Assignment 2

- *Auteur* -
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0.0.1 Question 1 :

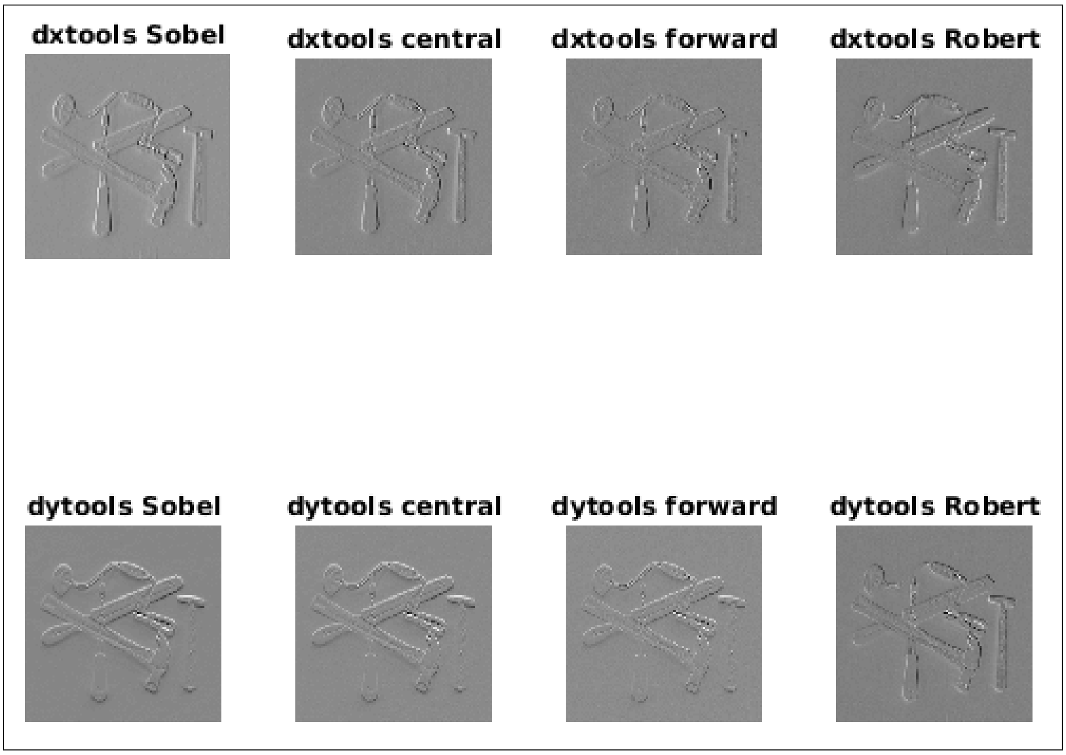

FIGURE 1 – **Difference operators effect**

We expect that difference operators emphasize edges, because the derivatives become bigger when there is variation in colors.

Dxtools size is smaller than tools size because when we use conv2D with the parameter 'valid' we do not use points that stuck in the border because each time we need former and next points to compute the derivate.

0.0.2 Question 2 :

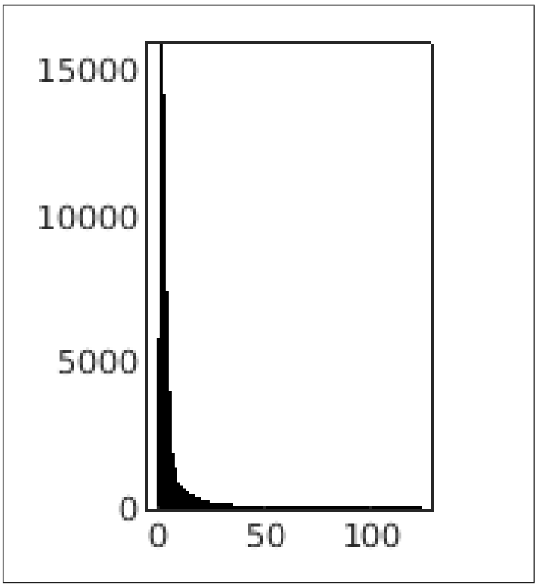

FIGURE 2 – **Histogram of gradmagntools picture.**

The histogram doesn't give us a precious information, because it contains only one peak. Therefore we cannot use it to detect objects that may have different colors.

