Windows 9 corp.

Floor counting and window recognition challenge

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Business problem

Business problem

How many floors has this building ?
How many windows ?

Business problem

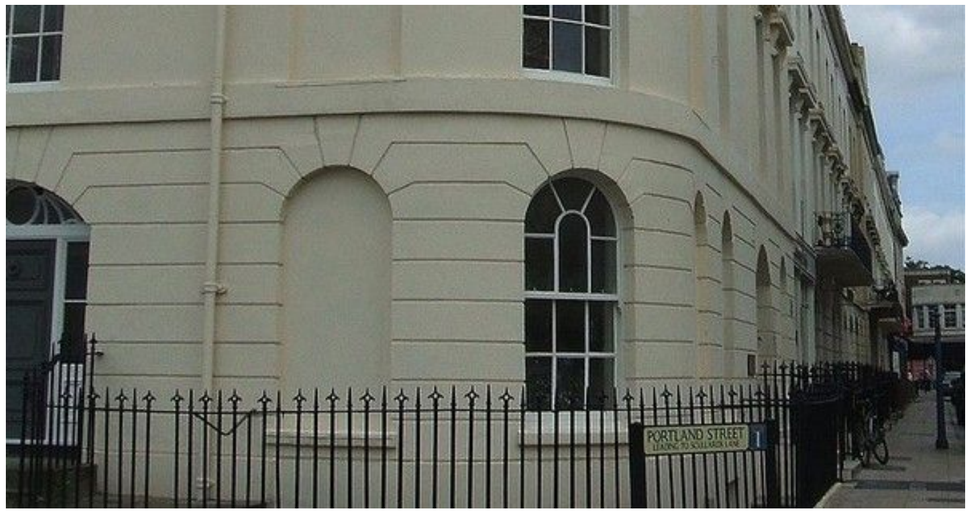
And now ?

Business problem

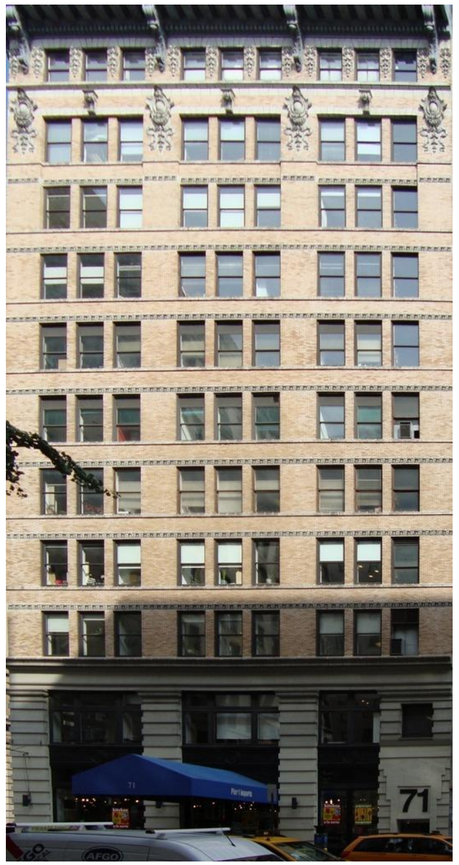
Window tax

From Wikipedia, the free encyclopedia

The **window tax** was a property tax based on the number of windows in a house. It was a significant social, cultural, and architectural force in England, France, Ireland and Scotland during the 18th and 19th centuries. To avoid the tax some houses from the period can be seen to have bricked-up window-spaces (ready to be glazed or reglazed at a later date). In England and Wales it was introduced in 1696 and was repealed in 1851, 156 years after first being introduced. France (established 1798, repealed 1926) and Scotland both had window taxes for similar reasons.



Goal : Count the number of floors on façades of modern buildings



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Perspective distortion fix

Problem definition

Photos taken from the ground

Rectangles malformed by the perspective

Algorithm

01 Ask for input

- User selects 4 points on image, that are a rectangle in real world.

02 Calculate target

- Calculate middle points for each segment connecting previously selected points.
- Generate a rectangle that intersects all the points.

03 Calculate transformation matrix

- Generate projective transformation for the image.

