

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 28, 2022

Objective

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Create a crowd counting algorithm.

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Create a crowd counting algorithm.

We can implement it as we want!

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Create a crowd counting algorithm.

We can implement it as we want!

Now what? Where do we have to start?

Where do we start

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

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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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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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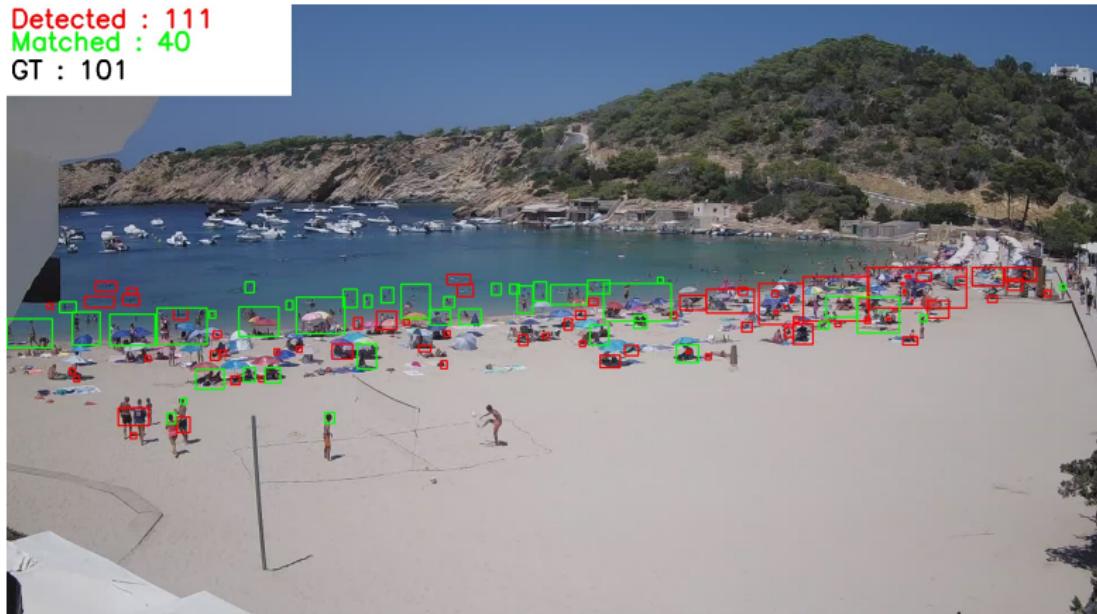
Find contours

Results

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Detected : 111
Matched : 40
GT : 101



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Evaluation

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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.

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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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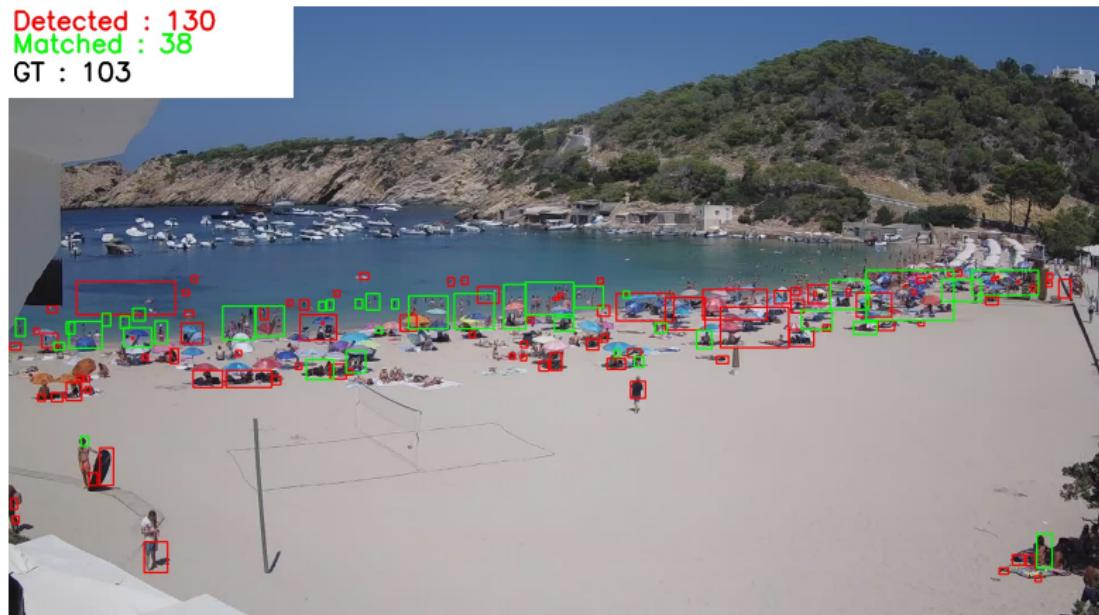
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Detected : 130
Matched : 38
GT : 103