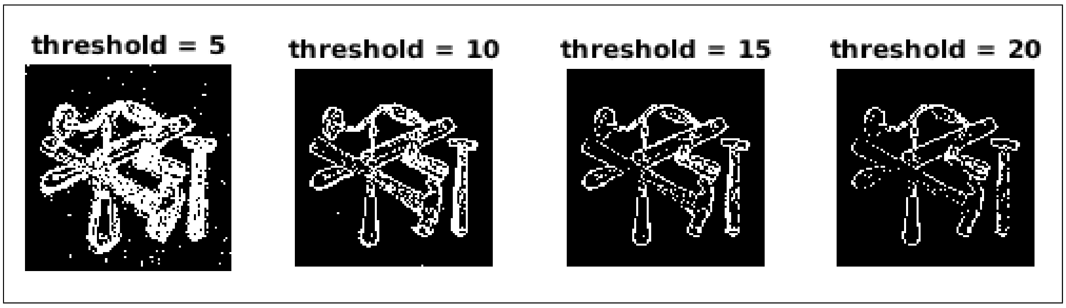

FIGURE 3 –

As we see in the the pictures above, it is difficult to find a thin lines that determine edges. If we reduce the threshold we end up by a thick edges and noise. And if we increase the threshold edges become thinner but we remove some of them. The alternative solution is to try to divide image into small parties and apply a convenient threshold to each of them and regroup them in the end.

0.0.3 Question 3

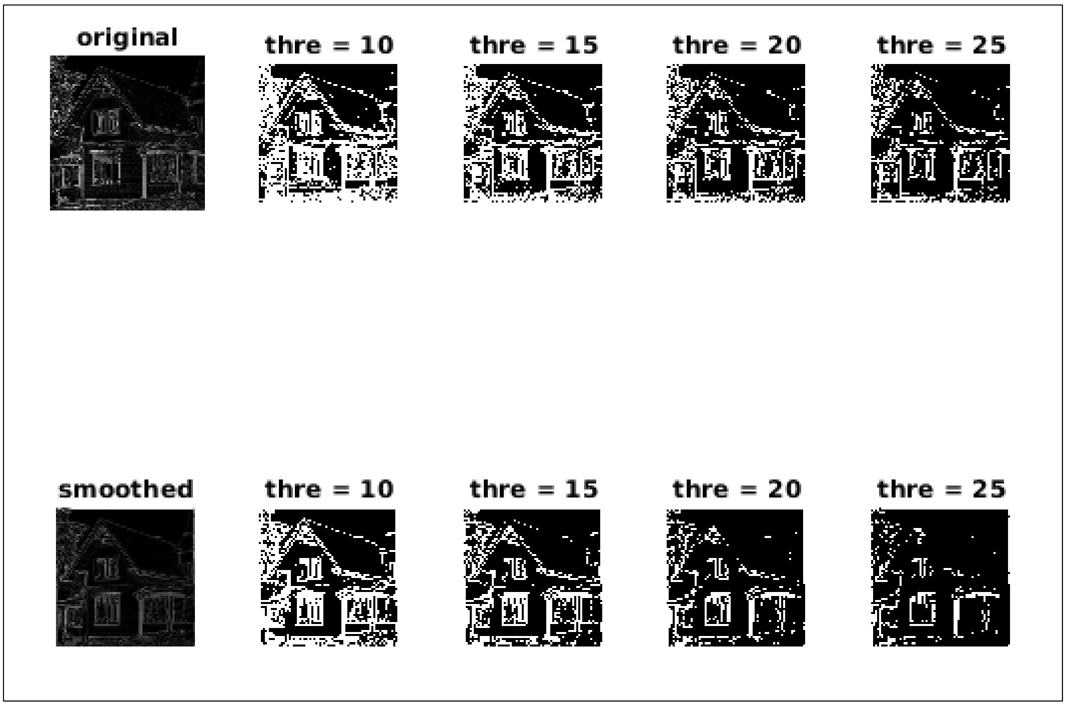

FIGURE 4 –

As we see in the figure 4 : smoothing the image before doesn't help a lot to find thin edges. It help to remove noise and may remove some important thin edges like the roof. The idea is to find a balance between smoothing and the threshold.