04 Apply transformation

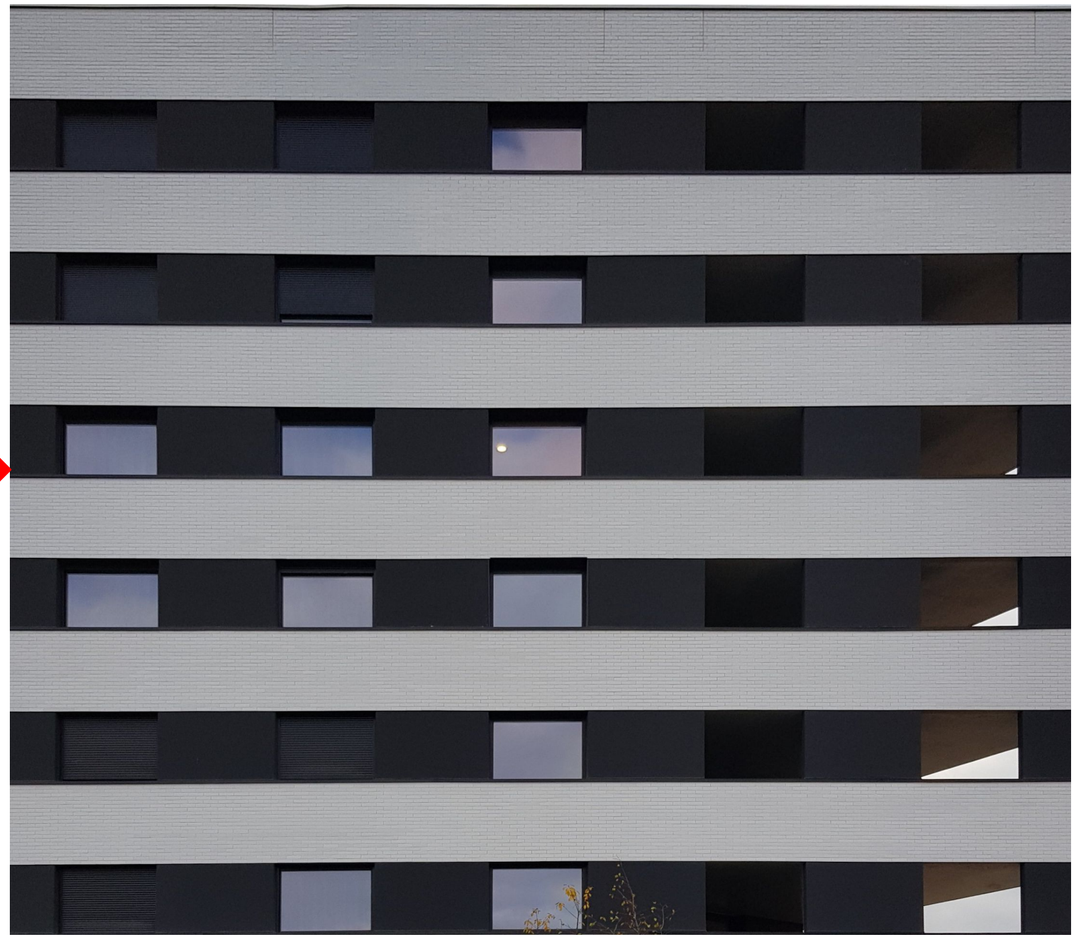
- Return an image with fixed perspective.
- Save result to file.

User Interface

Examples

Examples

Examples



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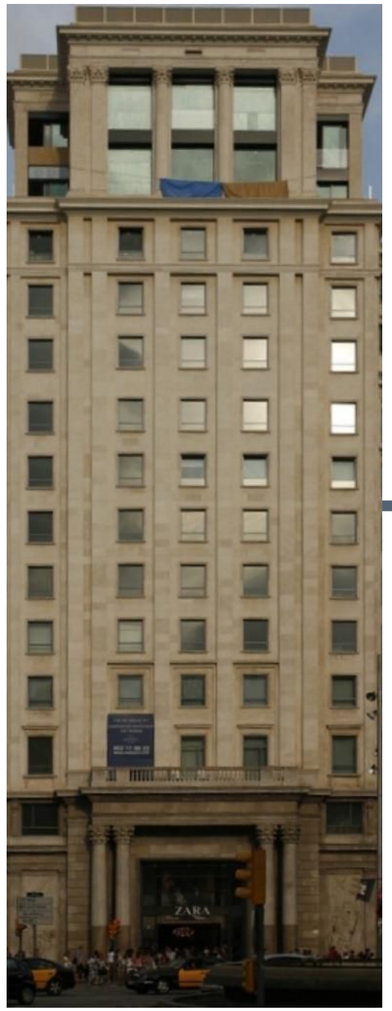
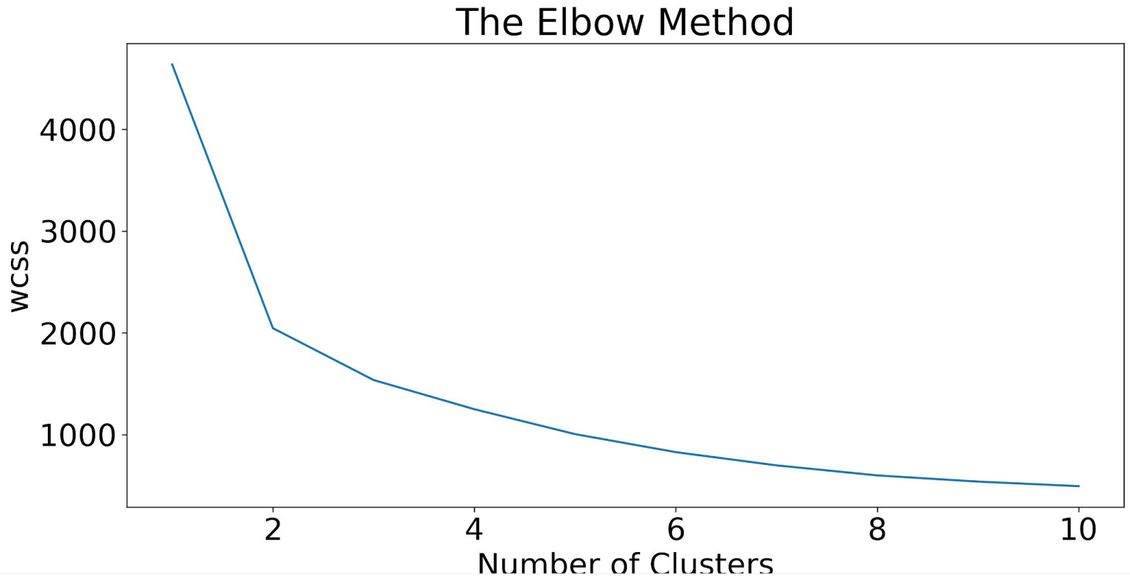
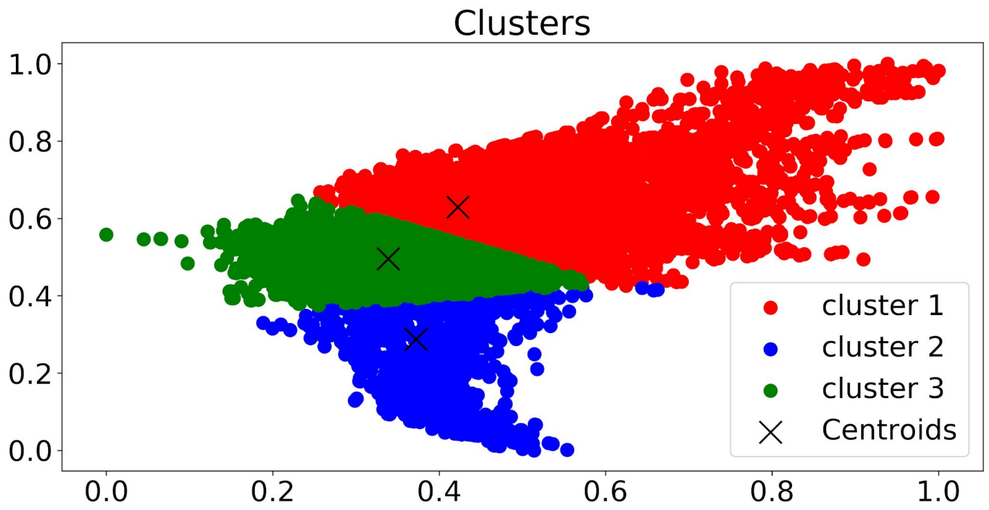
K-means approach

