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!

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**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?

Answers:

We expect to see contrast when the derivative is high in x for the dxtools and similarly for y. This can easily be seen in the screwdriver handle. For y, it has a higher "activation" than in y.

The sizes are different because of the 3x3 filter. conv2 with valid returns only pixels where the whole filter fits, which for a 3x3 filter causes 2 rows and columns to be removed. If we use 'same' instead of 'valid' this doesn't happen.

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

Answers:

It is not easy to find a threshold that results in thin edges. This could be because of smoothing, which results in wider edges. With a higher threshold we get a thinner edge.

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

Answers:

Smoothing helps with finding edges because it removes a lot of noise and therefore the false edges.

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

Answers:

When smoothing we blur out edges that correspond to noise. The gradient magnitude reaches a maximum quite often on noisy images.

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

Answers:

The sign condition masks the image into only black and white pixels. White pixels are where the sign is negative, which is where the gradient magnitude can be maximum and edges can be found.

We can conclude that smoothing the image results in removal of finer structures in the image and those edges. If we smooth more, we see that we have a much less noisy structure of possible edge locations.

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

Answers:

We can combine the result of Lvv and Lvvv, by considering edges as where Lvv is 0 and Lvvv is negative.

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

Answers:

We found it at scale = 10 and threshold = 22 for house.

Scale = 8 and threshold = 30 for tools.

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

Answers:

The strongest peak in the accumulator becomes a line in cartesian space with the corresponding theta and rho. Matlab origin is in the top left corner, negative angles to the left of the y axis.

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

Answers:

O(ntheta\*pixels + ntheta\*nrho\*LOG (ntheta\*nrho)) Calculating rho for each pixel and angle and sorting the found local maximas which in worst case should be the size of the accumulator space divided by 4.

**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:

Voting with the gradient acts sort of like a magnitude threshold. Noise has a low gradient magnitude and is taken less into account.