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:

The task of the difference operators is to calculate first order partial derivatives. For this is chose Sobel operator, respectively for x and y direction. We treat the image as a function, i.e. in places where the pixel values change the fastest, the derivative is the highest. Naturally, this happens on the edges in the image.

If we take a look at, for example, partial derivative with respect to *x* (image as *f(x,y)*), when we walk horizontally from left to right and, coming from the lighter background, encounter the edge of the darker instrument handle, the pixel intensity values drop here. Similarly, when we walk off on the right side from the darker instrument handle onto the lighter background again, the pixel intensity values jump up. Now, as the filter kernel is flipped when doing the convolution, I made the x and y kernels preflipped so that the filter response corresponds to the value changes, i.e. so that the *left-side* edges of the objects appear blacker (as pixel values drop there) and *right-side* values appear whiter in *dxtools*. Similarly, in *dytools* the *top-side* edges are blacker and *bottom-side* are whiter. Also, naturally, the more orthogonal the edge is to the direction we’re looking at, the more accented edge is produced in the filter response.

The filtered version of the image is slightly smaller, respectively 254x254 pixels compared to the original 256x256.

We perform the convolution with ‘valid’ shape argument, which is described to “return only parts of the convolution that are computed without zero-padded edges”. As I used a Sobel operator with a 3x3 kernel, it means we can’t place it on the edge pixels without zero padding on the outer side, therefore we lose one pixel on each side of the image as we only use the pixels on which the kernel can be placed on fully without using any extra zero-padding.

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

Answers:

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

Answers:

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

Answers:

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

Answers:

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

Answers:

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

Answers:

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**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:

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

Answers:

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**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:

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