Progress Presentation-I

e-Yantra Summer Internship-2015

Marker based localisation

Niharika Jayanthi
Dheeraj Kamath
Mentor: **Sanam Shakya**

IIT Bombay

June 16, 2015

Overview of Project

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Overview of Project

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- Marker based localisation

Overview of Project

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers

Overview of Project

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
  1. Develop modules for:
     1. Morphological operation
     2. Image filtering operation
     3. Lines and contour detection
     4. Shape detection

Overview of Project

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
  1. Develop modules for:
     1. Morphological operation
     2. Image filtering operation
     3. Lines and contour detection
     4. Shape detection
  2. Robot which is capable of recognizing the markers and localize in the indoor environment.

Overview of Project

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
  1. Develop modules for:
     1. Morphological operation
     2. Image filtering operation
     3. Lines and contour detection
     4. Shape detection
  2. Robot which is capable of recognizing the markers and localize in the indoor environment.
  3. For testing, robot will be placed in the predefined environment with markers.

Overview of Project

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
  1. Develop modules for:
     1. Morphological operation
     2. Image filtering operation
     3. Lines and contour detection
     4. Shape detection
  2. Robot which is capable of recognizing the markers and localize in the indoor environment.
  3. For testing, robot will be placed in the predefined environment with markers.
  4. Then robot should give the (x, y) coordinate in the room.

Overview of Project

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- Marker based localisation
- Objective: To develop modules for Image Processing and robot localisation using markers
- Deliverables:
  1. Develop modules for:
     1. Morphological operation
     2. Image filtering operation
     3. Lines and contour detection
     4. Shape detection
  2. Robot which is capable of recognizing the markers and localize in the indoor environment.
  3. For testing, robot will be placed in the predefined environment with markers.
  4. Then robot should give the (x, y) coordinate in the room.
  5. Robot which is capable of moving between two random way points in the room with markers.

Overview of Task

Task no	Tasks	Deadlines
1	Installation of required softwares on raspberry pi and documentation	2 days
2	Develop modules for morphological operation with documentation	3 Days
3	Develop modules for image filtering operation with documentation	2 Days
4	Develop modules for extracting lines and contours with documentation	3 Days

Overview of Task
cont...

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Task no	Tasks	Deadlines
5	Creation of various shape detectors for shape detection with documentation	3 Days
6	Design a marker and develop the marker detection and recognition algorithm	3 Days
7	Camera calibration and pose estimation and recognition algorithm	2 days
8	Mapping the robot position from the data obtained from the marker	5 Days
9	Create path from source to destination waypoints with the help of visual markers	6 Days

Task 1
Setting up of Raspberry Pi

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Task 1
Setting up of Raspberry Pi

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- **Setup of the Raspberry Pi**

Task 1
Setting up of Raspberry Pi

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- **Setup of the Raspberry Pi**

Raspberry Pi is a small,low-cost, powerful credit card sized computer that was developed to promote education among adults and children alike.

Task 1
Setting up of Raspberry Pi

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- **Setup of the Raspberry Pi**

Raspberry Pi is a small,low-cost, powerful credit card sized computer that was developed to promote education among adults and children alike.

