EECS: 332 Intro to Computer Vision, MP #6

Hough Transform, Due on 11/15/2016

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Introduction

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. This voting procedure is carried out in a parameter space, from which object candidates are obtained as local maxima in a so-called accumulator space that is explicitly constructed by the algorithm for computing the Hough transform.

Algorithm for Hough Transform

Two points (x,y) and (z,k) define a line in the xy plane. These points give rise to two different lines in the mc space. In the mc space, these lines will intersect in a point (m',c') where m' is the slope and c' is the y intercept. However, all points on the line defined by (x,y) and (z,k) in the xy space will parameterize lines that intersect in (m',c') in mc space.

We need to quantize the parameter space (m,c) which is often referred to as accumulator. We need to count the number of times a line intersects a given cell. So, the cells with a minimum number of votes are assumed to correspond to lines in the xy space

1. We need to first input the image, and convert into grayscale
2. We need to run an edge detection algorithm on this image (Canny is used in this implementation)
3. We need to find the Hough Transform to get the matrix with the Hough values
4. Find the significant points from the Hough value matrix
5. We need to then calculate the Hough Lines based on the Hough Matrix
6. We need to super impose the Hough Lines on top of the input Image
7. We have the desired output

Result Analysis

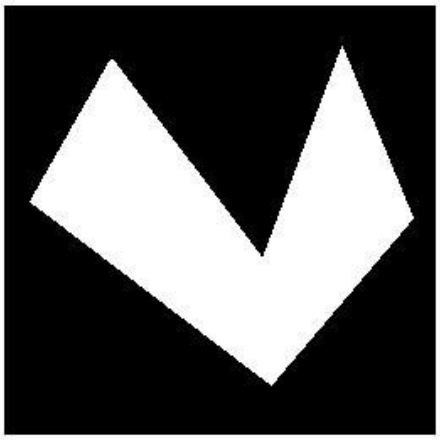


Fig 1

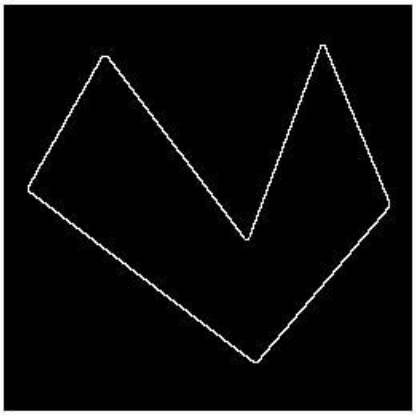


Fig 2

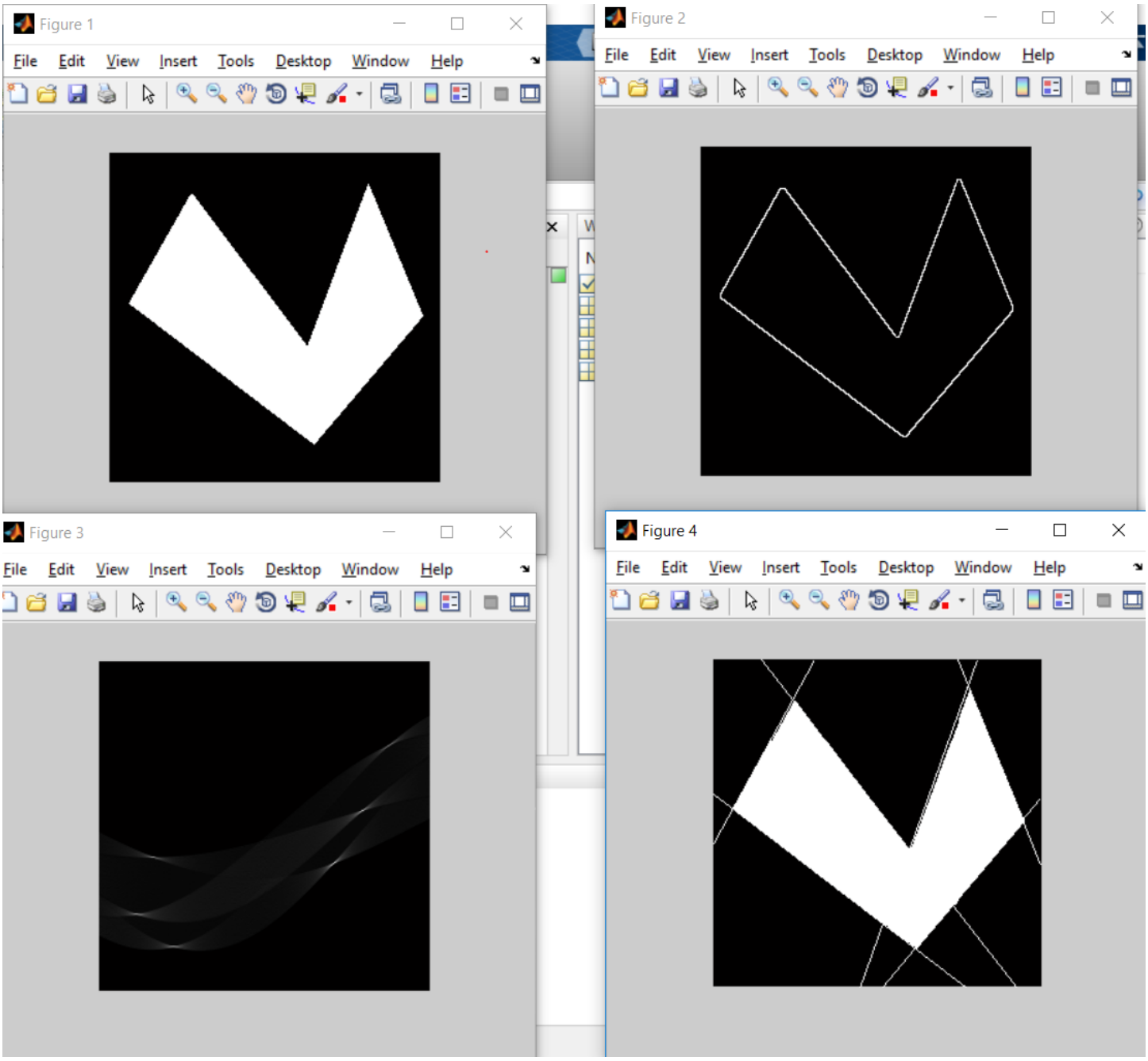
Fig 3 Fig 4

These are the results of running the Hough Transform on the test image “test2.bmp”