0.0.4 Question 4 :

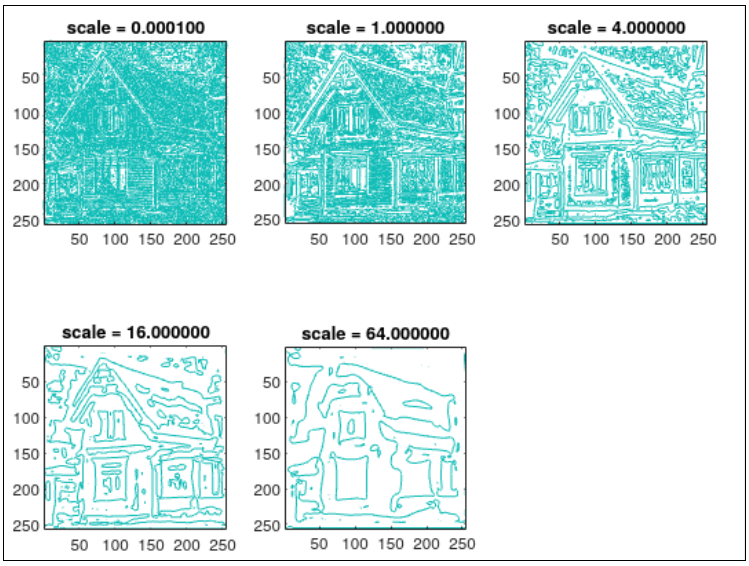

FIGURE 5 –

We draw in this image zero cross of $\tilde{L_{vv}}$ that correspond to local extrema of L_v. We notice that when we increase the variance of Gaussian filter the matrix $\tilde{L_{vv}}$ becomes more sparse and that is logical, because the image becomes smoother then high variance in colors becomes smaller. Therefore local maximum and minimum decrease.

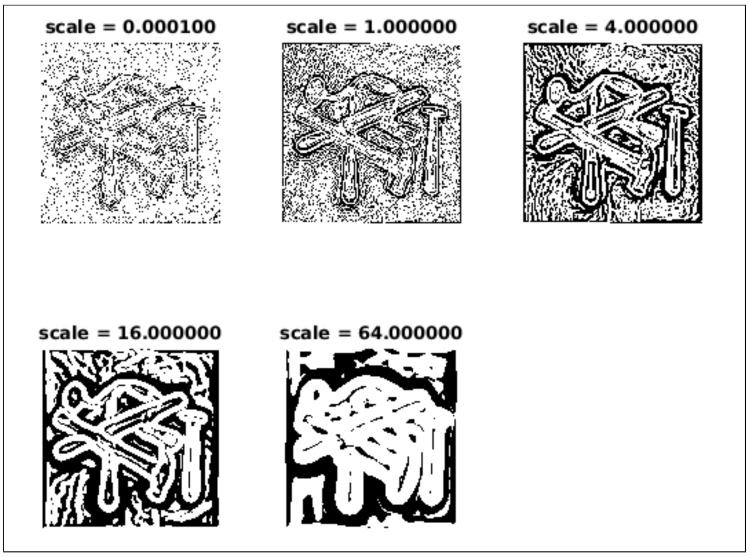

FIGURE 6 – $\tilde{L_{vvv}}$ **sign effect**

the white in the figure above correspond to the points where $\tilde{L_{vvv}} < 0$. We see that the white match with edges and some other points. If we increase the variance of Gaussian filter the white that surround edges become wider because smoothing make edges wide.

