Project-03

Image Processing | Instructor: Dr. Mihran Tuceryan

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Canny Edge Detection

Introduction and Description:

The Canny edge detection method is an edge detection operator that can be used to detect a wide range of edges in any given images.

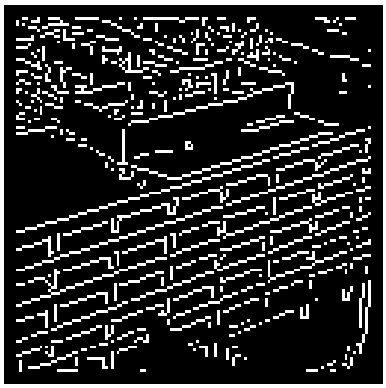
The whole process of edge detection can be divided into five steps given below:

- First of all we should remove all the noise that is there in the image using Gaussian filter.
- Then we are supposed to find the gradient magnitude of the image.
- After finding the gradient magnitude, apply the non-maxima suppression to the image. This will help us in getting rid of spurious response.
- After that use the input thresholds and apply them.
- Now once the thresholds are applied, we have to track down all the edges using hysteresis.
- In the end connect all the weak edges to the string edges.

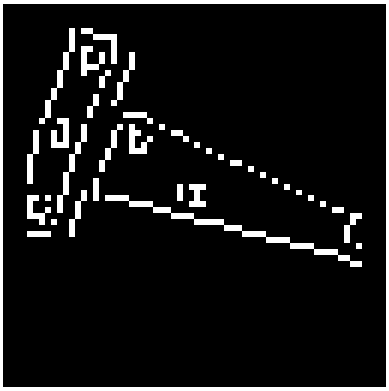
The Canny algorithm is highly adaptive algorithm that can be applied to various environments. Since we have ability to change the sigma value, maximum and minimum threshold values, we can change the parameters and recognizes edges in different situations.

Results:

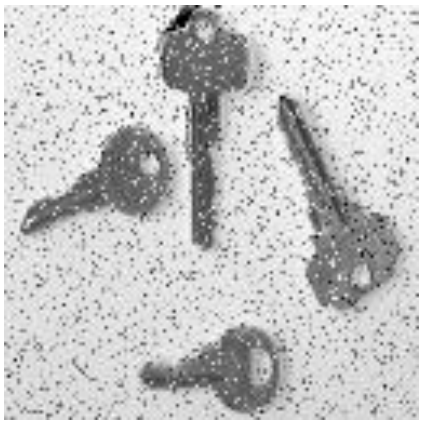
- Building image with Sigma = 1, Minimum threshold = 0.03 and Maximum Threshold = 1.6.

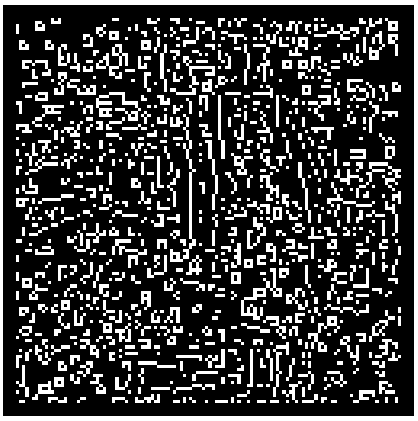



- Hinge image with Sigma = 1, Minimum threshold = 0.03 and Maximum Threshold = 1.6.