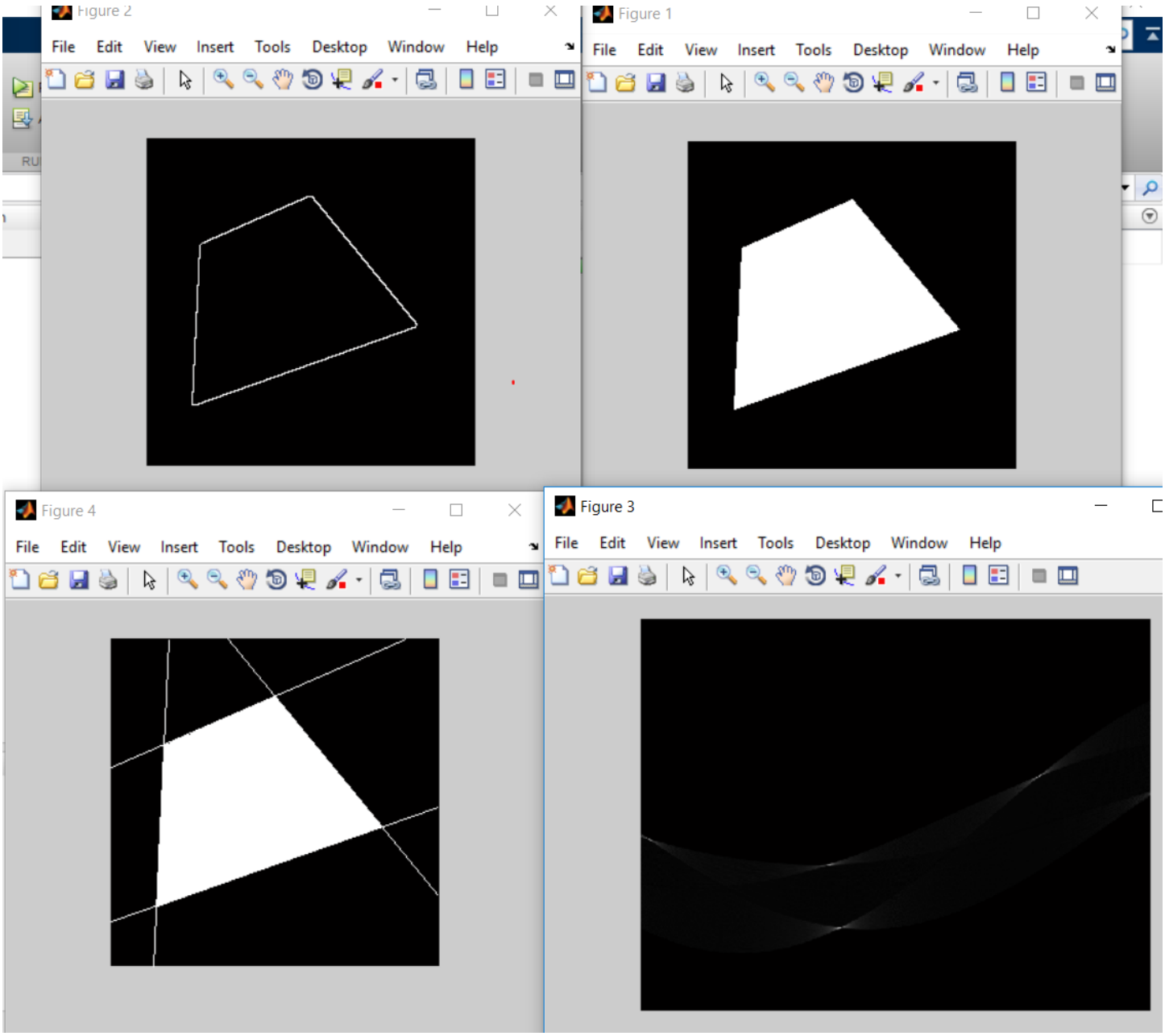
- Fig 1 shows the input image after being converted into a grayscale form
- Fig 2 shows the input image after being processed by the edge detector function. In this example, we have used Canny Edge detector in order to detect the edges
- Fig 3 is the Output of the Hough Transform with the Hough values. This has been displayed as an image. The strong white points depict the peaks in which there is maximum number of lines passing through the point. As you can see that each line is like a sinusoidal curve
- Fig 4 is the output image where the Hough Lines have been superimposed on the Input Image. Thus, performing the desired task. The edges are being detected using the Hough Transform