Color space reduction using K-means

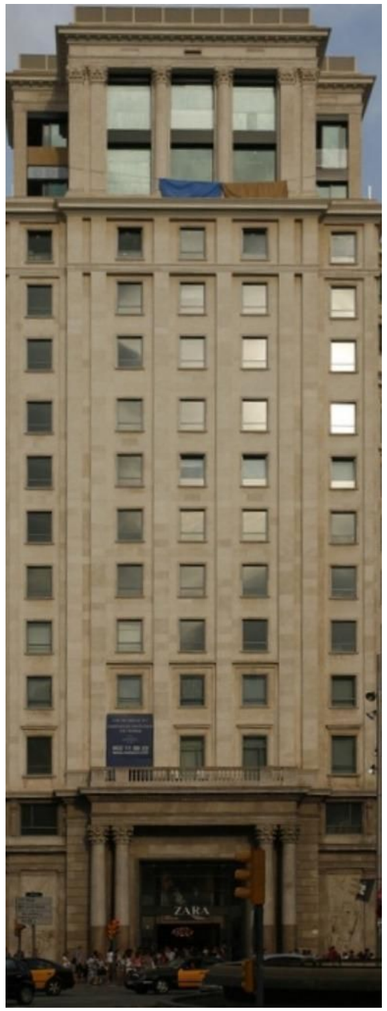


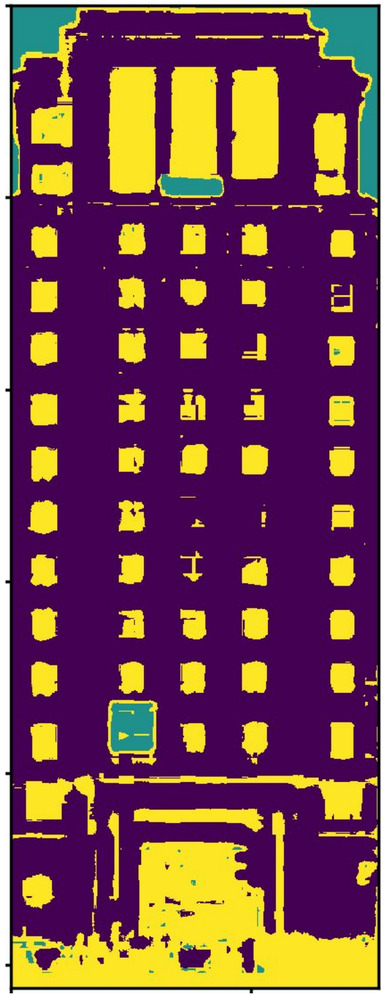
CIE L*a*b space



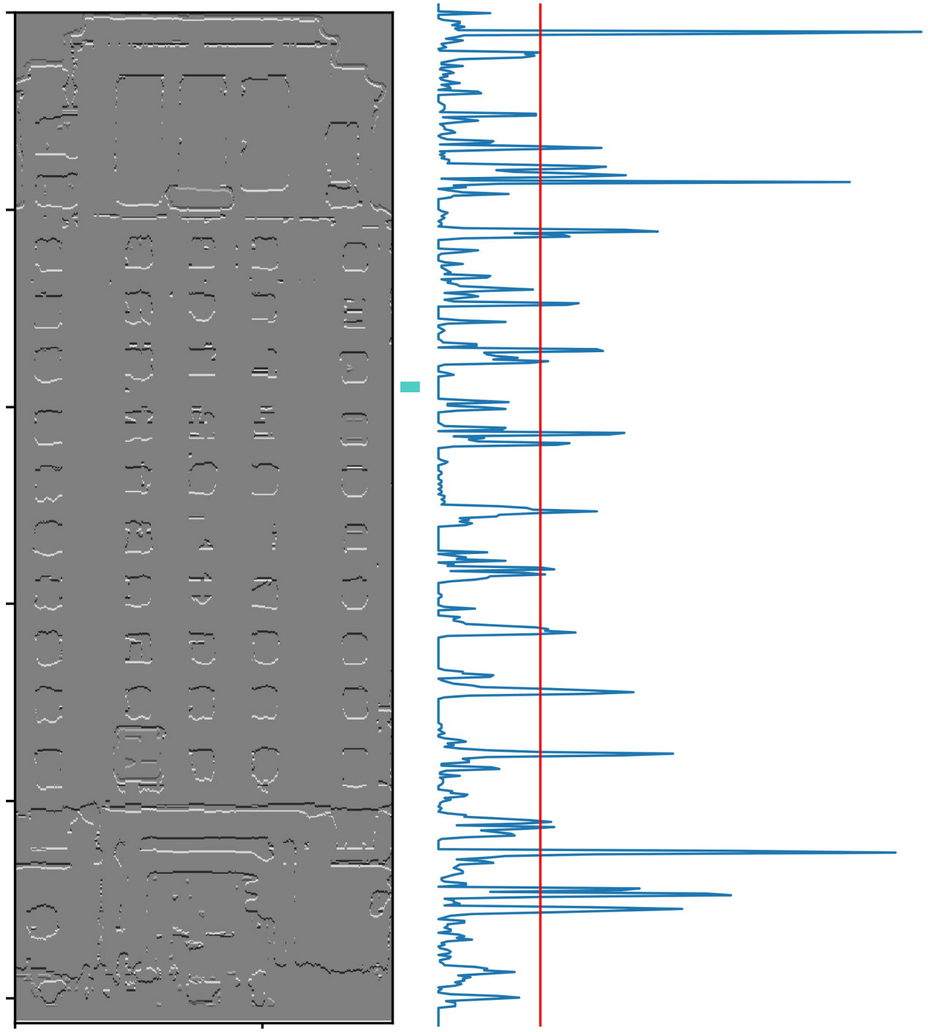


Computing K-means

