Answers to questions in

Lab 2: Edge detection & Hough transform

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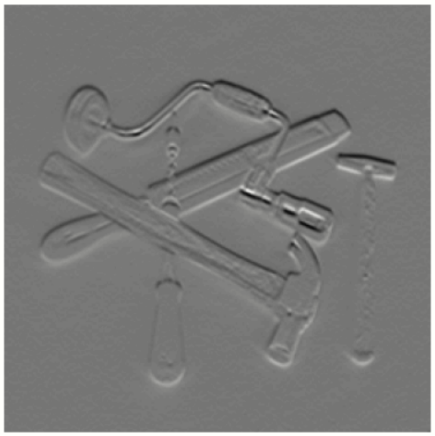
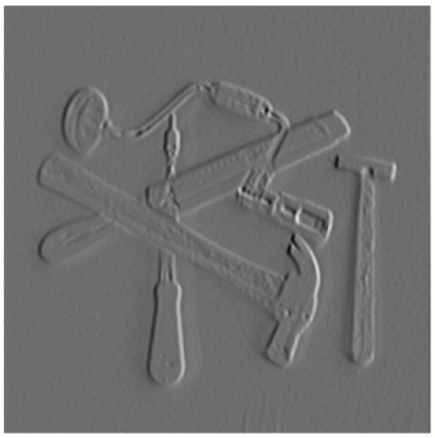
Instructions: Complete the lab according to the instructions in the notes and respond to the questions stated below. Keep the answers short and focus on what is essential. Illustrate with figures only when explicitly requested.

Good luck!

Question 1: What do you expect the results to look like and why? Compare the size of *dxtools* with the size of *tools*. Why are these sizes different?