Results

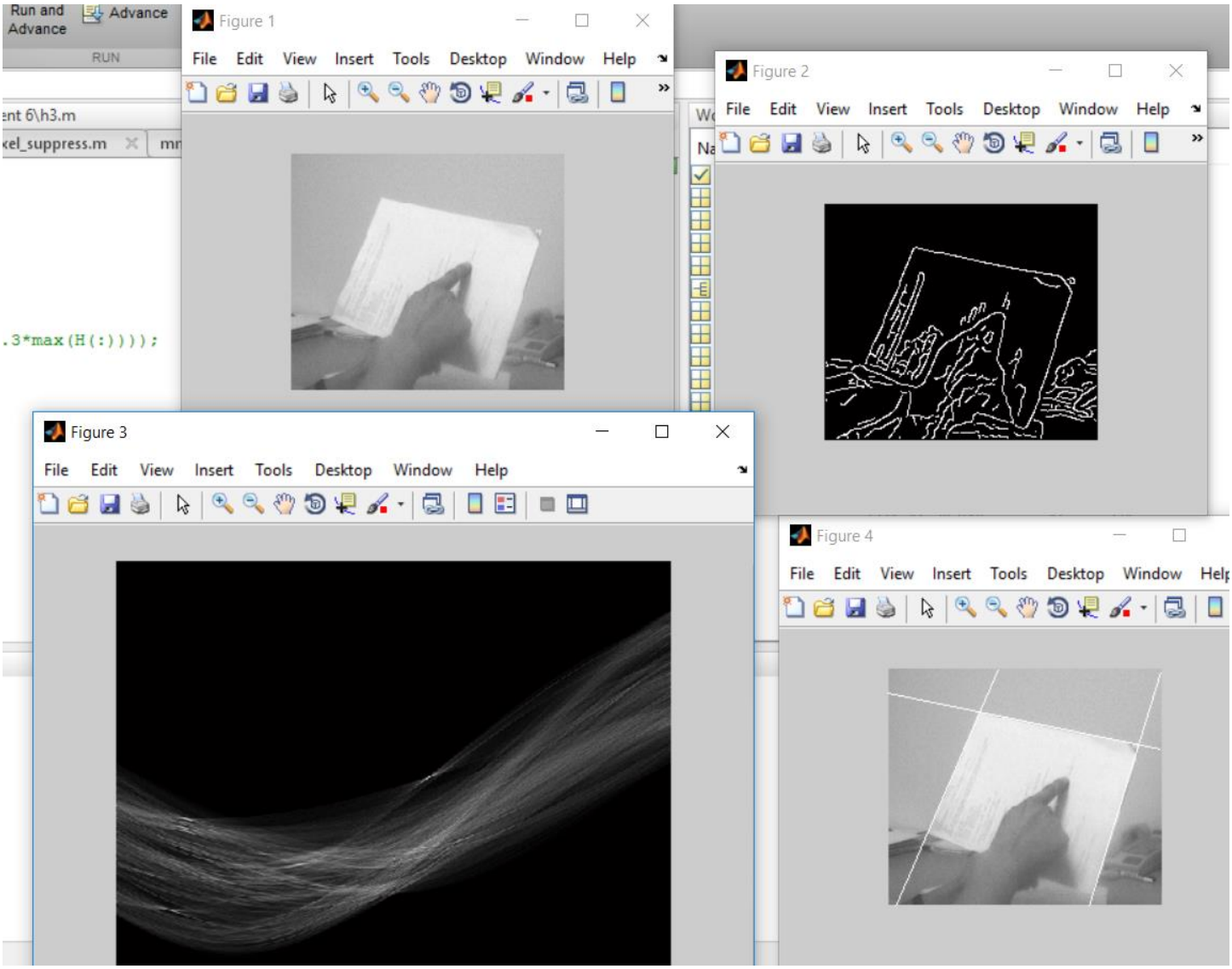
1. Outputs for “test2.bmp”



