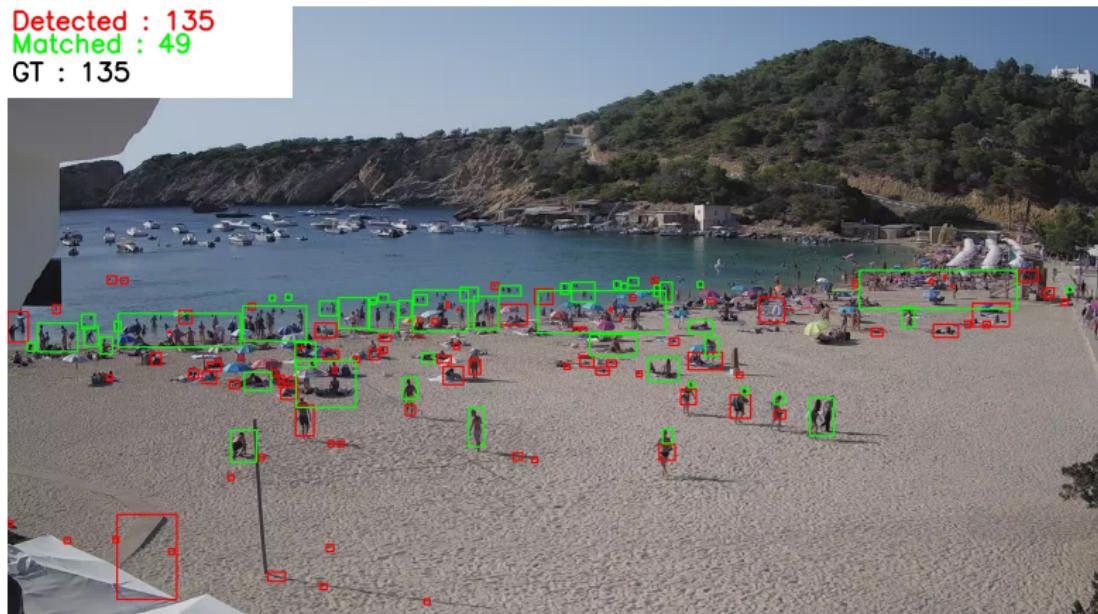
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Detected : 135
Matched : 49
GT : 135



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Detected : 40
Matched : 8
GT : 17



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Detected : 95
Matched : 33
GT : 106



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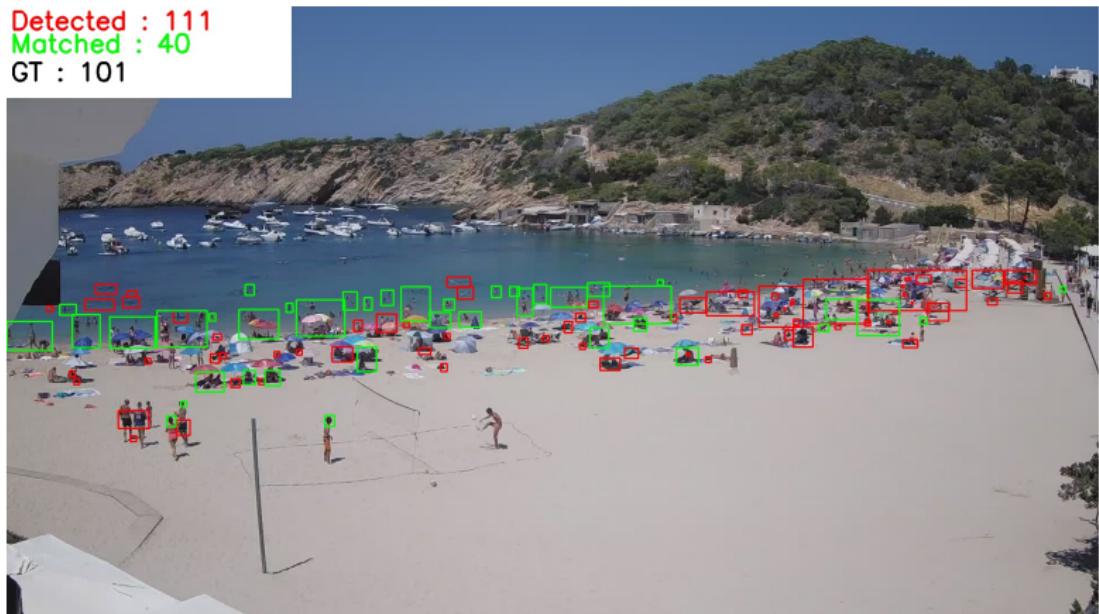
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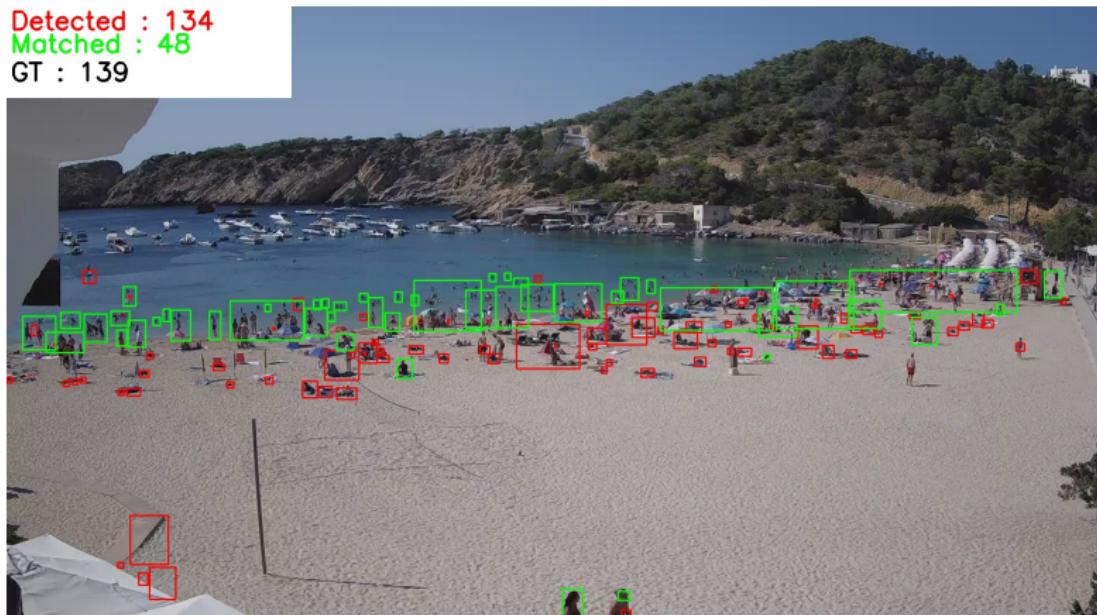
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Detected : 134
Matched : 48
GT : 139