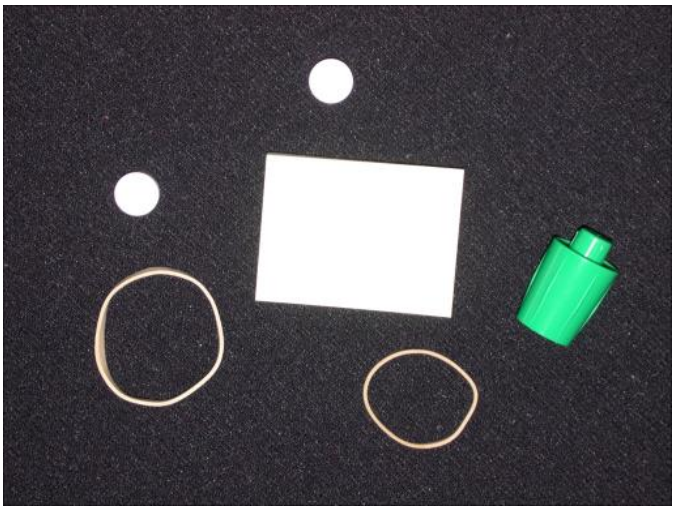



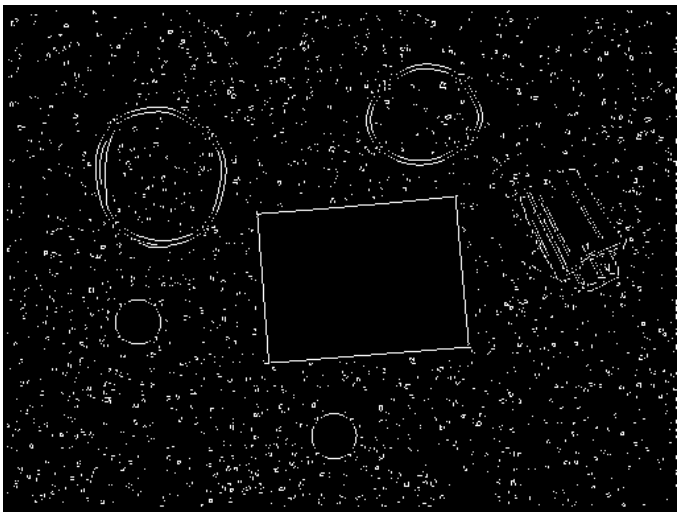
- Keys image with Sigma = 1, Minimum threshold = 0.03 and Maximum Threshold = 1.6.





- Pillsetc image with Sigma = 1, Minimum threshold = 0.03 and Maximum Threshold = 1.6.





Analysis and Application:

From the above figure we can observe that the implementation of the canny edge detection works fine. It is still not able to detect some of the edges, which may be due to some implementation mistake or the type and quality of the image also.

Hough Transform

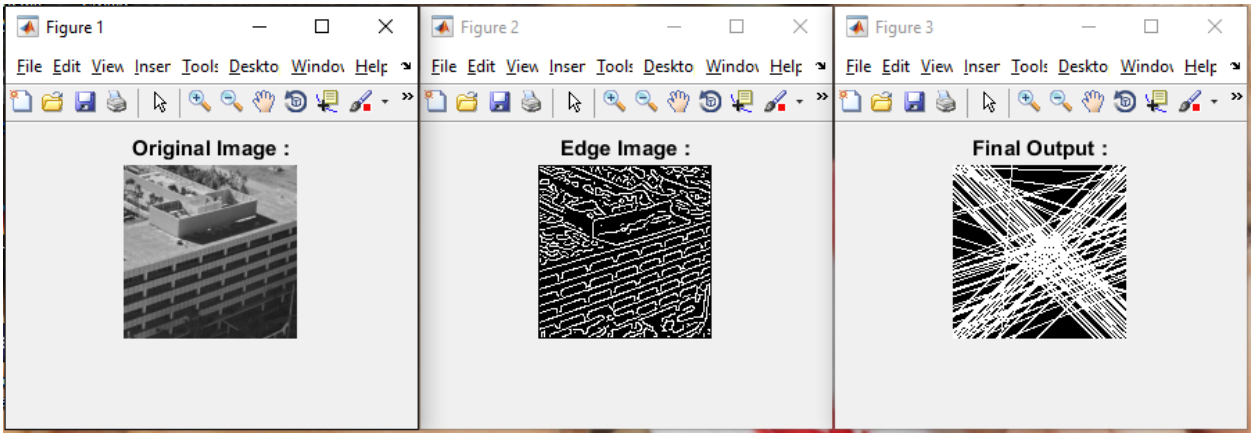
Introduction and Description:

The Hough transform is one of the method to extract features from the given image that has wide number of application in the field of computer vision. The basic purpose is the detect some of the imperfect or partial instances of the different shapes form the image which can be further combined to obtain much more complex feature. A type of voting procedure is implemented here using different parameters that will be used to obtain the local maxima in a accumulator space constructed externally.