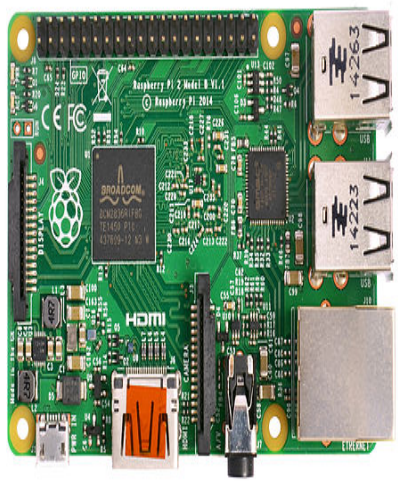


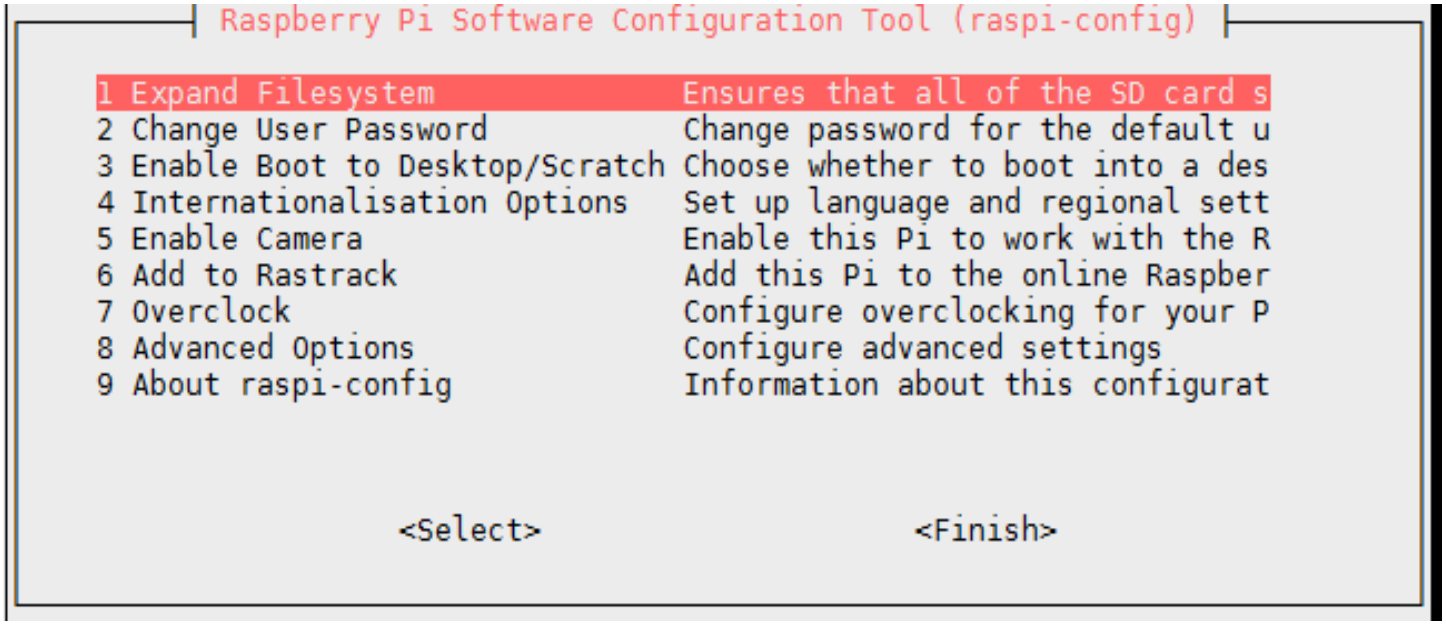
Figure: Raspberry Pi

Steps Involved

- Download Raspbian and win32DiskManager softwares.
- Insert your sd card.Run win32DiskImager and choose the Raspbian image and select the drive corresponding to your sd card.
- Insert it into the sd card slot of the Raspberry Pi.
- Use HDMI cable to connect the board to the monitor/tv. Power on the board and the monitor. You will notice a set of code running on the monitor.
- It opens a software configuration tool.

Steps Involved

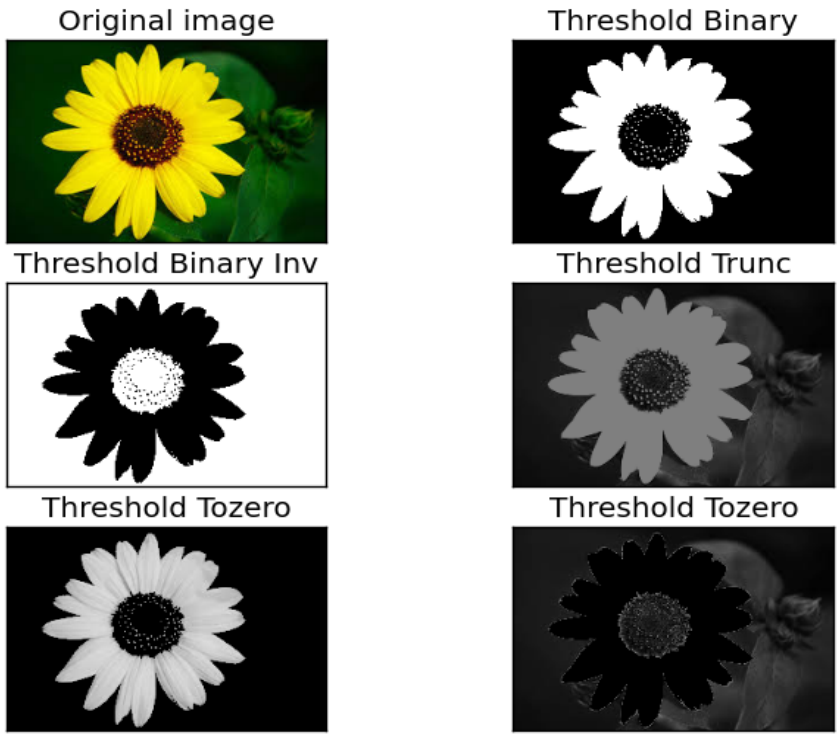
Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**