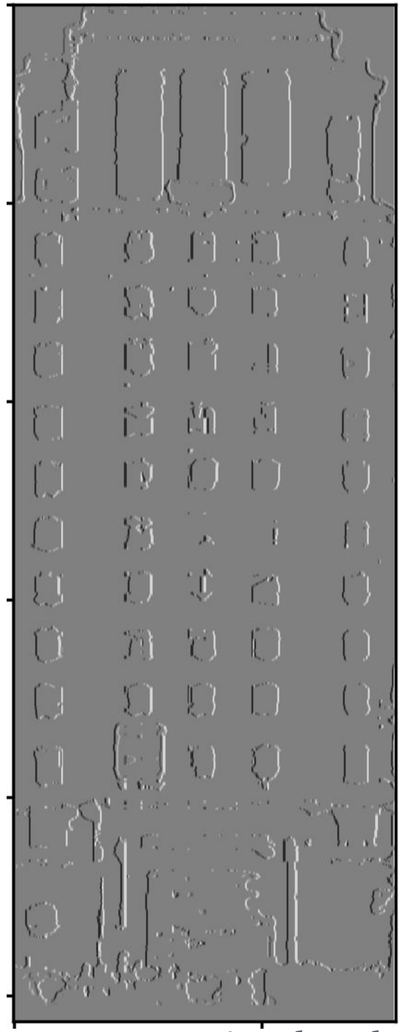


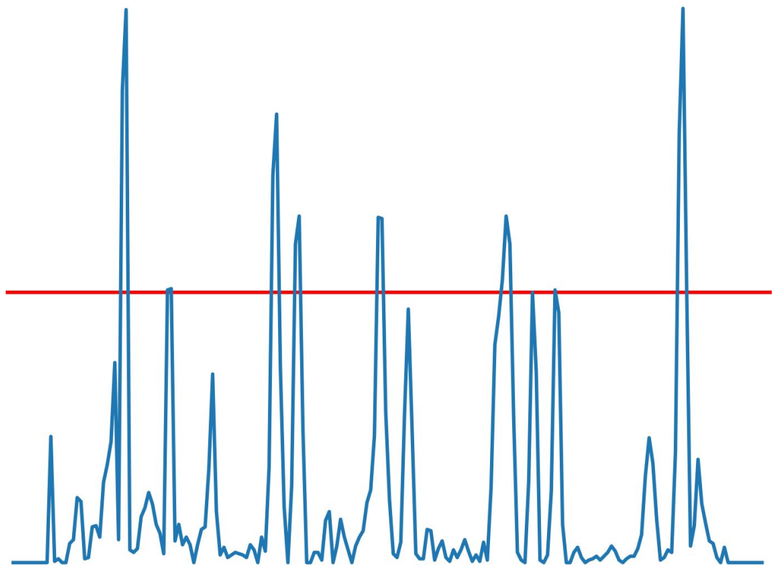


Identifying edges from a three-color image



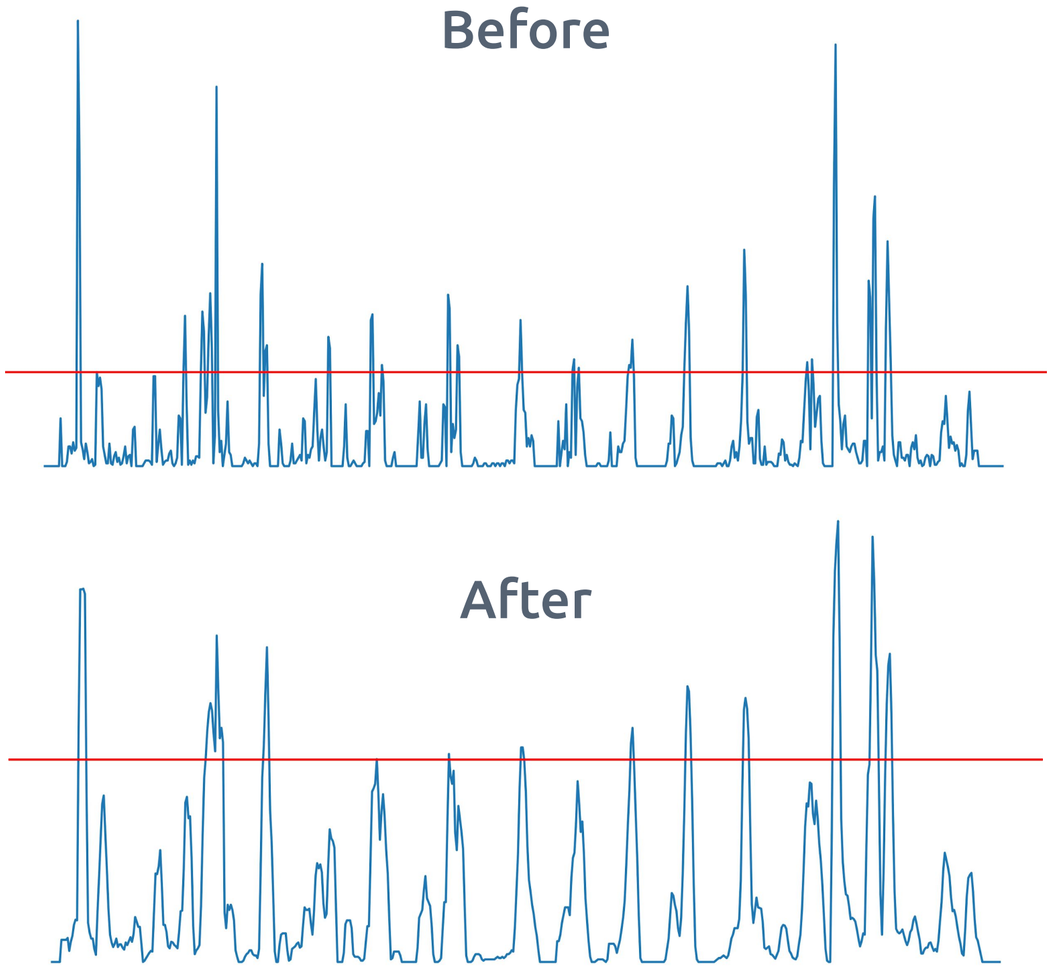
Detect horizontal edges (parallel to x)