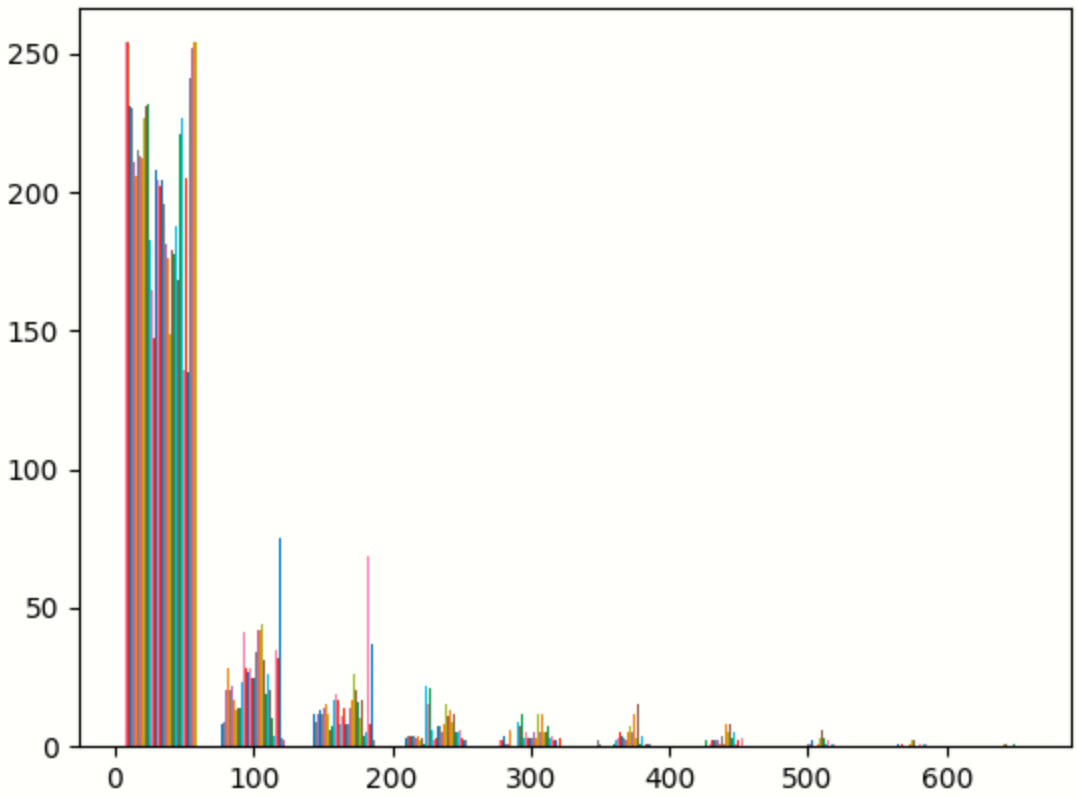




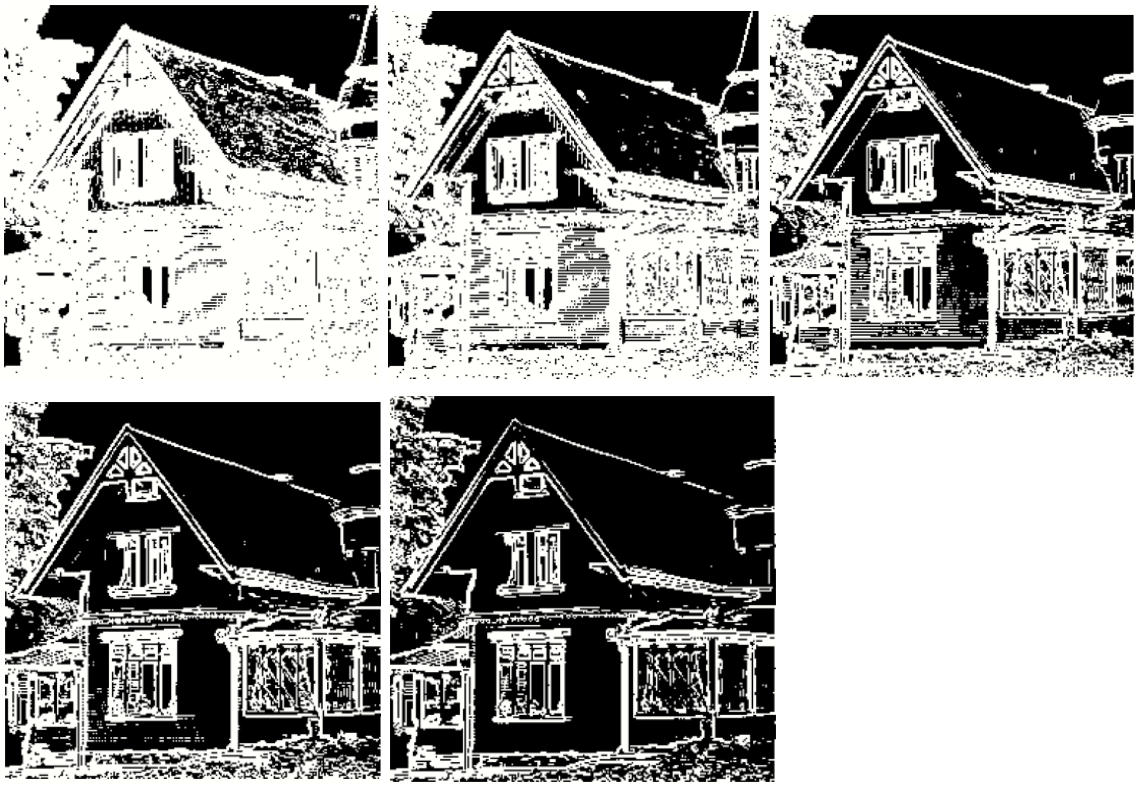
Since we are calculating the derivatives with respect to x (right) and y (left) we expect the edges in horizontal and vertical direction to be highlighted. Dx/dytools are 64516 while *tools* is 65536. Looking at the documentation of convolve2d with the ”valid” option we see that padding is not used near the borders which makes us drop pixels.

Question 2: Is it easy to find a threshold that results in thin edges? Explain why or why not!

It is not easy. If the threshold is too low the edges become too thick and there is also a lot of noise. If the threshold is too high the edges become thin but in some cases too thin and invisible.



This histogram depicts the amount of occurrences of edges of certain magnitude differences. Edges with low contrasts occur a lot, compared to edges with high contrast. If we set a threshold at approximately 100, then all small contrasts will disappear. We could guess that these contrasts correspond to noise in the background.

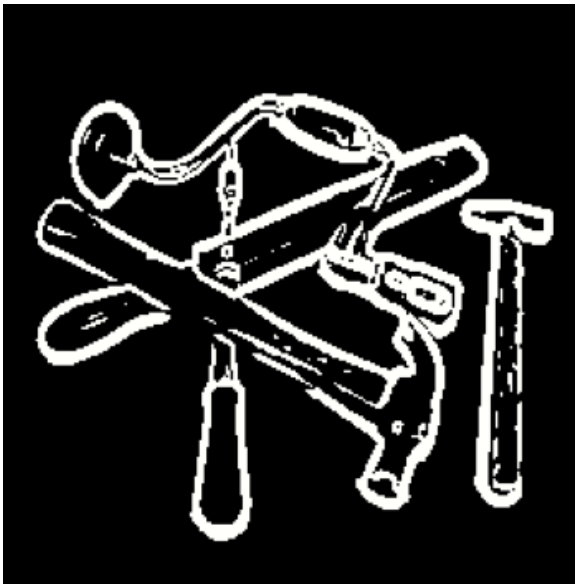


We plot the resulting image with different thresholds 20,50, 100, 150, 200. We can see that the low contrast edges disappear first, and as the threshold increases.

Question 3: Does smoothing the image help to find edges?

In some cases it does help. Since we even out the edges, small edges may disappear while the larger ones remain. This causes very thick edges.

