



Windows 9 corp.

Floor counting and window recognition challenge

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1

Business problem

Business problem



How many floors has this building ?
How many windows ?



Business problem



And now ?



Business problem

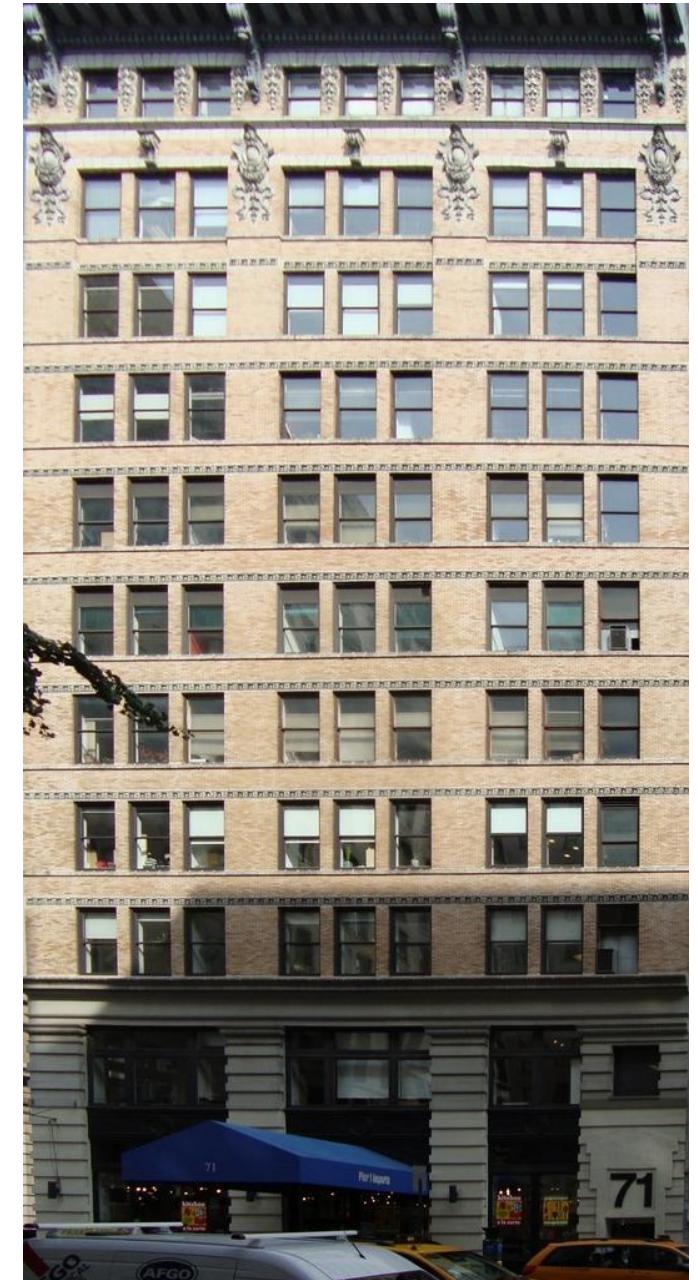
Window tax

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 In [England and Wales](#) it was introduced in 1696 and was repealed in 1851, 156 years after first being introduced. France (established 1798, repealed 1926) and Scotland both had window taxes for similar reasons.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