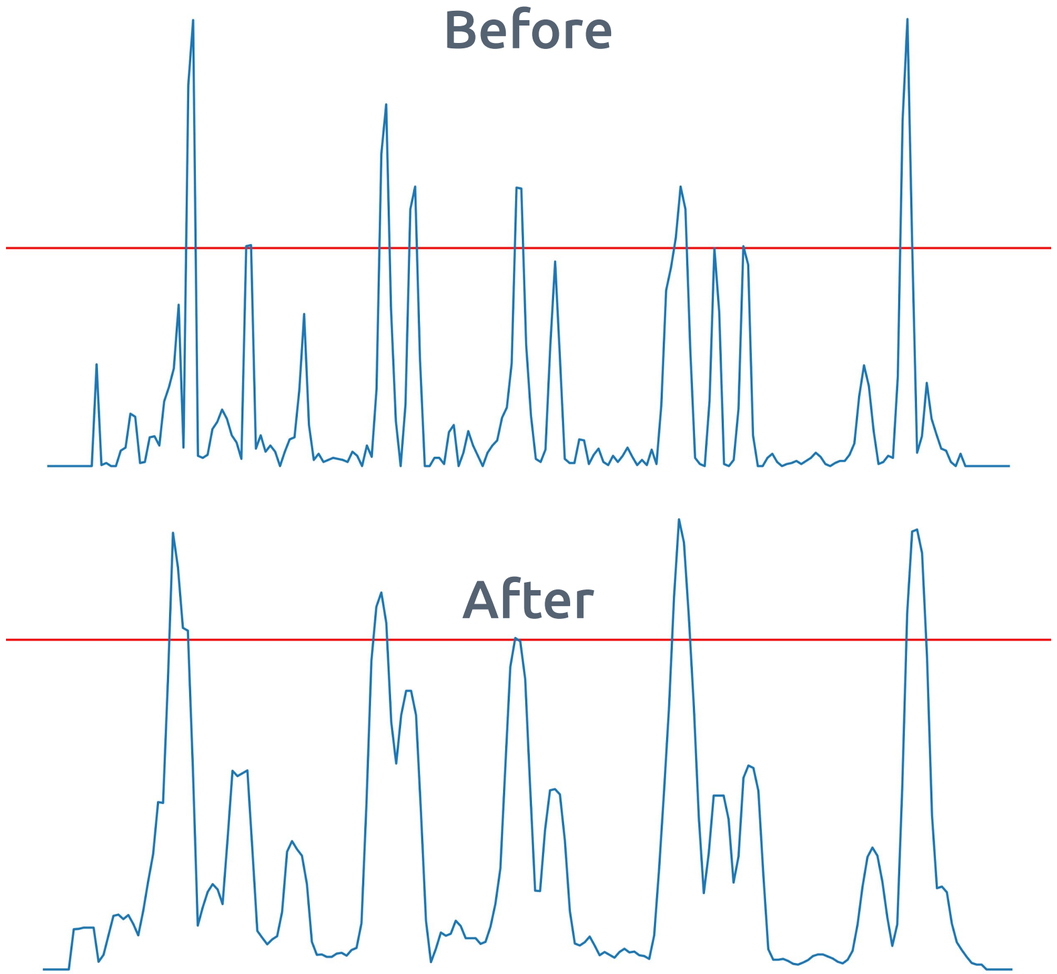


Detect vertical edges (parallel to y)

Counting



Moving average for floors



Moving average for windows

Counting

```
The number of floors using the quantile on the moving
average is:  12
The number of windows using the quantile on the
