# 2025 Spring CV HW3

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# 1 Hough Transform

## 1.1 Line

Line detection worked well with the default parameters as seen in Figure 1. But many false positives were detected.

Figure 1: Line detection with provided image and default parameters

## 1.2 Circle

The default parameters for the given image worked decently as seen in Figure 2. Most of the circles were detected, but there are some errors. One false positive in the middle and one false negative on the right side.

Figure 2: Circle detection with provided image and default parameters

### 1.3 Own images

The image I used is shown in Figure 3. The image was created by myself. It contains various sized circles and various lines.

Figure 3: Own image

The Hough Transform for lines was applied to my own image in Figure 3 using both default and tuned parameters. The results are shown in Figures 4a and 4b. Default parameters for Hough Transform for lines are:

- `sigma = 2`
- `threshold = 0.08`
- `rho = 2`
- `theta = pi/180`
- `num = 20`

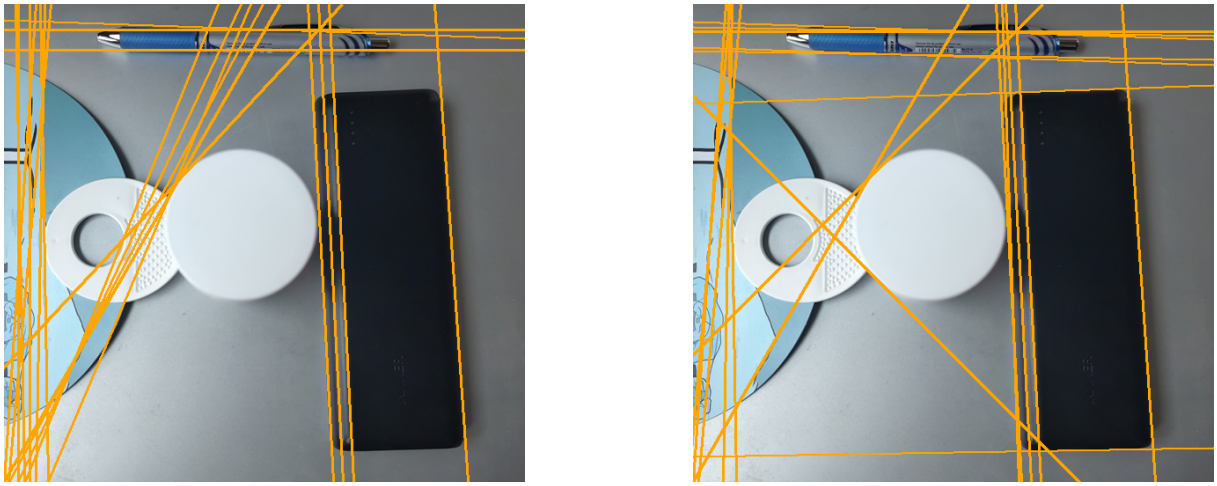
The tuned parameters are:

- `sigma = 3`
- `threshold = 0.03`
- `rho = 1`
- `theta = pi/180`
- `num = 20`

The tuned parameters were optimized so that both straight edges of the pen and all edges of the black square are detected. Some more straight lines are detected in the left, where the image is more chaotic. Most lines also have multiple detections, which could mean that NMS is not working quite as expected.

The Hough Transform for circles was applied to my own image in Figure 3 using both default and tuned parameters. The results are shown in Figures 5a and 5b. Default parameters for Hough Transform for circles are:

- `sigma = 2`
- `threshold = 0.1`
- `a = 2`



(a) Default parameters (b) Tuned parameters

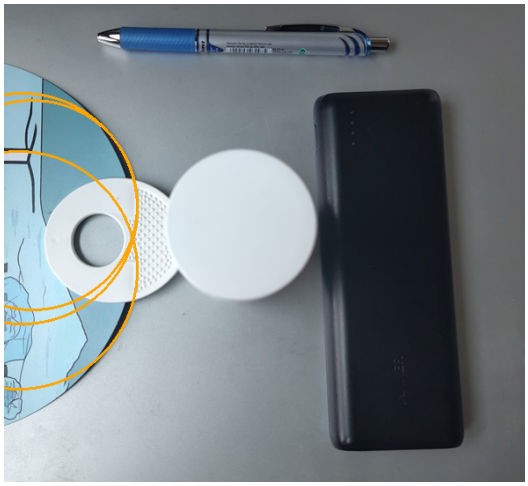
Figure 4: Hough Transform for lines on own images.

- `b = 2`
- `r = 4`
- `range = 120 to 180 degrees`
- `num = 3`

The tuned parameters are:

- `sigma = 2`
- `threshold = 0.1`
- `a = 2`
- `b = 2`
- `r = 3`
- `range = 80 to 90 degrees`
- `num = 1`

The tuned parameters for the circle were very restrictive due to the very long runtime. Due to the run with default parameters taking 18 minutes to run. Therefore, the range of radii to check was reduced from 120 to 180 degrees to 80 to 90 degrees. The run with these parameters took about 7 minutes to run.



(a) Default parameters

(b) Tuned parameters

Figure 5: Hough Transform for circles on own images.

# 2 Homography estimation

## 2.1 Inserting input image

The previous figure 3 was used as the input image. It was inserted into part of the provided image replacing part of the image on the screen. Producing the image 6. The input image is a bit oversized in comparison to the area it is inserted into. Leading to some clipping into other parts the input image.


Figure 6: Image insertion

## 2.2 Panoramic image

The panoramic image 7 was created by stitching the two images together. Looking at both input images individually reveals that the second image should be on the right of the first image. The images are being placed correctly on the canvas, but the last two corners of the second image are outside of the view. Leading to strong distortion of the second image. Due to the canvas being too small or treated as a flat surface.

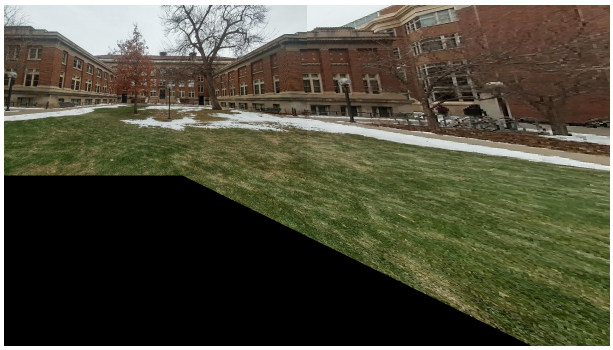


Figure 7: Panoramic image