2

Perspective
distortion fix

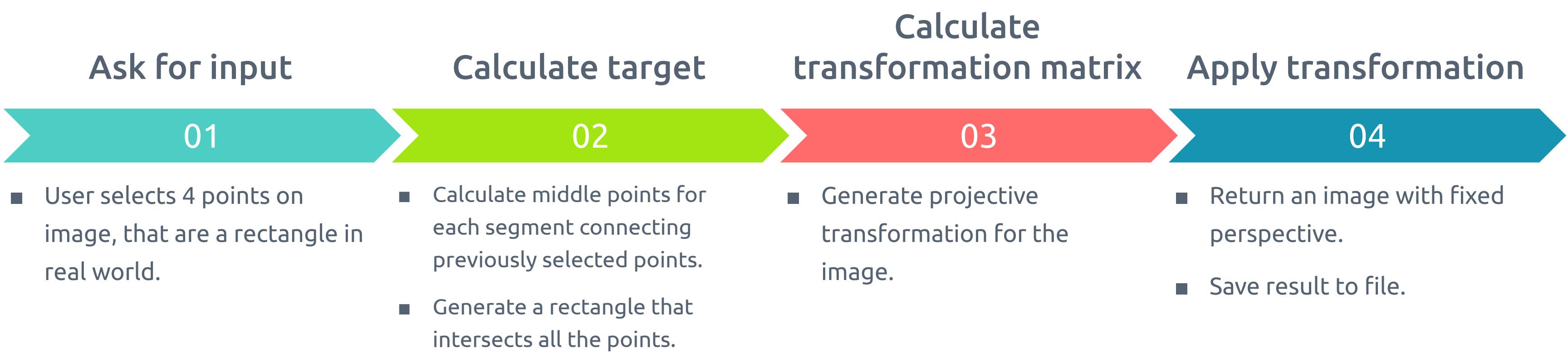
Problem definition



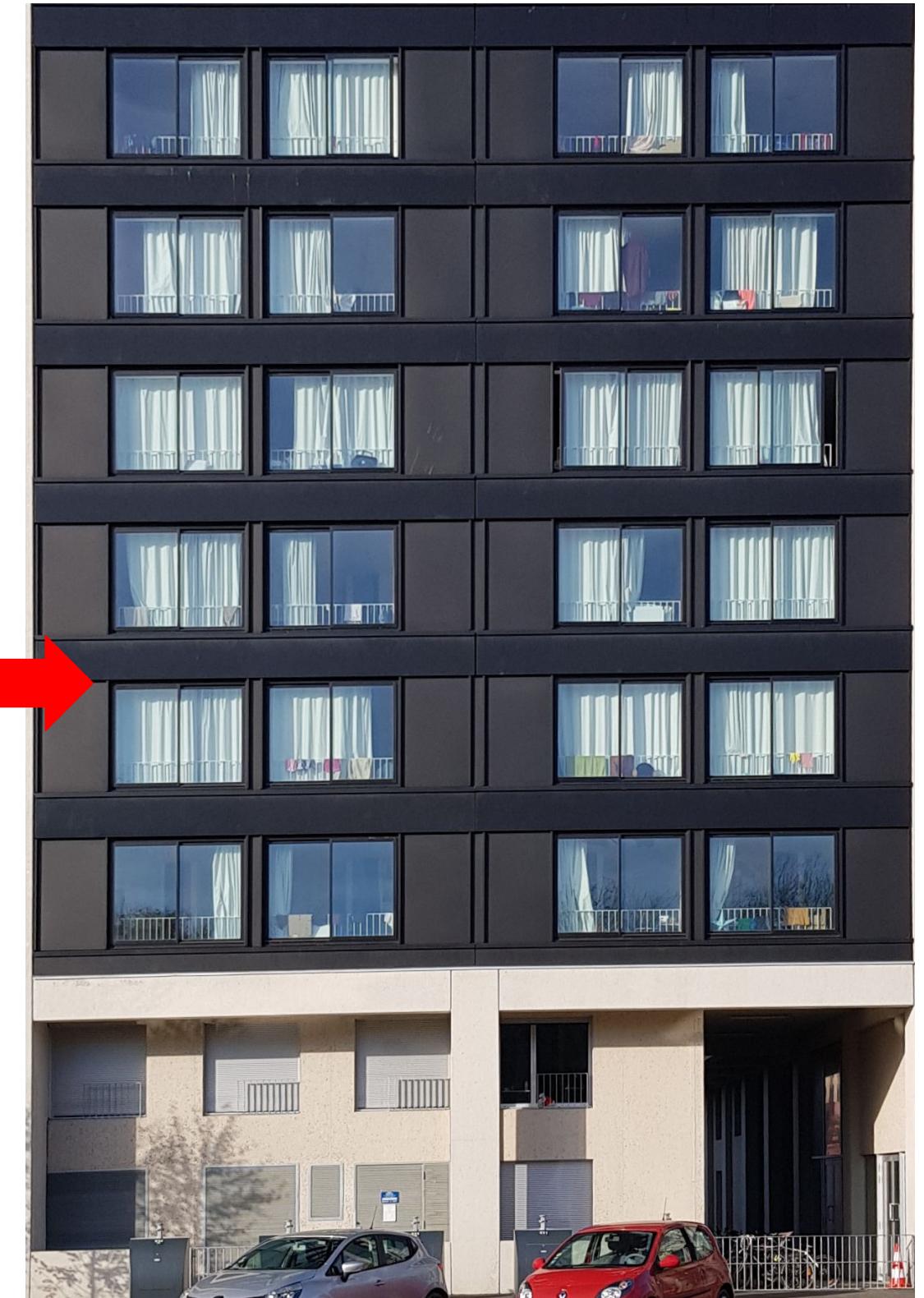
Photos taken from the ground