moving average is:  60
```

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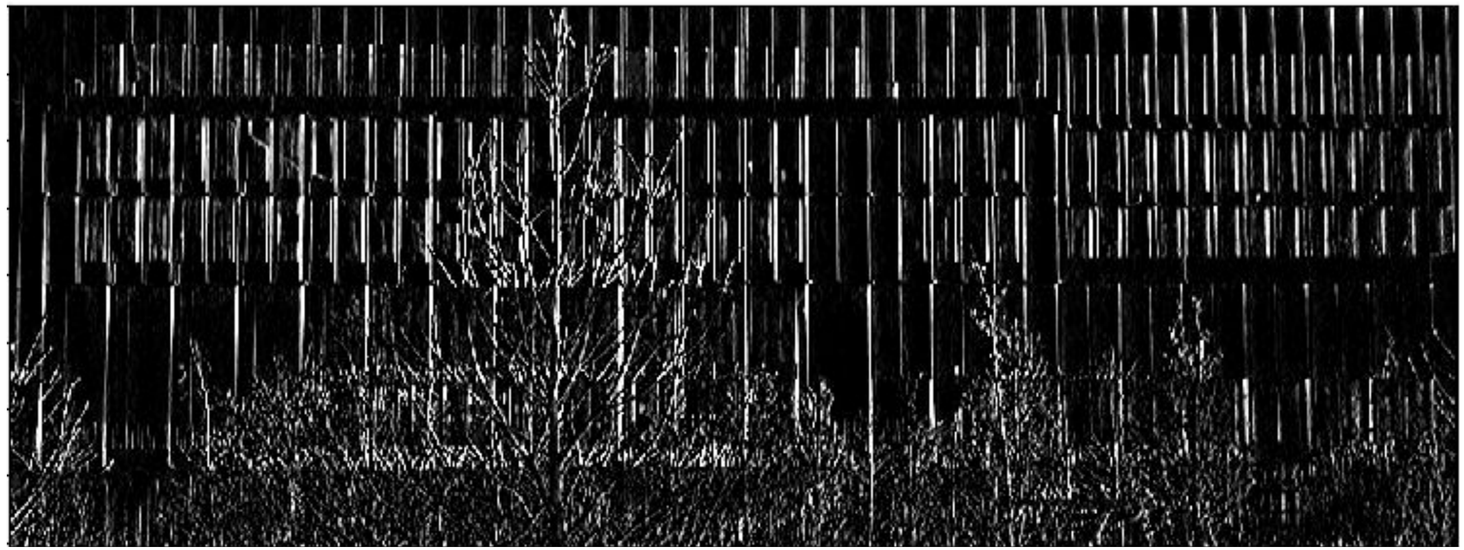
Edge Projection

Edge Detection

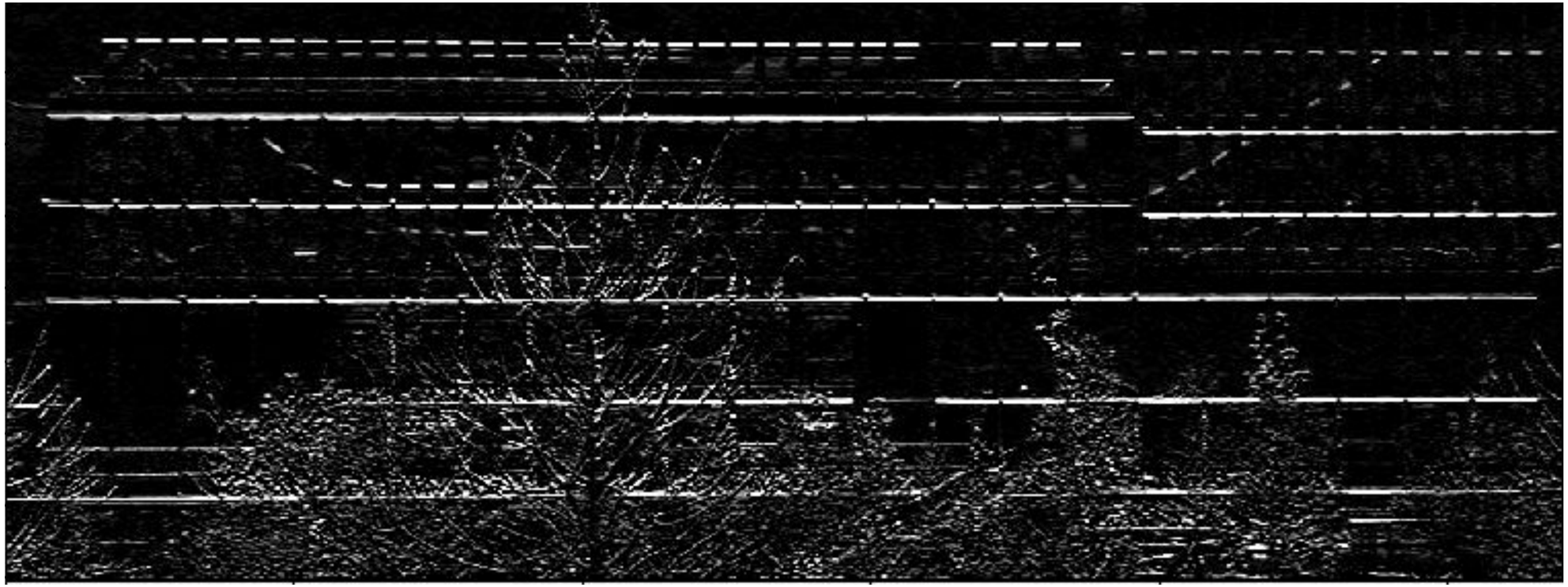
- Image Pre-processing
- Comparison of techniques
- Morphological Operations
- Edge Projection