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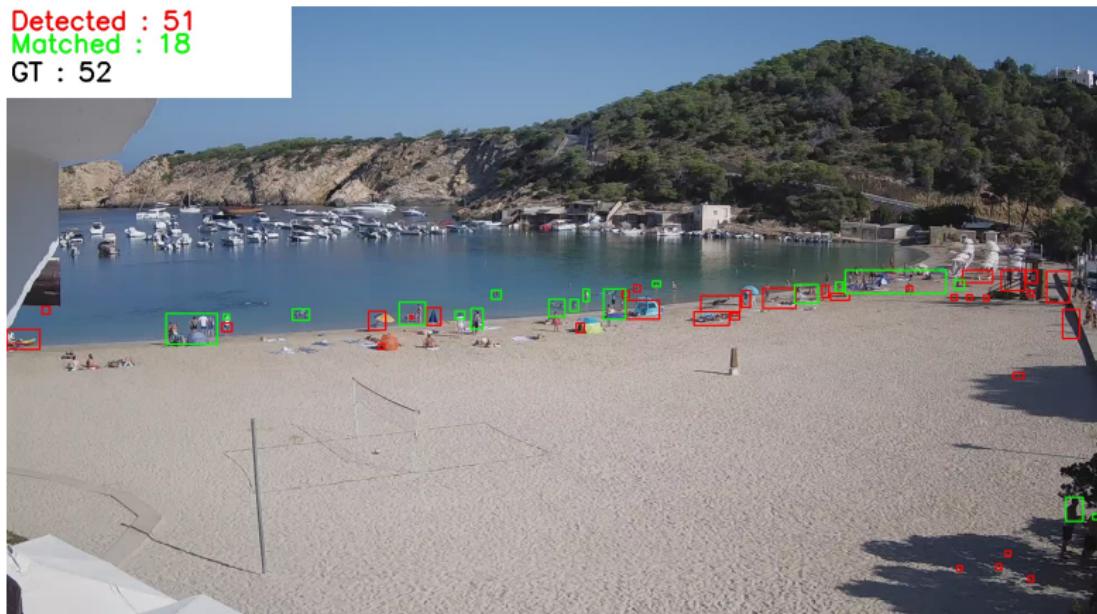
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Detected : 51
Matched : 18
GT : 52



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- Not seeking perfect detection.
- The cast shadows can confuse our algorithm.
- Working in color could be not ideal.
- The results are really fragile.

Thank you!

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Any Questions?