2. Outputs for “test.bmp”

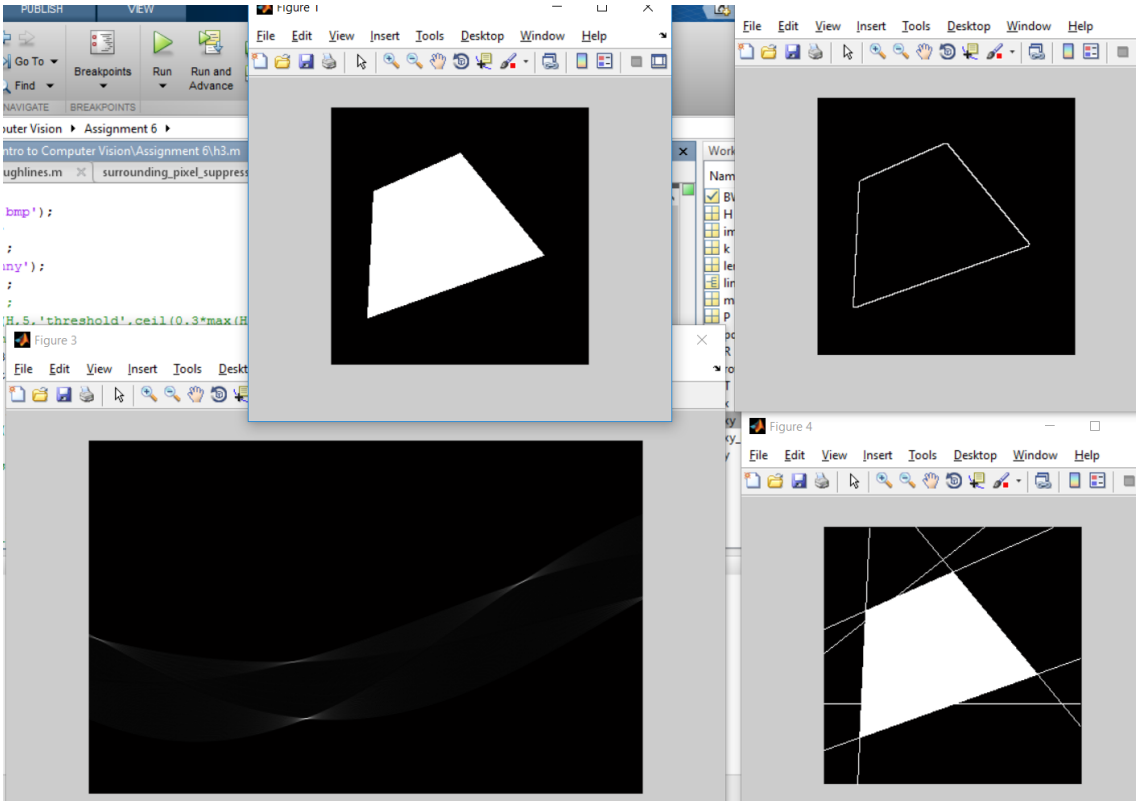