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Detected : 99
Matched : 33
GT : 72



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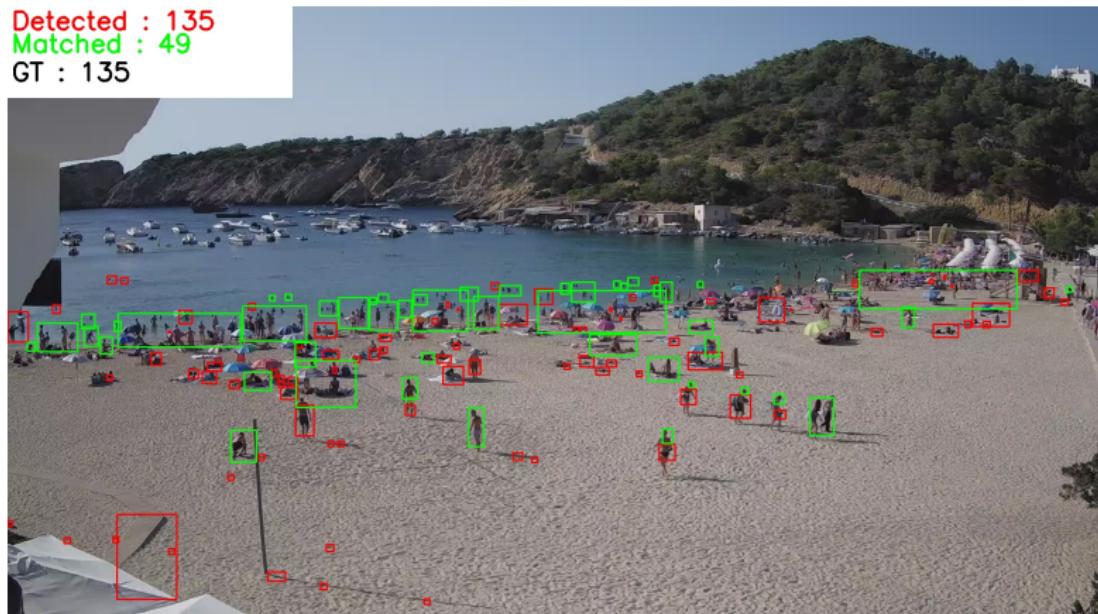
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Detected : 135
Matched : 49
GT : 135



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Detected : 40
Matched : 8
GT : 17