Rectangles malformed by the perspective

Algorithm



User Interface



Examples



Examples



Examples





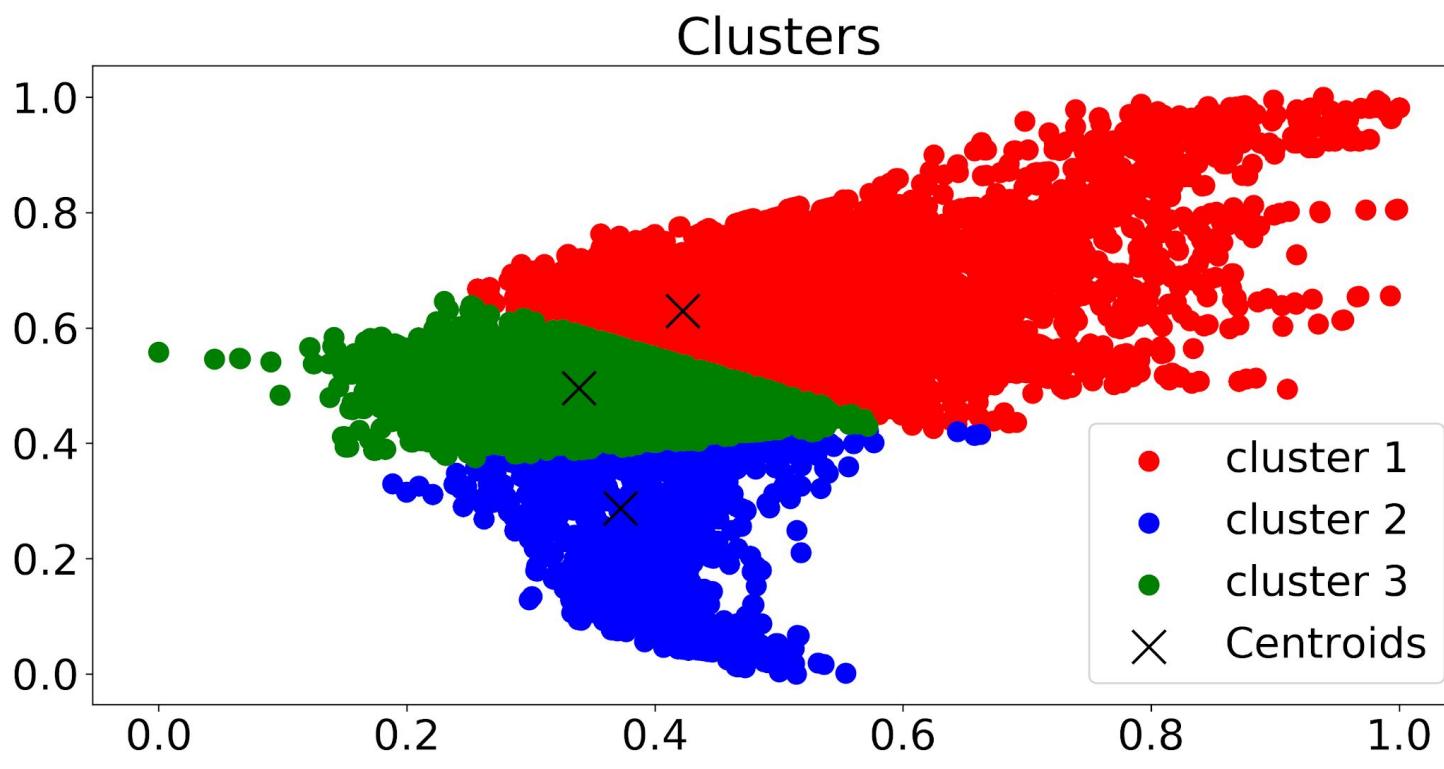
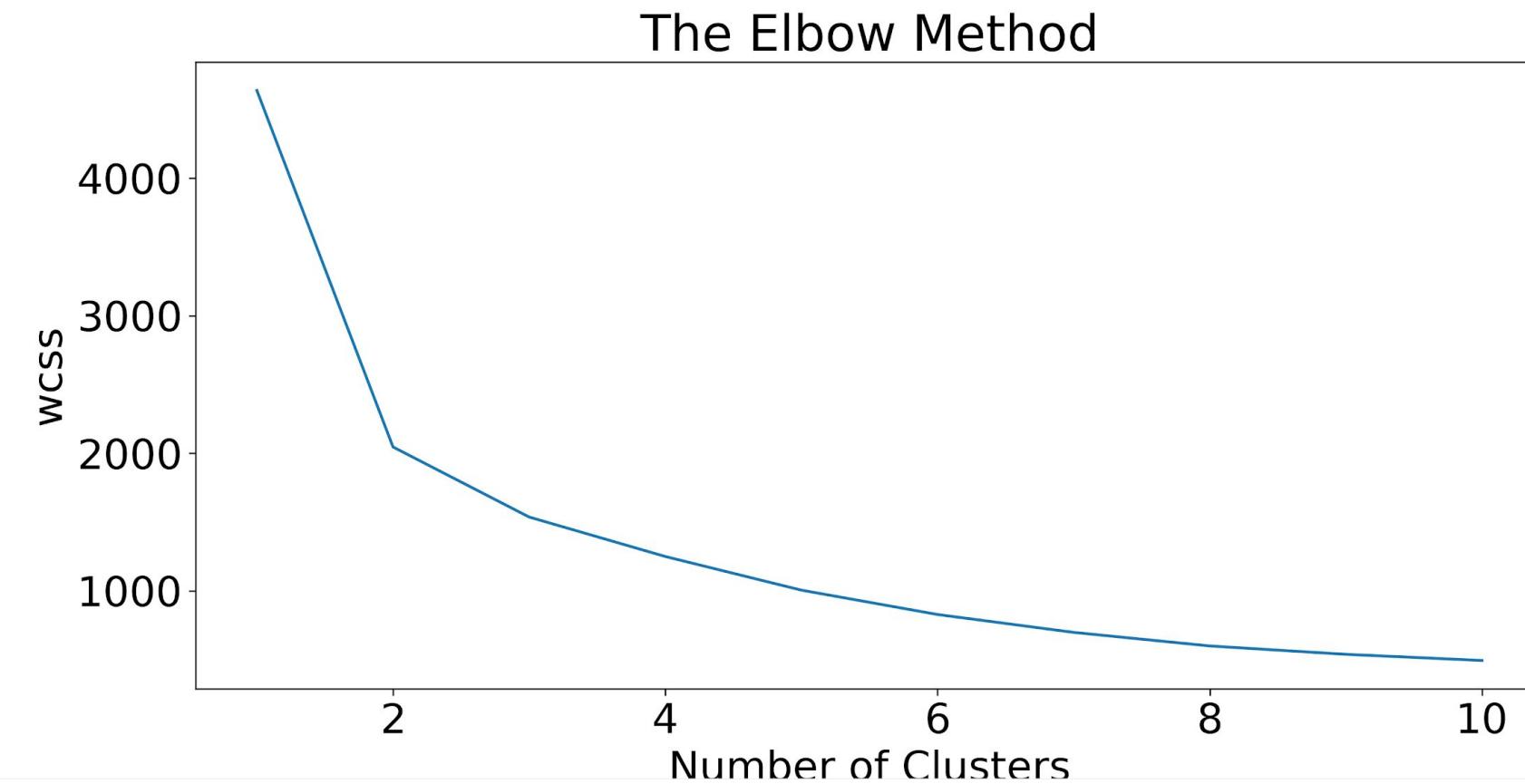
3