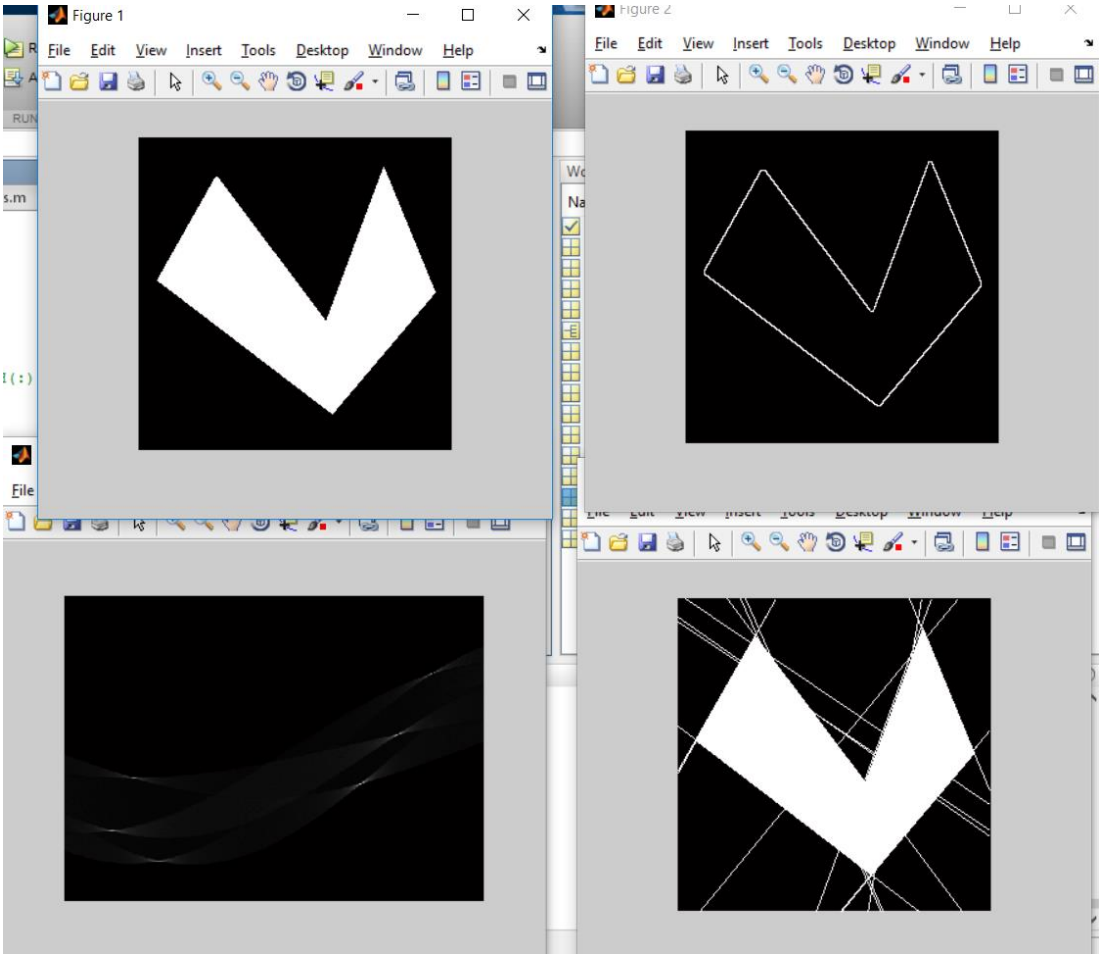
3. Outputs for “input.bmp”



