Beeldverwerking Assignment 1

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Default Image

Can be found at Wikipedia (320 x 240).

Image A

Grey scale and auto-contrast

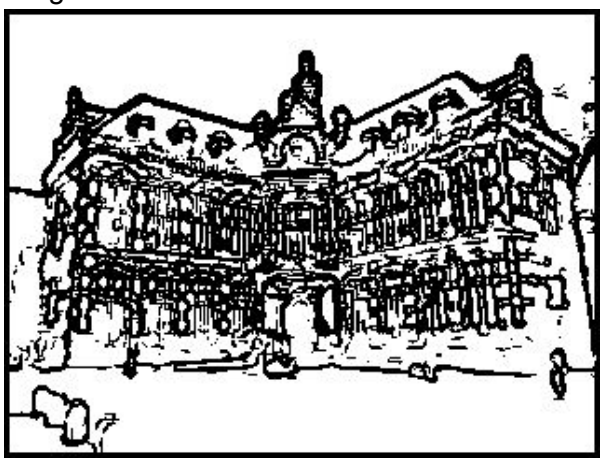
Default Image -> Image A

First, the image was converted to greyscale by averaging the colors of the R, G and B channels for every pixel. Then auto-contrast was applied, by linearly remapping the default range of color values in the image. This causes the color values to spread out over the maximum interval 0 to 255.

Image B

Gaussian 5x5 => sigma 1.1 - threshold 243

Image C



Median 5x5 - threshold 249

Image A -> B vs Image A -> C

Image B has been generated by applying a gaussian filter, edge detection, and a threshold of 243 respectively. Image C has been generated the same way, except for using a median filter instead of a gaussian filter and having a slightly higher threshold.

Compare images B and C. Why do you see these differences?

The edges in image B seem finer and more delicate, while the edges in image C seem more rough and robust. The Gaussian filter will take a weighted average of the kernel with emphasis on the center pixel, while the median filter will simply take the "average" median value in the kernel. This means that, in image B, the new pixels value will be relatively close to the original and edges will stay mostly intact. If the two values next to each other become

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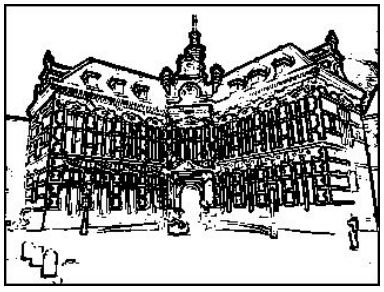
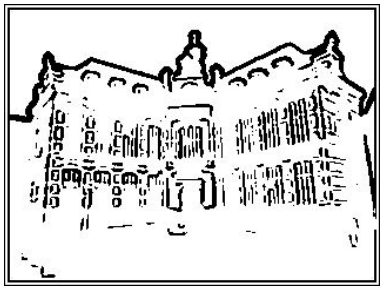
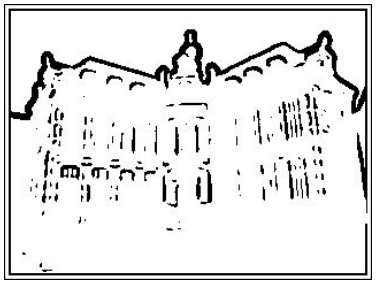
very similar due to the gaussian blur, the edge will not be detected anymore, but the edges will not be displaced.

In image C, the median filter will take the median value of the kernel and assign it to the corresponding pixel. This means that the pixel will be replaced another pixel in the area around it. Therefore, certain pixels on the edge can shift, causing them to break or connect differently, which is clearly visible in the image. The edges displace until similar areas connect, and the edge cannot be detected.

What is your motivation for your choice of kernel and parameters in getting images B and C?
The edge detection yields a very low contrast image, close to white. Therefore, 127 shows a completely white image. Bringing it up to 255 gives no clear image due to the noise. Bringing it down to about 243 yielded the most clear image for image B without too much noise of the building. For image C, most of borders in the windows were not visible at this point. At about 249 they showed well.



Kernel 3x3 = > sigma 0.8
Kernel 5x5 => sigma 1.1
Kernel 7x7 => sigma 1.4
Kernel 9x9 => sigma 1.7
Kernel 11x11 => sigma 2

Images D1 - D5, in order from bottomleft to bottomright. With D1 Gaussian 3x3, D2 Gaussian 5x5, up to 11x11. The corresponding sigma's were calculated with the formula from OpenCV:
sigma = 0.3*((ksize-1)*0.5 - 1) + 0.8

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Image A -> Images D1 – D5

Explain which trend you see, and explain this trend.
From D1 to D5 more and more edges are removed. When a Gaussian filter is applied, the pixel it is applied to, wil be averaged with the surrounding pixels (taking the middle pixels more into account), making the pixel more similar to the pixels next to it. If increasingly larger Gaussian filters are applied, each pixel will be similar to a increasing larger area surrounding it. This means that two pixels next to each other will be more similar as well. At some point, the values will become so similar (or equal) that the threshold after the edge detection, will discard these small value differences, and the edge will not be displayed in the final image.