K-means approach

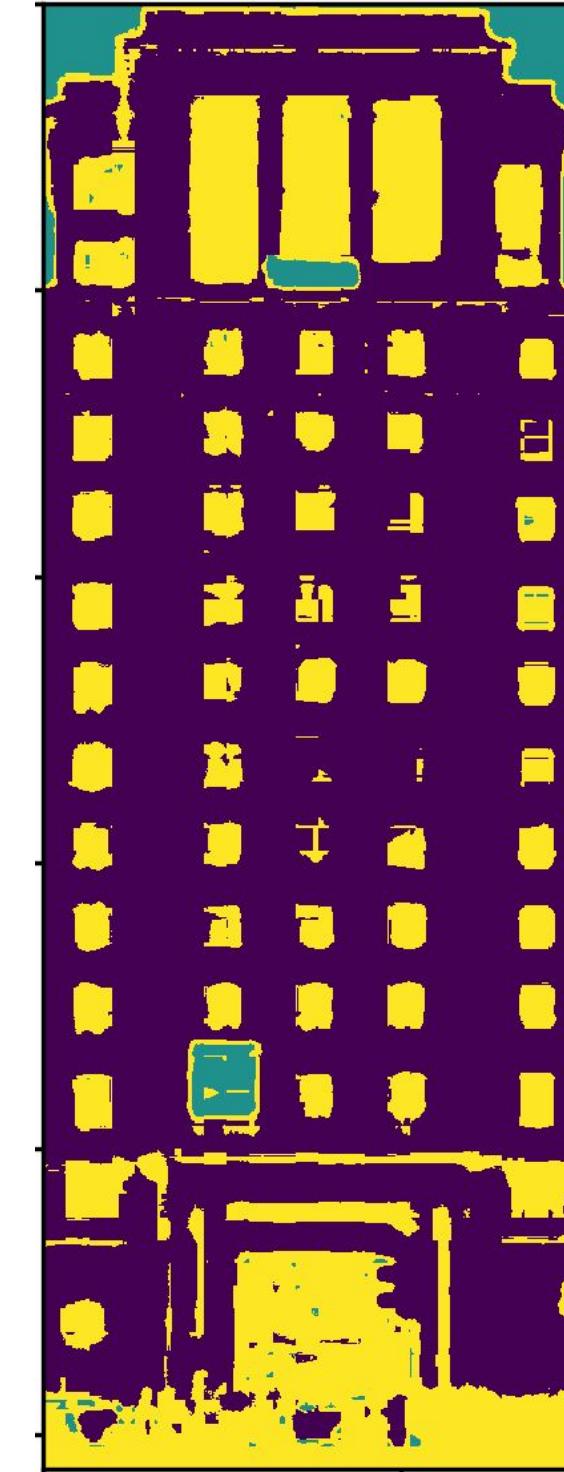
Color space reduction using K-means



CIE L*a*b
space

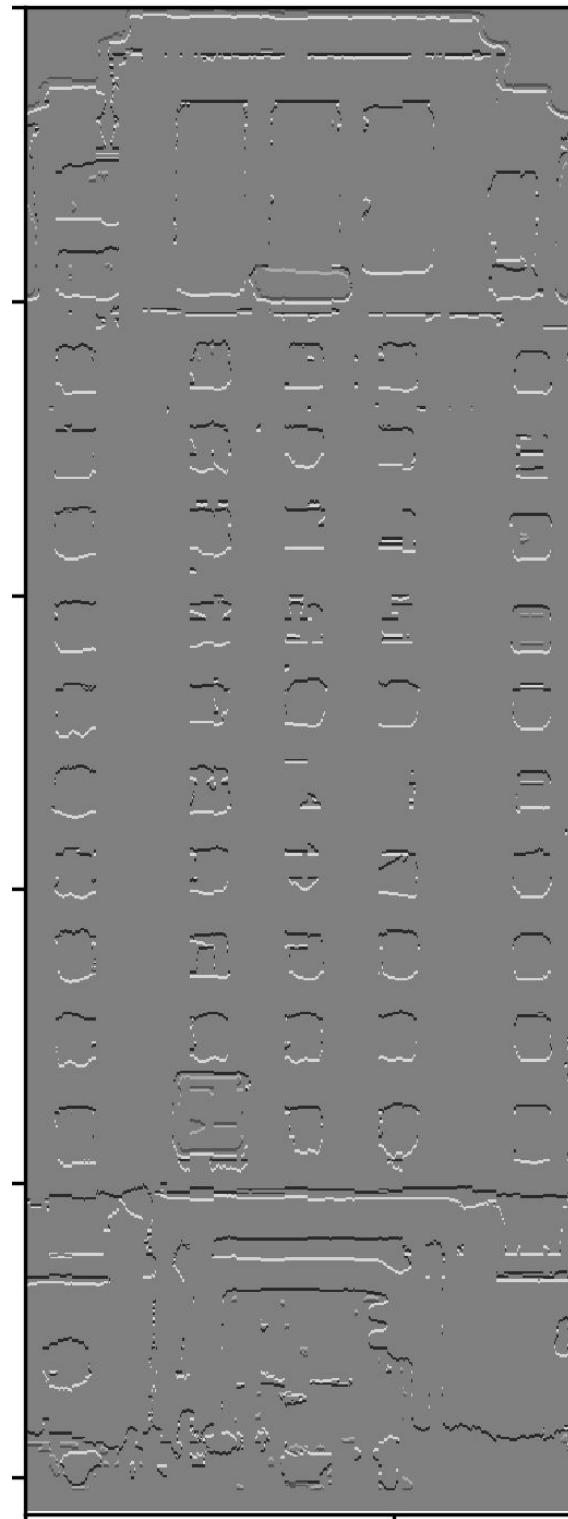


Computing K-means

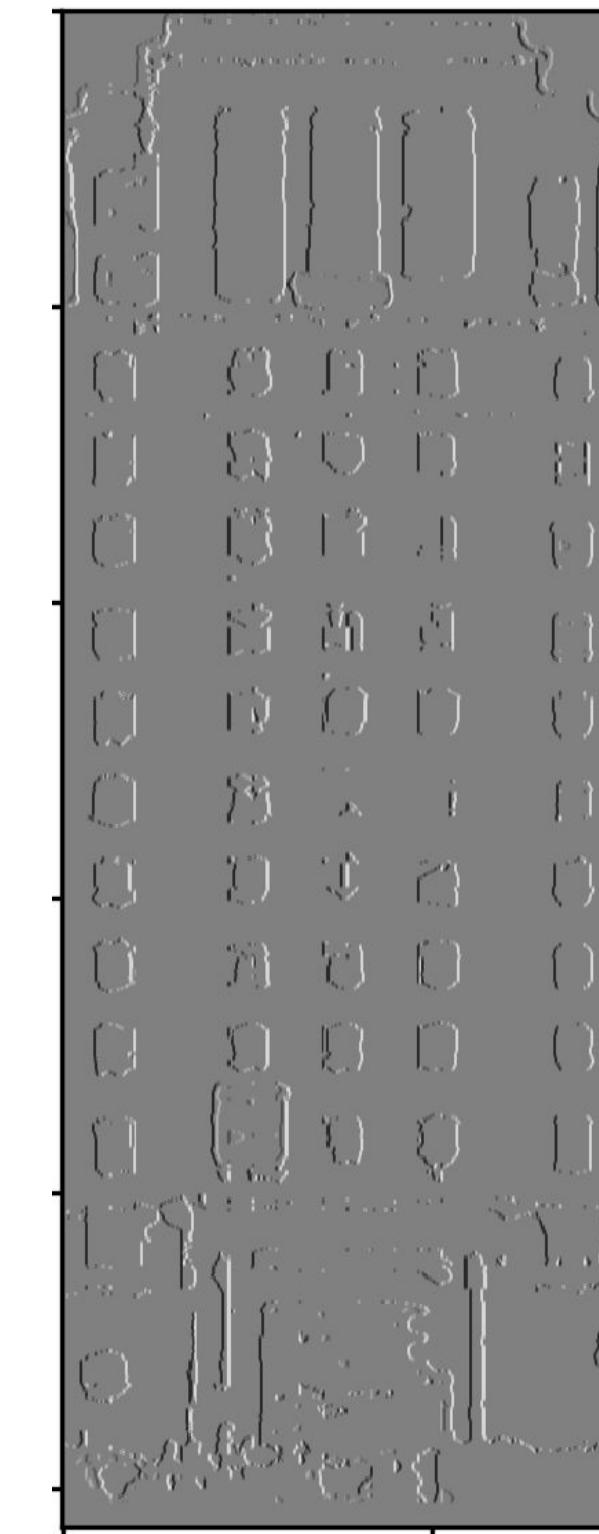


Floors & Window detection - ATHENS

Identifying edges from a three-color image



Detect horizontal
edges (parallel to x)

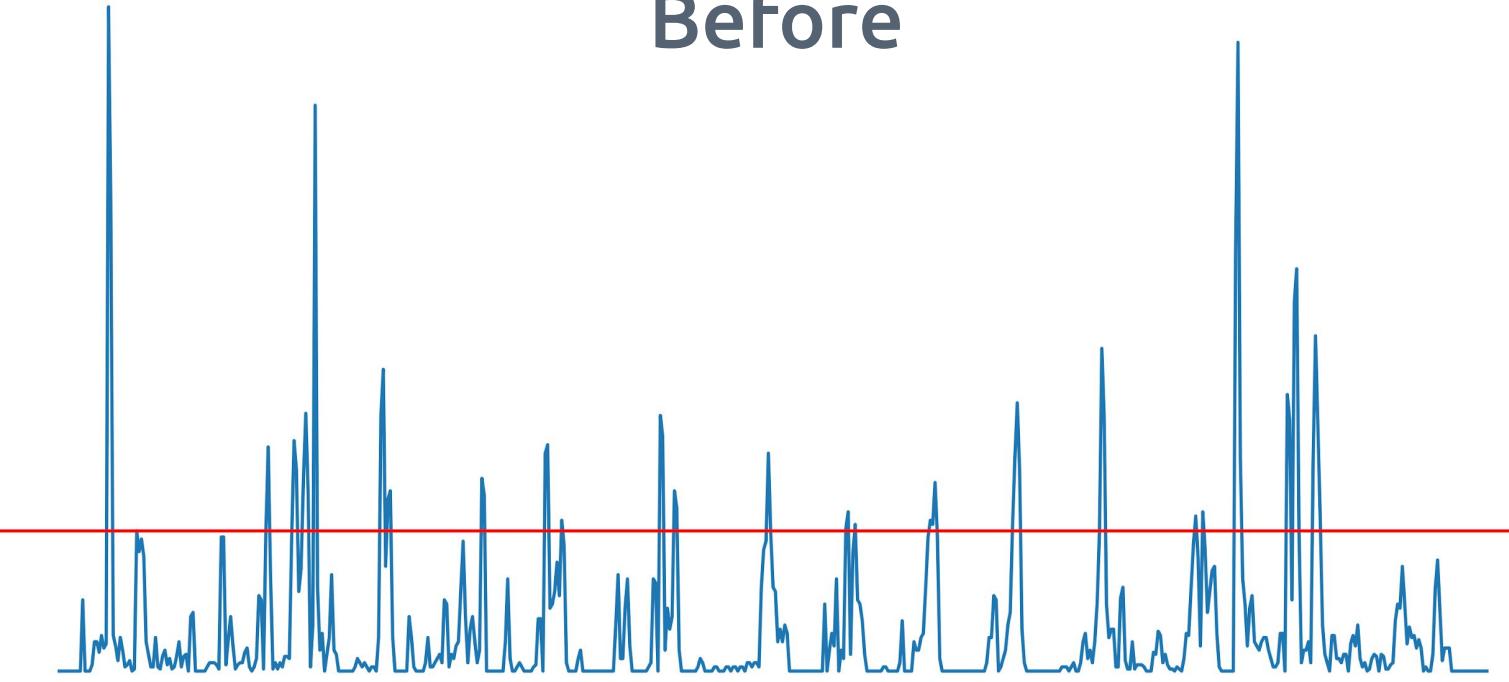


Detect vertical edges
(parallel to y)