As you can see, significant intersections of the parameter space are being detected

Comparison of different quantization in the parameter space





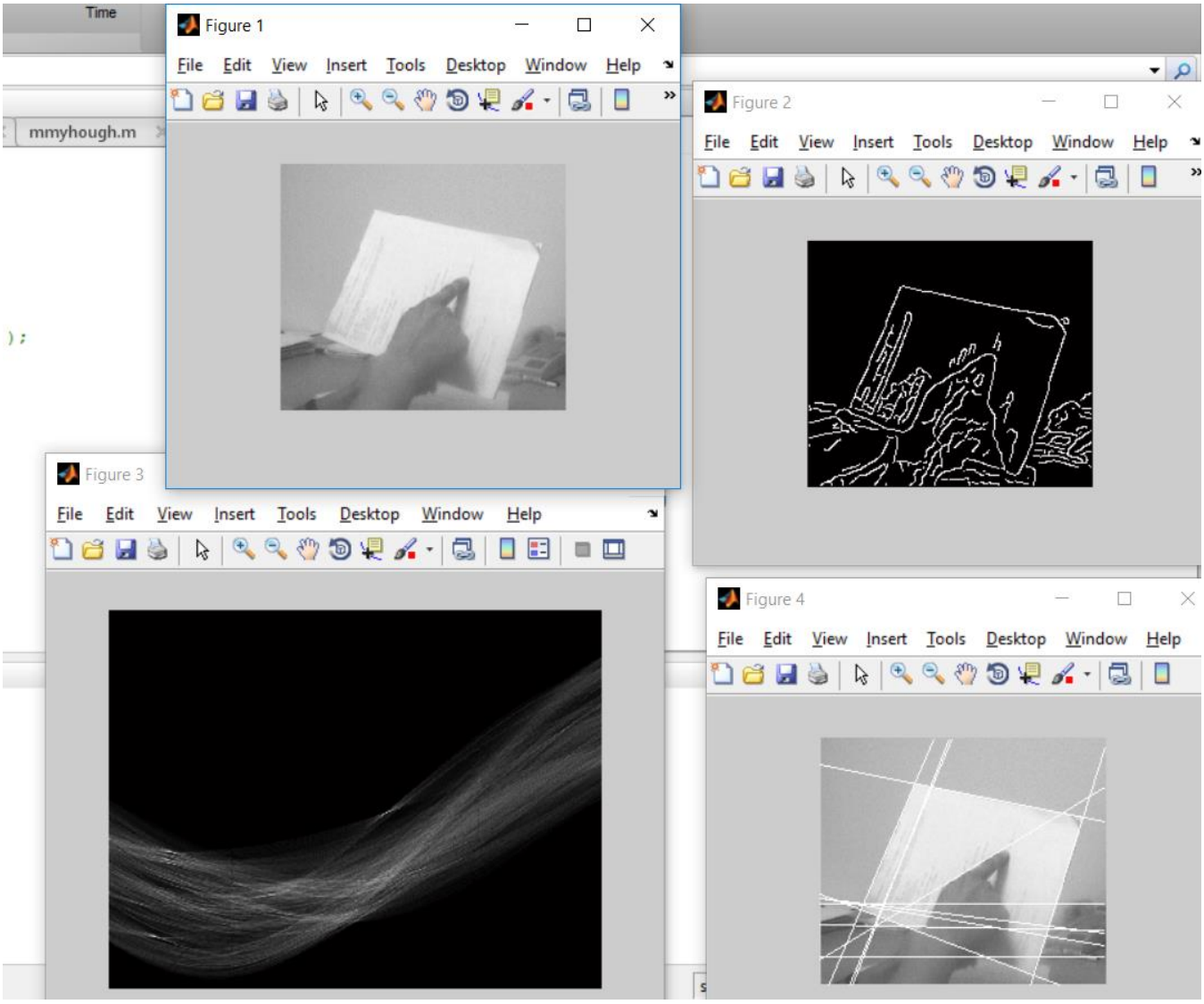

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Figure 1
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