0.0.5 Question 5 :

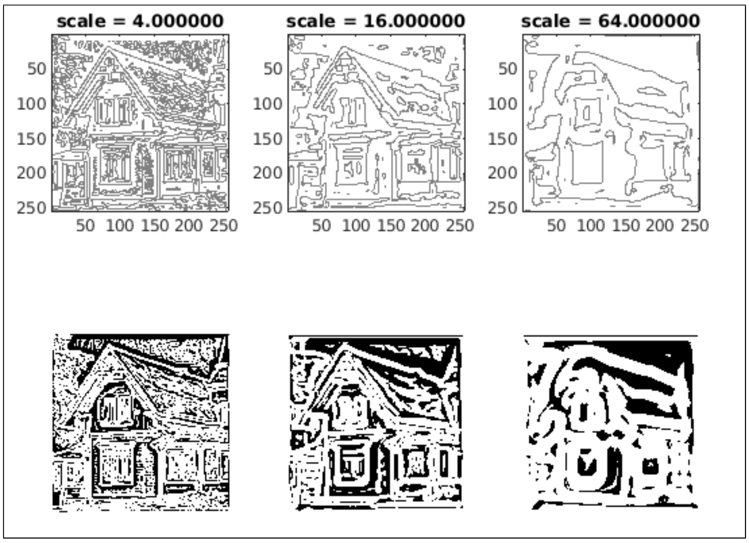

FIGURE 7 –

If we combine both $\tilde{L_{vv}} = 0$ and $\tilde{L_{vvv}} < 0$ we will obtain points where L_v is maximal that correspond to edges. We see that a combination of the two pictures will give a good results.

0.0.6 Question 6 :

When we solve $\tilde{L_{vv}} = 0$ we obtain local extrema of L_v. But when we add the constrain $\tilde{L_{vvv}} < 0$ we only leave points where L_v is maximal.(That is our goal to detect edges).

0.0.7 Question 7 :

My best result obtained by applying extractedge are :

Figure 8 – **scale = 4, threshold = 5**

Figure 9 – **scale = 8, threshold = 9**

0.0.8 Question 8

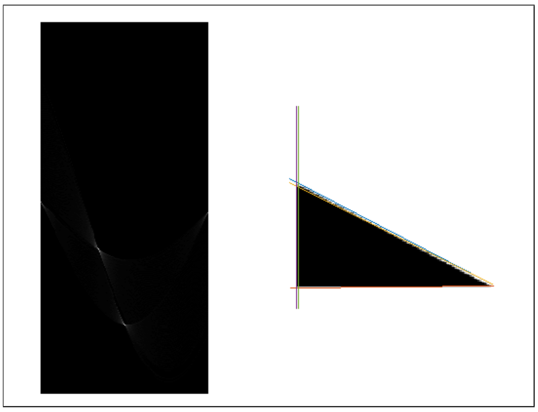

Figure 10 – **scale = 8, threshold = 9**

We see that we have tree luminous points in Hough space that correspond to the tree edges in the image. with a variance of 8 of Gaussian filter and a threshold of 9 we obtain 3 lines that correspond to the 3 edges.

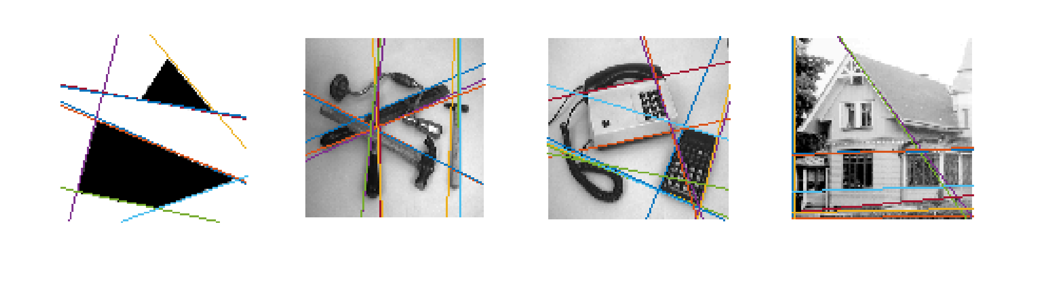

FIGURE 11 – **Best result applied to the imagesfew256,phonecalc256 and godthem256**