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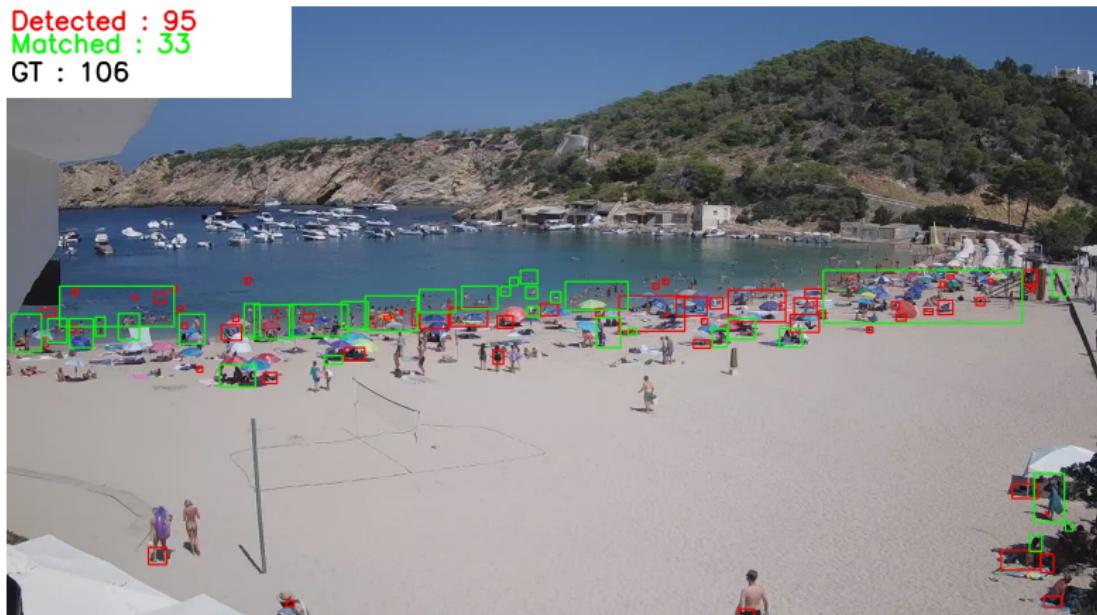
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Detected : 95
Matched : 33
GT : 106



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Detected : 134
Matched : 48
GT : 139



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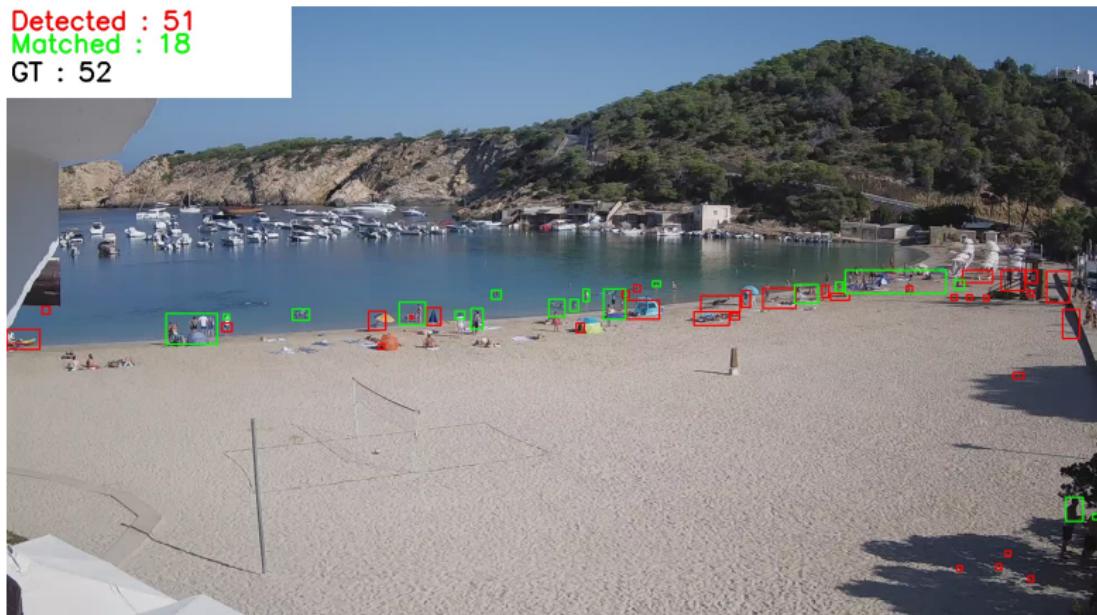
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Detected : 51
Matched : 18
GT : 52



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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?