

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

Conclusions

# A simple detector for crowd counting using OpenCV and Python

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# 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 

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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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# Subtraction

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## Binarization

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

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# Masking

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## Find contours

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# Matching

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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	0.529	0.700	0.603	90	119	63
1660302000.jpg	0.446	0.563	0.498	103	130	58
1660294800.jpg	0.535	0.736	0.620	72	99	53
1660320000.jpg	0.770	0.770	0.770	135	135	104
1660287600.jpg	0.275	0.647	0.386	17	40	11
1660298400.jpg	0.663	0.594	0.627	106	95	63
1660305600.jpg	0.595	0.653	0.623	101	111	66
1660316400.jpg	0.888	0.856	0.872	139	134	119
1660291200.jpg	0.667	0.654	0.660	52	51	34

$$\text{MSE} = 341.666667$$

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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.