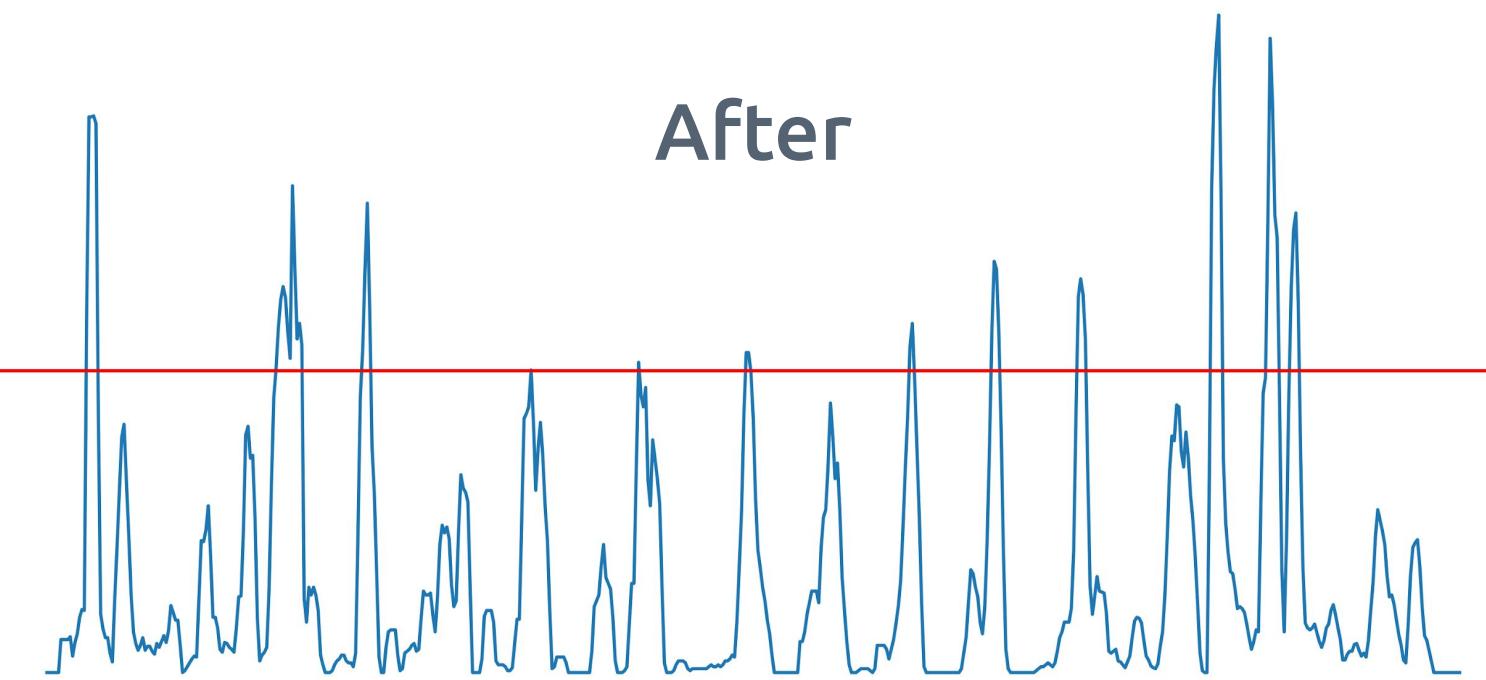
Counting



Before

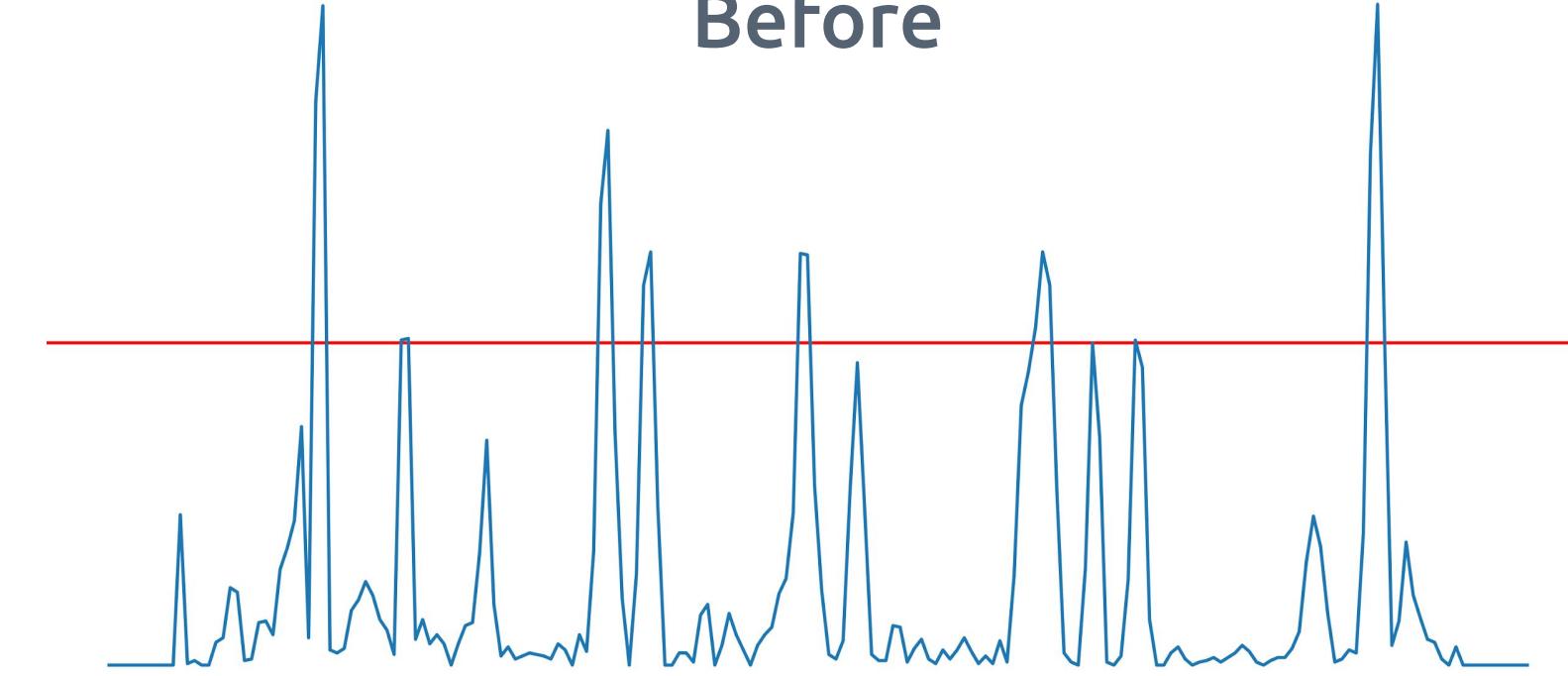


After

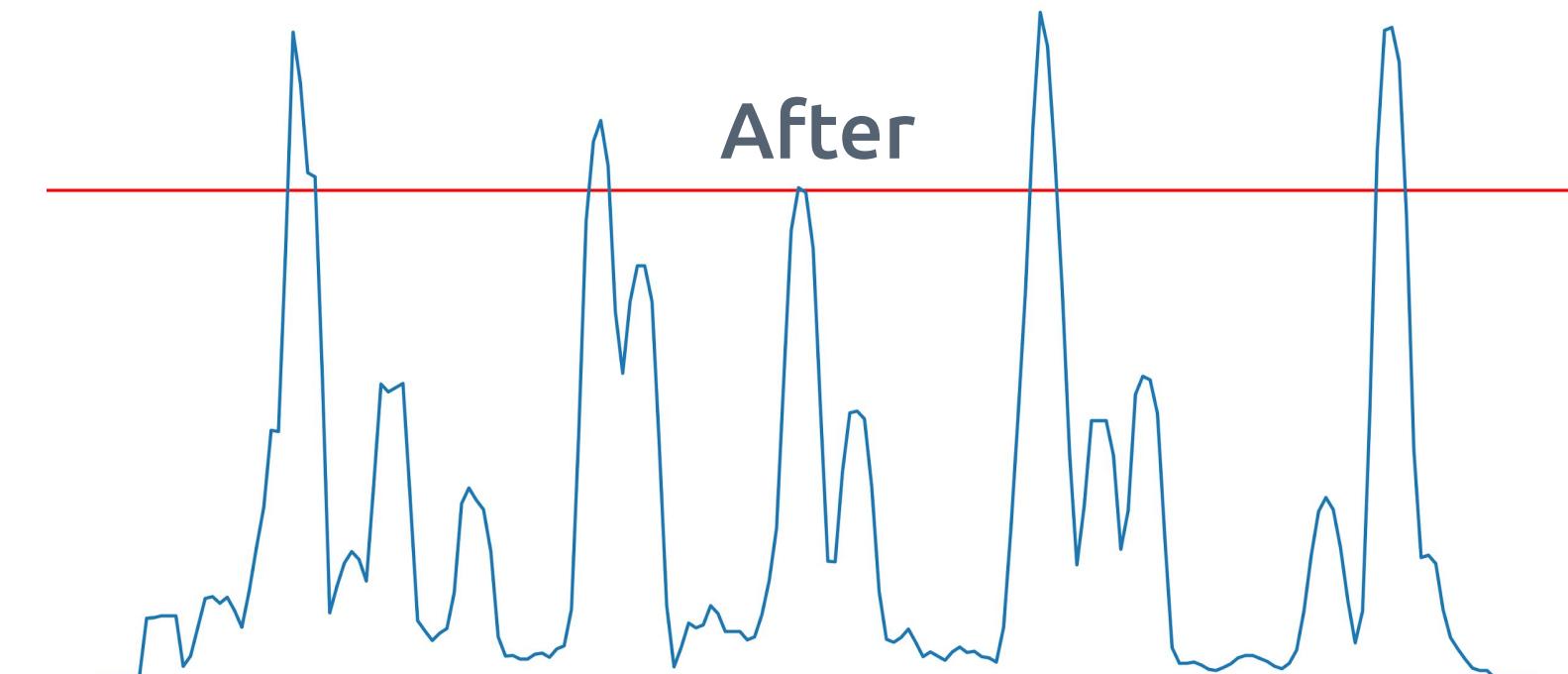


Moving average for
floors

Before

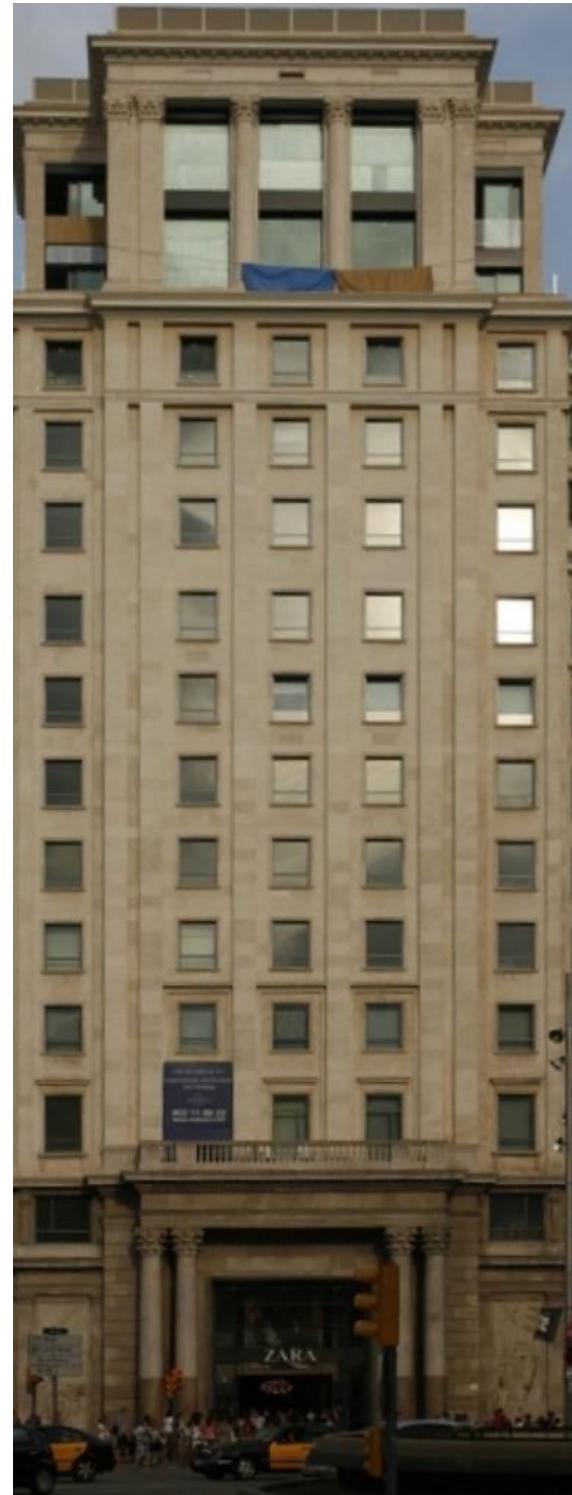


After