Discgaussfft 4.0, treshold = 100,



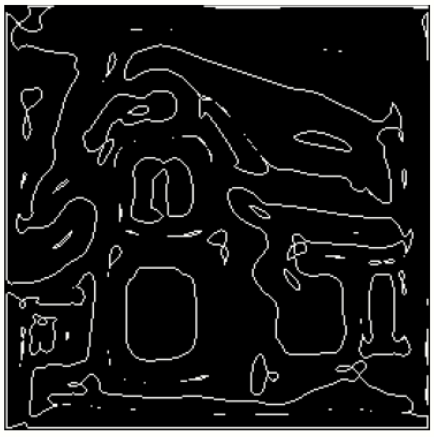
same but treshold = 1

Question 4: What can you observe? Provide an explanation based on the generated images.

We can observe that, for higher scale, the edges in Lvv=0 are imprecise like a rough estimate of where the real edges are. We lose details as the scale goes up. We also plot the Lvvv>0 where we can see the same edges, but with low precision.

Question 5: Assemble the results of the experiment above into an illustrative collage with the *subplot* command. Which are your observations and conclusions?

Answers:



Lvv, scale 64

Lvvv, scale 64

Lvv, scale 16

Lvvv, scale 16

Lvv, scale 4

Lvvv, scale 4

Lvv, scale 1

Lvvv, scale 1

Lvv, scale 0.0001

Lvv, scale 0.0001

In the leftmost images we use LVV (with scale 64) and rightmost have LVVV (with scale 16).

Question 6: How can you use the response from *Lvv* to detect edges, and how can you improve the result by using *Lvvv*?

We can see that Lvv and Lvvv both work to detect edges, but they give somewhat different results. Some things that are picked up by Lvv could be missed by Lvvv depending on the image, and vice versa. So if we combine the methods we might get a good intersection giving us a better final result.

Question 7: Present your best results obtained with *extractedge* for *house* and *tools*.

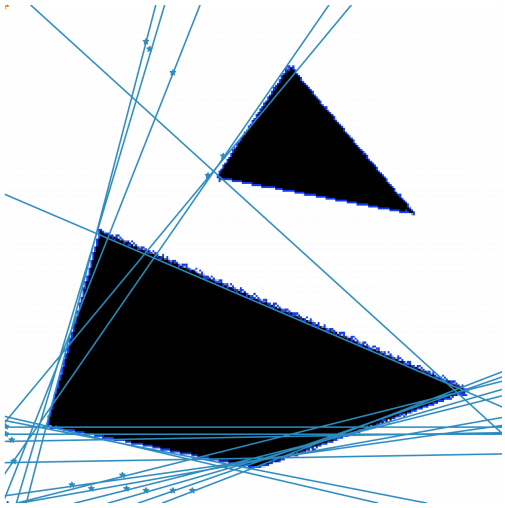
Answers:

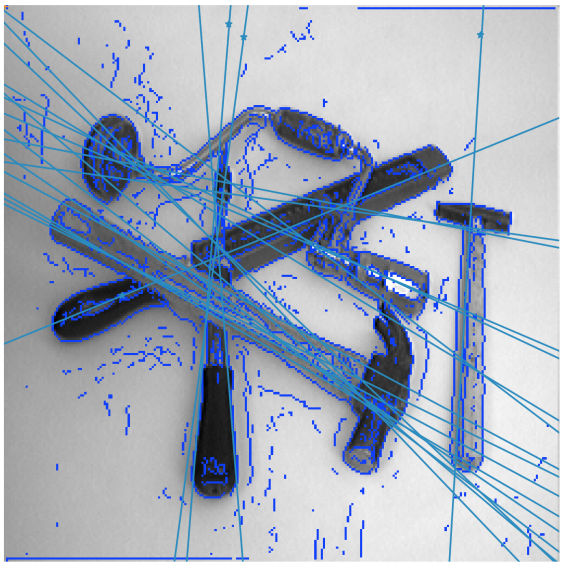
Threshold = 100 on tools yielded the best result. And threshold 50 for the ouse

Question 8: Identify the correspondences between the strongest peaks in the accu-mulator and line segments in the output image. Doing so convinces yourself that the implementation is correct. Summarize the results of in one or more figures.

Answers:

In the houghtest image we can clearly see that the lines added correspond to respective angles in each scale, this convinces us that our implementation is correct. Furthermore we have plotted the individual points from where the lines originate and by eyeballing it we can see that the lines are orthogonal to the rho in polar coordinates.





Question 9: How do the results and computational time depend on the number of cells in the accumulator?

Answers:
The runtime becomes incredibly slower as we increase nrtheta and nrrho which is expected as the accumulator matrix's dimension are (nrtheta, nrho)

Question 10: How do you propose to do this? Try out a function that you would suggest and see if it improves the results. Does it?

Answers:

We think this depends on what we aim to achieve. If we want to put more emphasis on lower contrasts, for instance a background pattern that is not quite visible, while we want to put less emphasis on the foreground object we could for instance use a function h() that follows the shape of an inverse logarithm. If we want to put less emphasis on abnormally high contrasts and include even less contrasts we could just use a regular logarithmic function - but the bottom line is that we think it depends on what we aim to achieve.