

In this lab, you will use MATLAB's built-in Hough transform functions to detect the lines and circles.

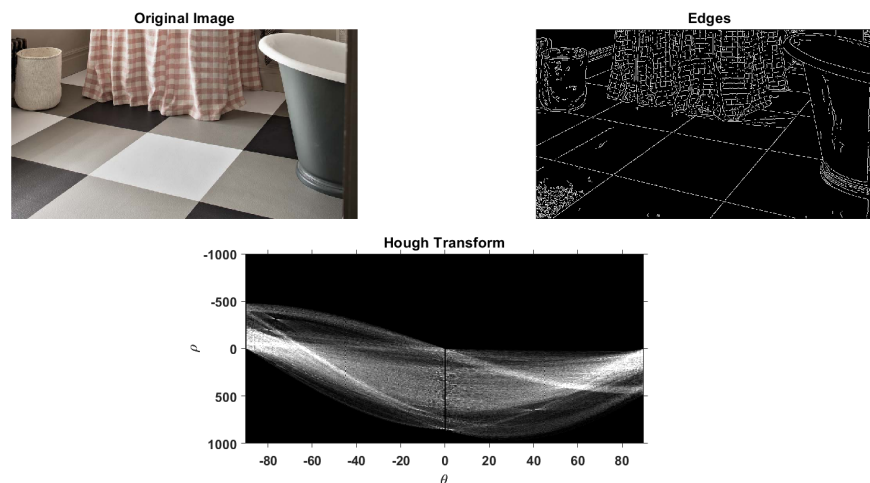
**Important Note:** Submit all your codes and the resulting images you used in the lab to SUCourse as a single zip file. Deadline for submission to SUCourse is **until the end of the lab**.

## Things to do:

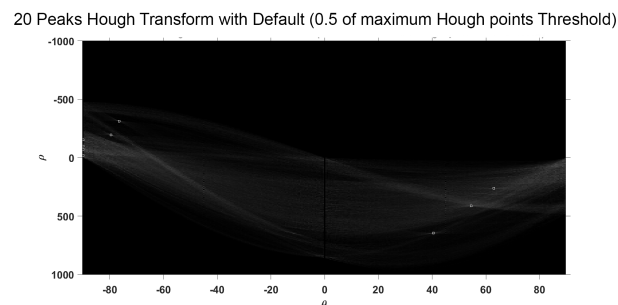
Write two programs ("lab4houghlines.m" and "lab4houghcircles.m") to detect lines and circles by using Hough transform **with different parameters**. Use "tic-toc" commands to evaluate the execution time performances of each method.

### Line Detection

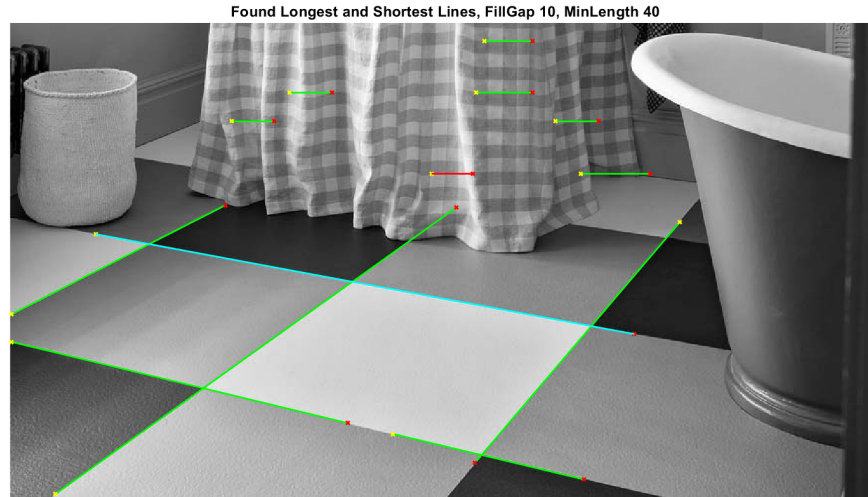
- Read an image and convert it to a black-white edge image with your edge detector choice.
- Obtain the Hough transform of the black-white image and display it along  $\rho$  vs  $\theta$  axes.  
*Hint:* use 'hough' function



- Select the peak Hough points with an appropriate threshold (e.g., half of the maximum Hough points).  
*Hint:* use 'houghpeaks' function



- Find the lines in the image by using these peak points *Hint:* use 'houghlines' function
- Plot all the lines that you detected with green color and highlight the longest and shortest detected lines with cyan and red color, respectively. What are the maximum and minimum lengths of the detected lines?

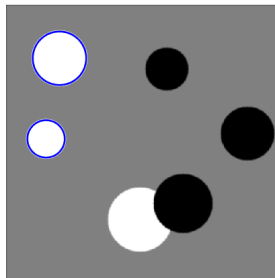


### Circle Detection

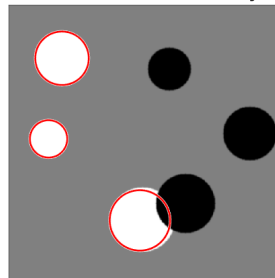
- Read an image that contains several different size circles and convert it to a black-white image.
- Detect all the circles with radius  $r$  such that  $20 \leq r \leq 60$  pixels by using Hough transform.  
*Hint:* use 'imfindcircles' function
- Change 'Sensitivity' factor and test the performance of circle detection
- Change 'ObjectPolarity' parameter to detect 'bright' and 'dark' circles separately

You can call the function as `imfindcircles(I, [Rmin, Rmax], 'Parameter', value)` where parameter can be 'Sensitivity' and value is a number between 0 and 1, or 'ObjectPolarity' and value is either 'bright' or 'dark'.

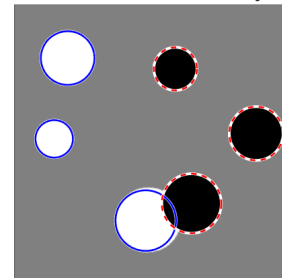
Detected Circles using Hough Transform  
20 ≤ Radius ≤ 60



Detected Circles using Hough Transform  
20 ≤ Radius ≤ 60 & Sensitivity = 0.9



Detected Bright and Dark Circles  
20 ≤ Radius ≤ 60 & Sensitivity = 0.9



### Post Lab

Post lab reports must include brief explanations of each method that you used in this lab. Provide resulting images by utilizing all these methods and discuss your results. How do changing parameters such as threshold or sensitivity factor affect the accuracy of the line and circle detection?

Deadline for post lab report submission to SUCourse: **12 November 2018, 23:55.**