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



4

Edge Projection

Edge Detection



Image Pre-processing



Comparison of techniques



Morphological Operations

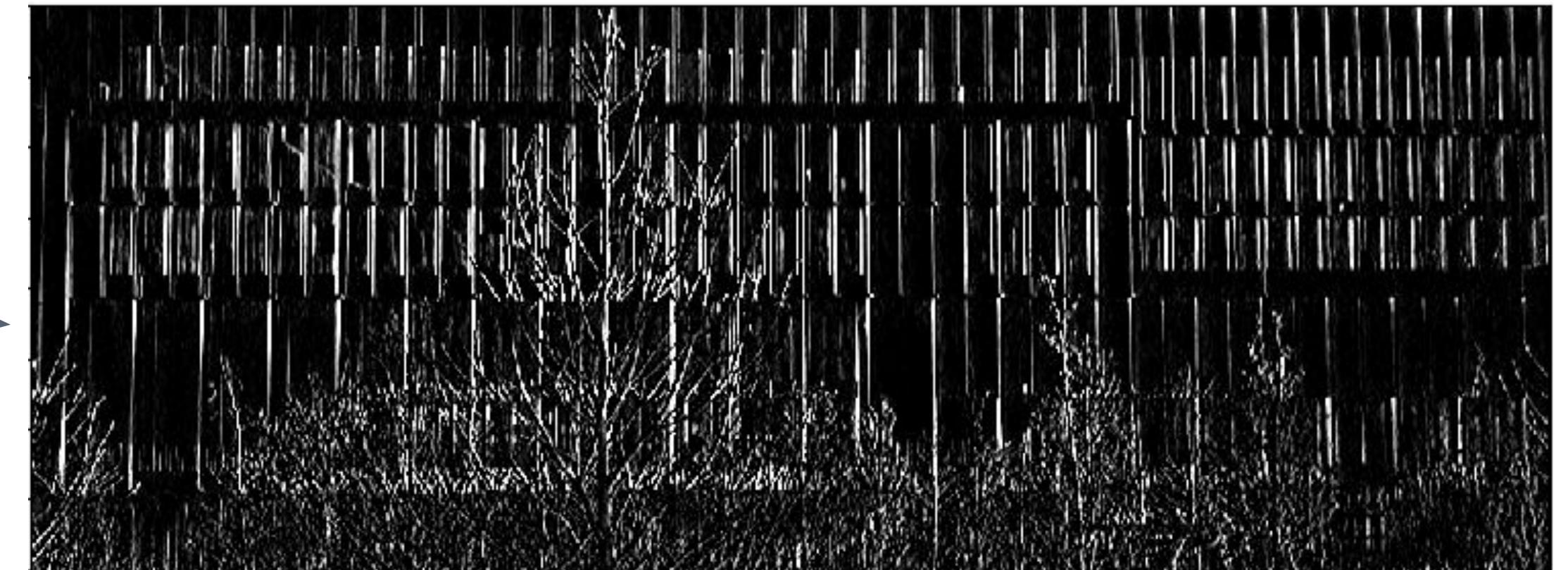
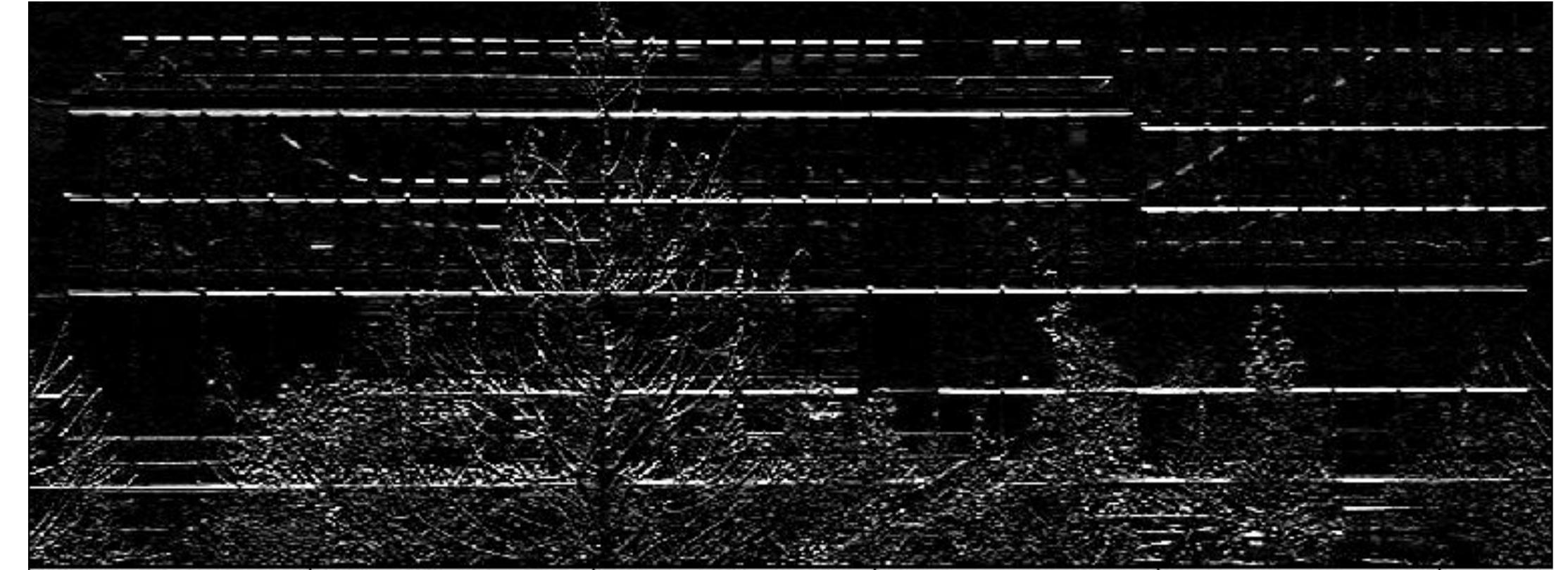