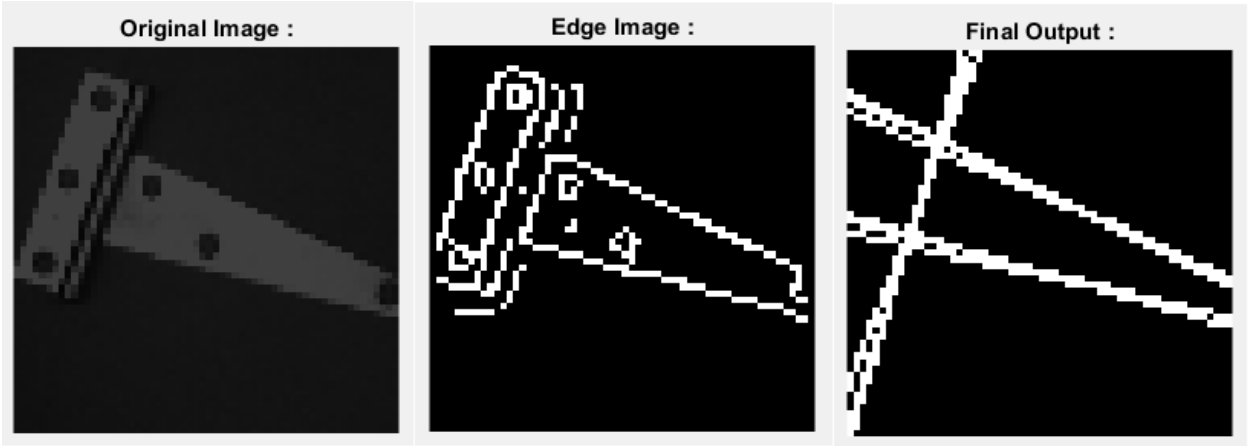
There are different versions available that can be used to identify lines, circles, ellipses and many more. Here we have implemented the line detection version.

Results:

- Building image.



- Hinge image.



Analysis and Application:

From the above figure we can observe that the implementation works fine and it is able to detect the lines from the images. Since the implementation is not as accurate, it is not able to draw all the lines. Also since the canny edge detection implementation mentioned above is not 100% accurate,

I have used the inbuilt function edge of the MATLAB that has canny implemented which will provided the much more accurate detection of the lines making the possibility of error less.

References:

- https://en.wikipedia.org/wiki/Canny_edge_detector
- http://dasl.mem.drexel.edu/alumni/bGreen/www.pages.drexel.edu/_weg22/can_tut.html
- http://www.cs.ucf.edu/~mikel/Research/Edge_Detection.htm
- http://www.mathworks.com/help/images/ref/edge.html?refresh=true
- https://en.wikipedia.org/wiki/Hough_transform
- http://homepages.inf.ed.ac.uk/rbf/HIPR2/hough.htm
- Feature Extraction Using the Hough Transform, Tara Ferguson
- http://www.mathworks.com/help/images/hough-transform.html
- Lecture slides by Dr. Mihran Tuceryan.

Note:

- All the functions and filters are implemented using MATLAB as it provides much easy and simpler interface for image processing.
- For both the tasks to be performed, I have created different MATLAB functions.
- All the functions were tested on all the images mentioned in the project document like building, hinge, hinges, keys, pillsetc but I have showed few results only for the sake of simplicity.
- Following is the list of files:
  - **Canny Edge Detection:**
    - Canny.m
  - **Hough Transform:**
    - HoughTransform.m
- For canny the function expects the input of the parameters of Sigma, Maximum and minimum Threshold form the user. I have used the value Sigma = 1, Maximum Threshold = 1.6 and Minimum Threshold = 0.03, but you can use any suitable combination.
- For Hough Transform, setting the suitable parameter value is very difficult. I had to perform the exhaustive method to find the suitable parameter values. The implementation of the Hough Transform is not quite working with pillsetc image that is to be fixed.
- Also for the both function the images should be placed in the same folder of the function.