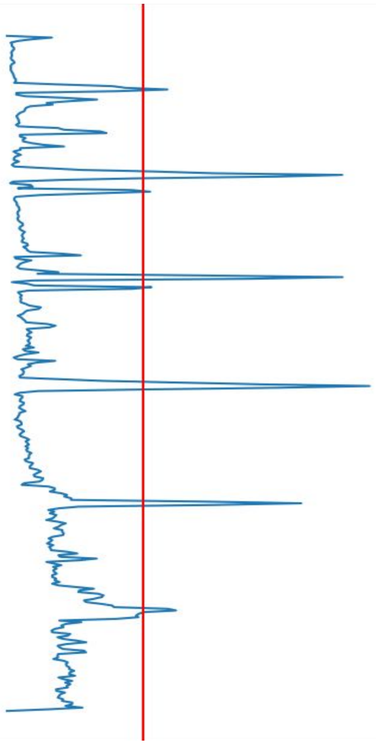
Computing horizontal and vertical gradients

Grayscale
+ Histogram
equalization

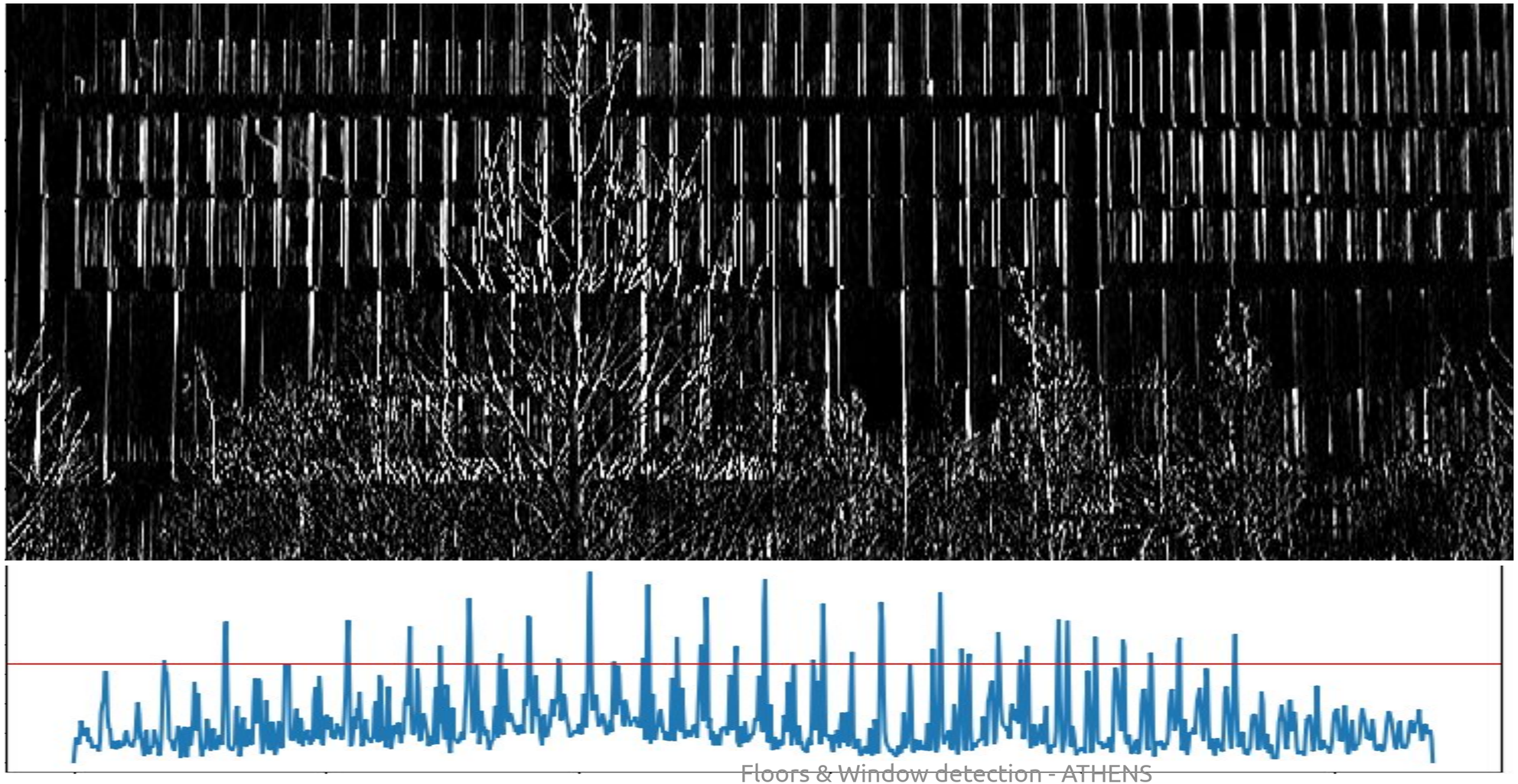


Axis projection (horizontal)

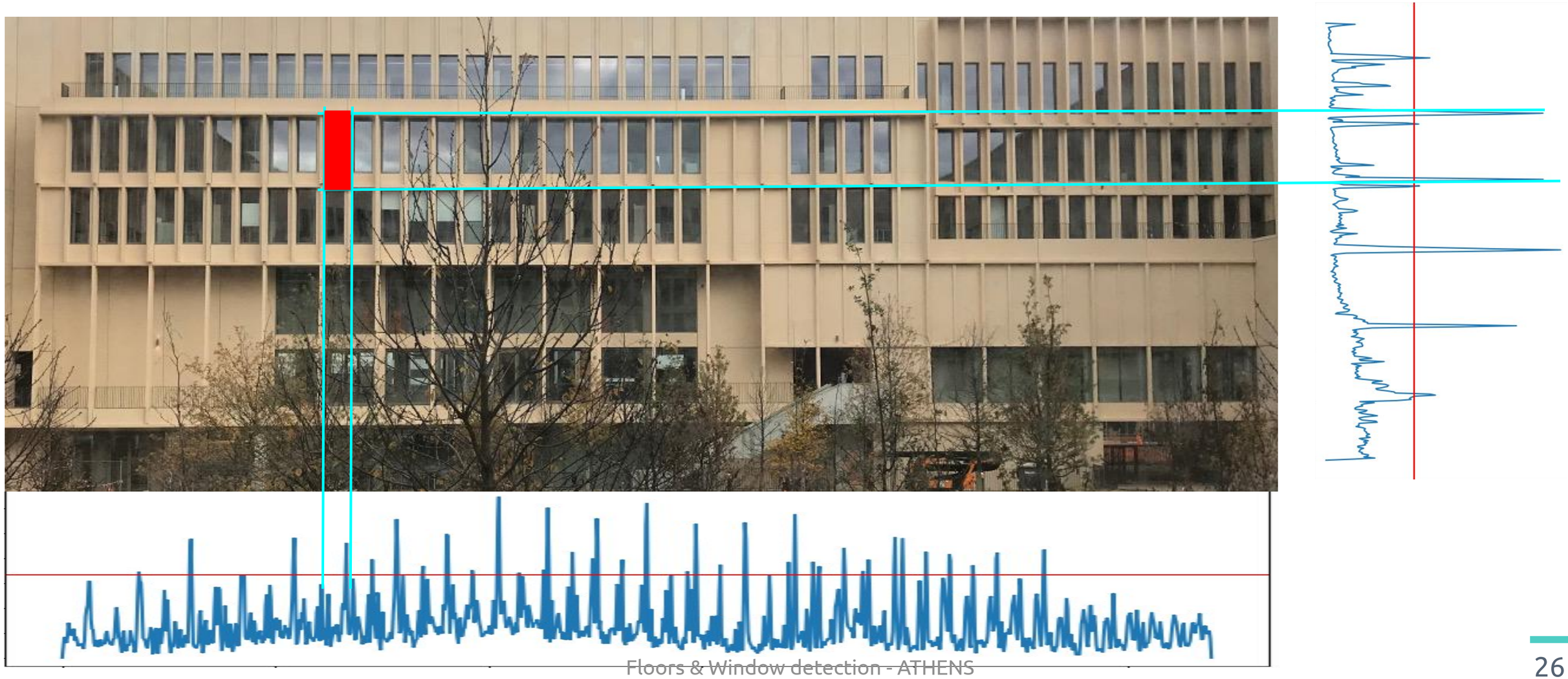




Axis projection (vertical)



Infering “probable” window position from peaks



For every box, do a horizontal matching search

Due to noise, we get **a lot** of “probable” windows. We need a metric to filter them.

First, we filter by the box size (only keep large boxes).
Then, we count the number of times “similar” shapes, on the picture, are seen on the same line of the image. We assume that a window will be repeated many times on the same line.

Window boxes plotting

Green = Good pattern matching score

Floors number approximation

Approximate number of floors =
Building height / largest window height

```
>>> nicolas('img/cropped telecom.jpg')
Finding and scoring boxes..
Number of floors guessed :  5.4615384615384462
```

5

Conclusion

Goal achieved !

We counted the number of floors of Telecom Paris' building ! Mission's achieved !...

Almost : our methods don't generalize well.

Conclusion

- A though problem (PhD thesis on the topic !)
- Hard to generalize
- Working with convolutional neural networks looks amazing
- Very interesting experience

Thank you!

Any questions?