Edge Projection

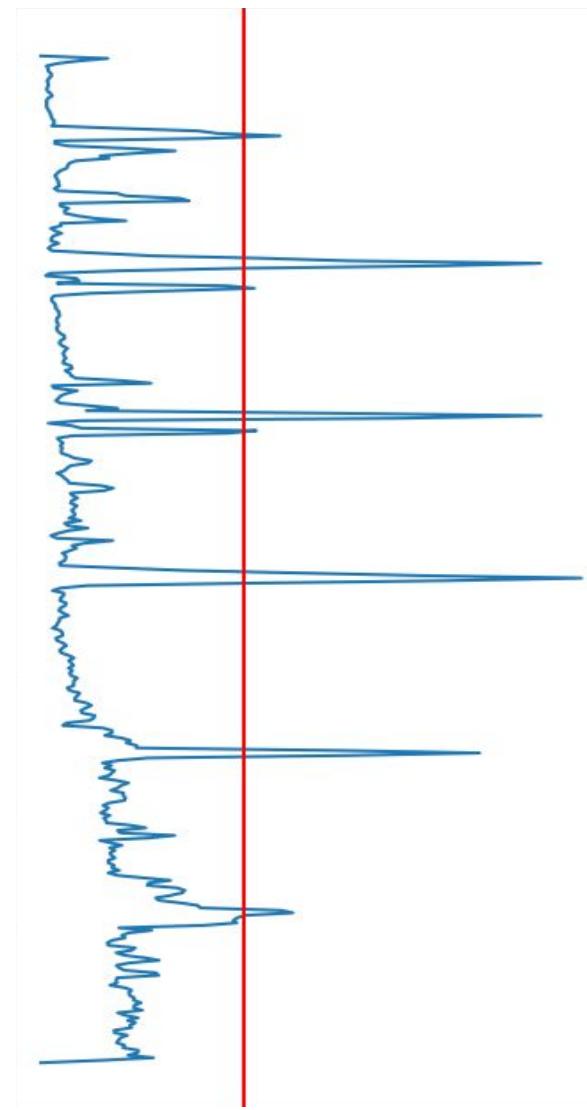
Computing horizontal and vertical gradients



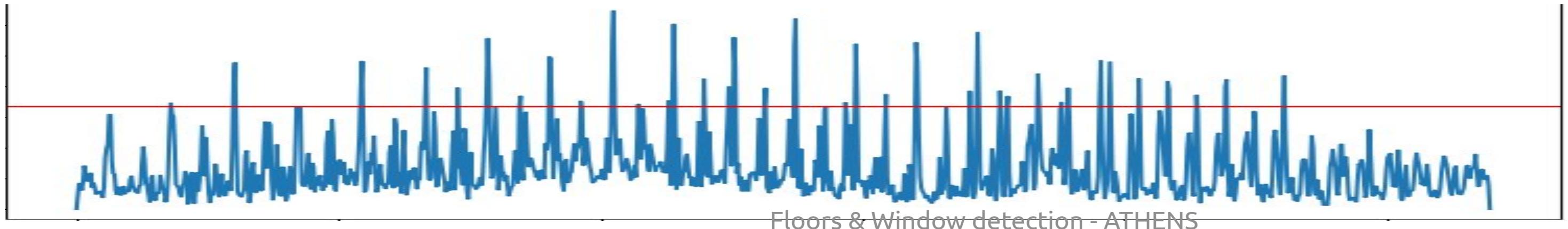
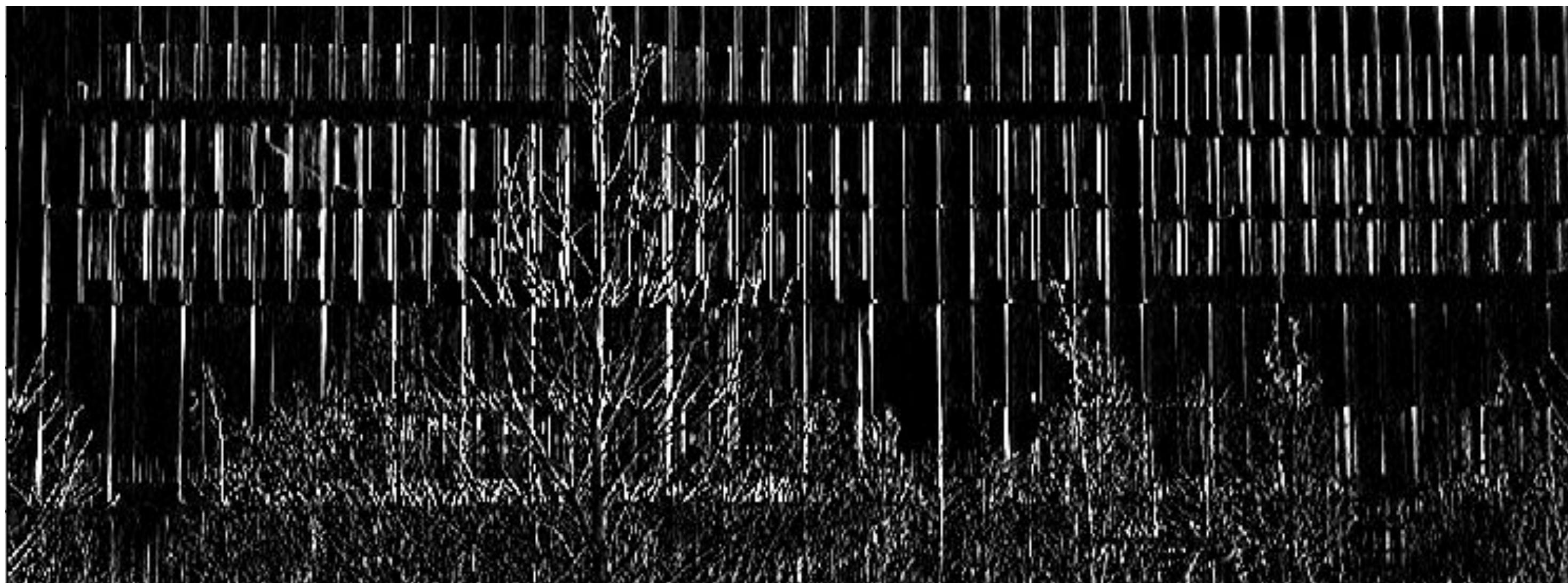
Grayscale
+ Histogram
equalization