We see that soem edges are represented by a lot of lines. That because we have a high value of nthetas (= 180).

the best parameters for each picture above are :
houghtest256 : scale = 8, gradmagnthreshold = 8, nrhos = 350, nthetas = 170
imagesfew256 : scale = 8, gradmagnthreshold = 8, nrhos = 350, nthetas = 170
phonecalc256 : scale = 3,gradmagnthreshold = 18, nrhos = 350, nthetas = 170
godthem256 : scale = 3, gradmagnthreshold = 10, nrhos = 256, nthetas = 256

0.0.9 Question 9 :

The complexity of the algorithm implemented is O(sizeimage $\times ntheta \times nrho$)

0.0.10 Question 10 :

The implementation of this choice is not so difficult, we should just replace 1 by $h(magn(x, y)$. The difficulty is to find a monotonically increasing function that give a good result.

Let try differents h on tools image.

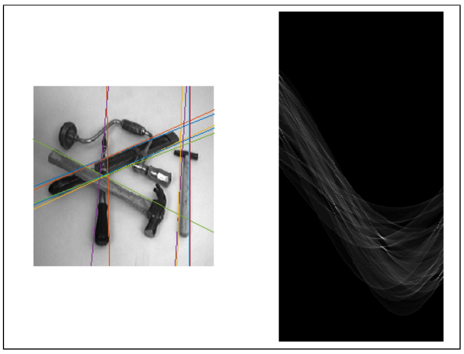

FIGURE 12 – $\mathbf{h(x) = 1}$

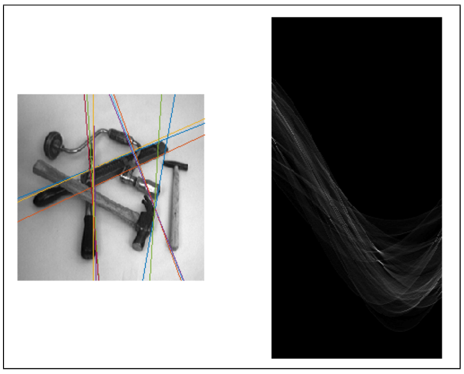

FIGURE 13 – $\mathbf{h(x) = x}$

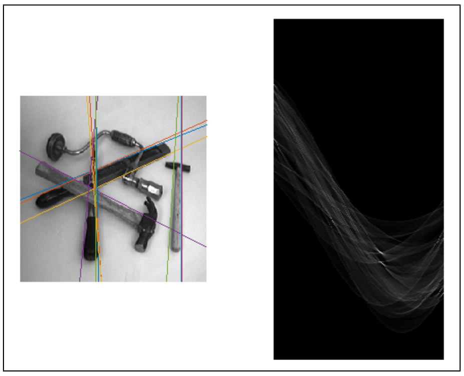

FIGURE 14 – $\mathbf{h(x) = log(x)}$

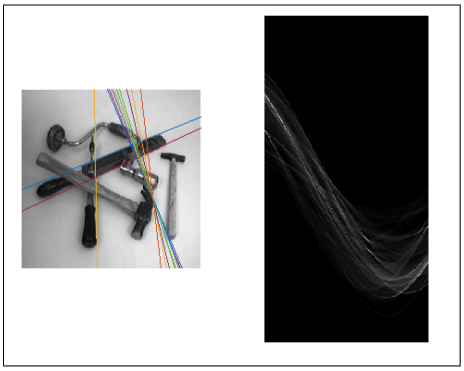

FIGURE 15 – $\mathbf{h(x) = x^2}$

We notice that the normal case where we increase the accumulator just by one is similar to $h(x) = log(x)$ because log will decrease high values and increase low values. Therefore it gives the same weight to both high and low magnitude. However in the case where $h(x) = x$ or $h(x) = x^2$ we favor only points with high magnitude and it give too much weight to strong edges.