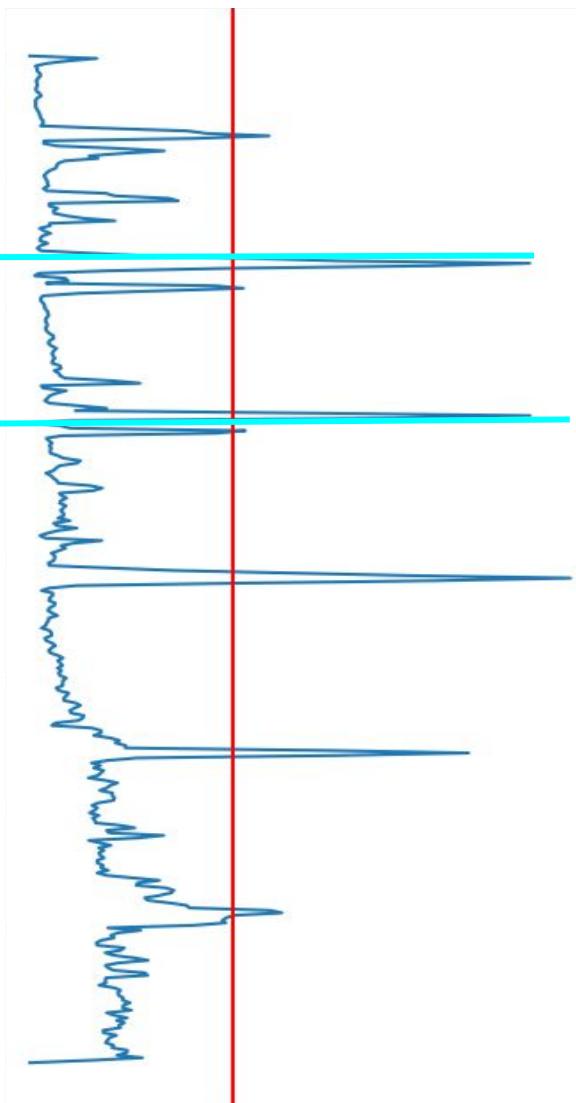
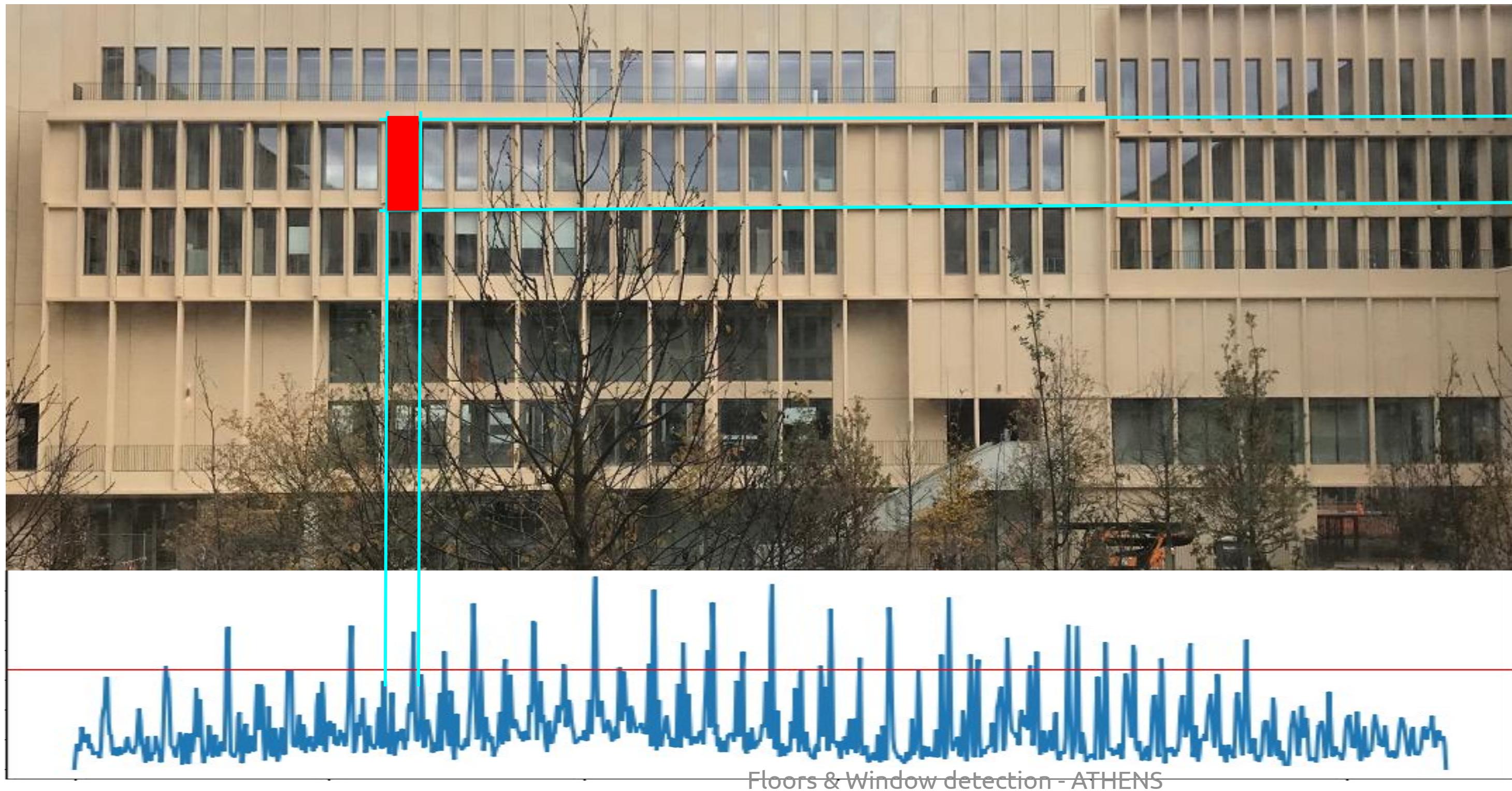
Axis projection (horizontal)



Axis projection (vertical)



Inferring “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).

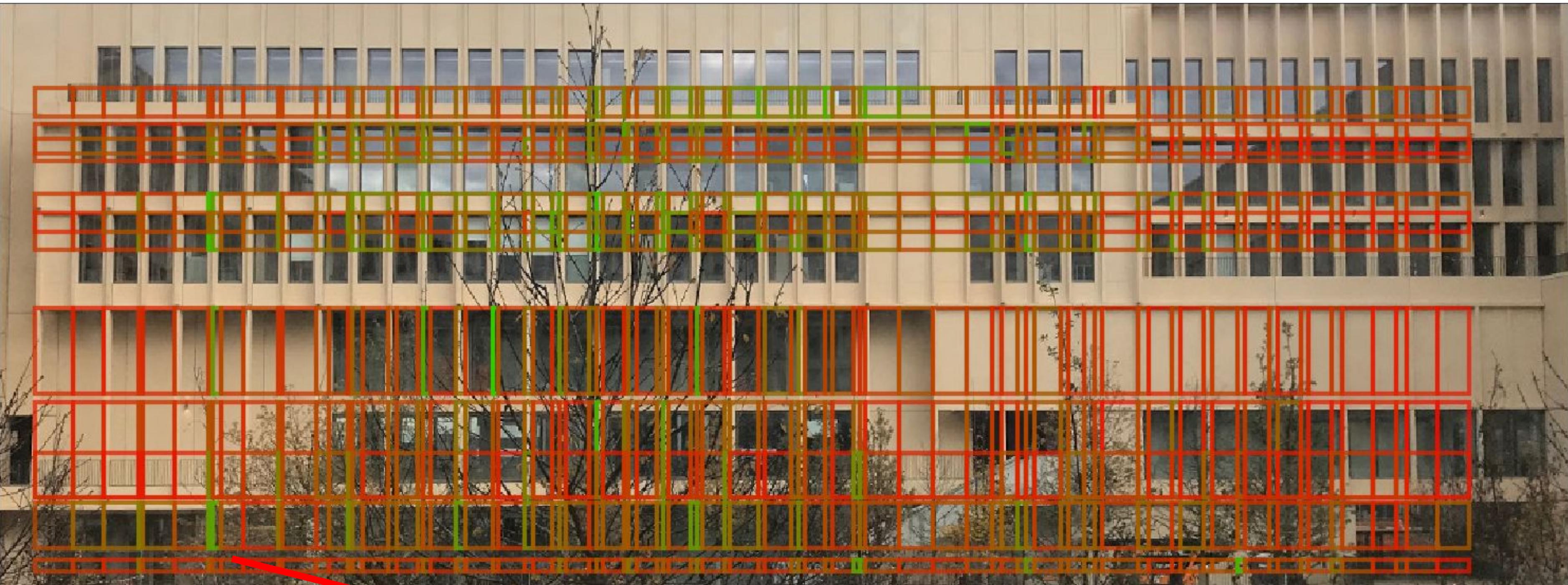
Then, we count the number of times “similar” shapes, on the picture, are seen on the same line of the image. We assume that a window will be repeated many times on the same line.

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 : 5.461538461538462
```



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?