Task 2
Thresholding

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- Simplest method of image segmentation
- Can be used to create binary images from grayscale images
- Pixels compared with threshold value



Task 2
Morphological Operations

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- **Erosion**
  Erodes the boundaries of an object image
- **Dilation**
  Increases the size of boundary of image
- **Opening**
  Erosion followed by dilation
- **Closing**
  Dilation followed by erosion

Task 2
Morphological Operations

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Erosion

Dilaion

Opening

Closing

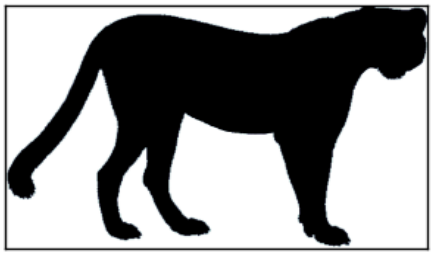
Task 2
Distance Transform

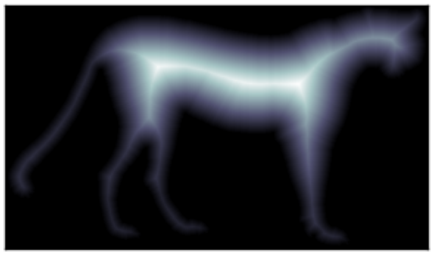
Distance transform is used to modify a image to display its skeleton.

How is the image modified?

The closer a pixel is to the boundary of the object image, the darker it is (i.e. it has a lower value).

In this way, the center (or the skeleton) of the image is highlighted.





Task 2
Watershed Segementation

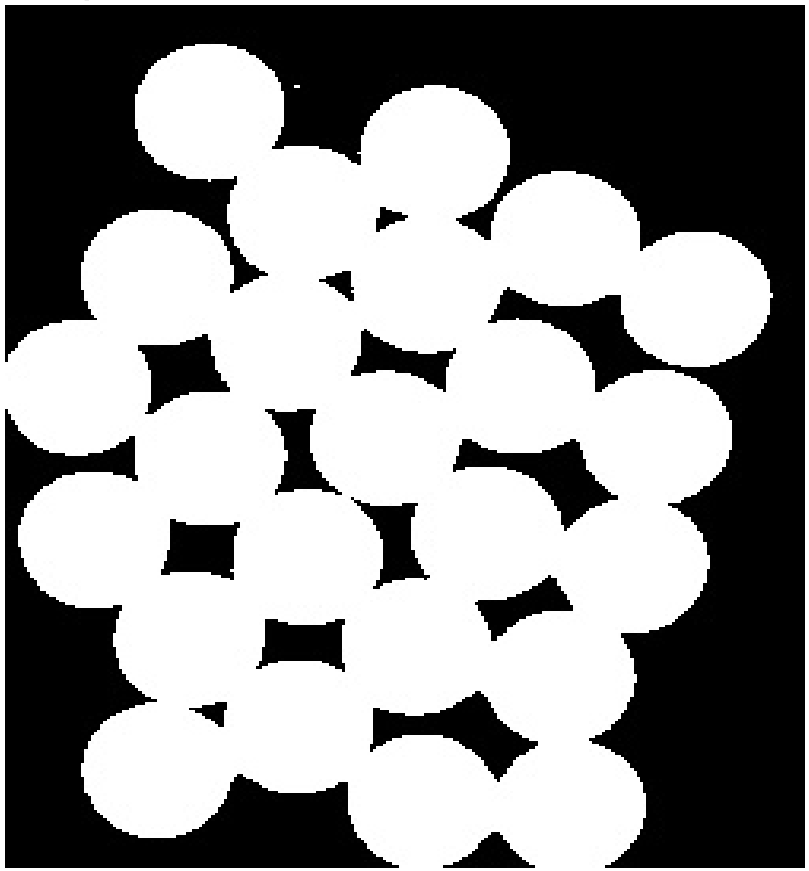
Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Watershed is an algorithm in image processing used for isolating objects in the image from the background.

Task 2
Watershed Segementation

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

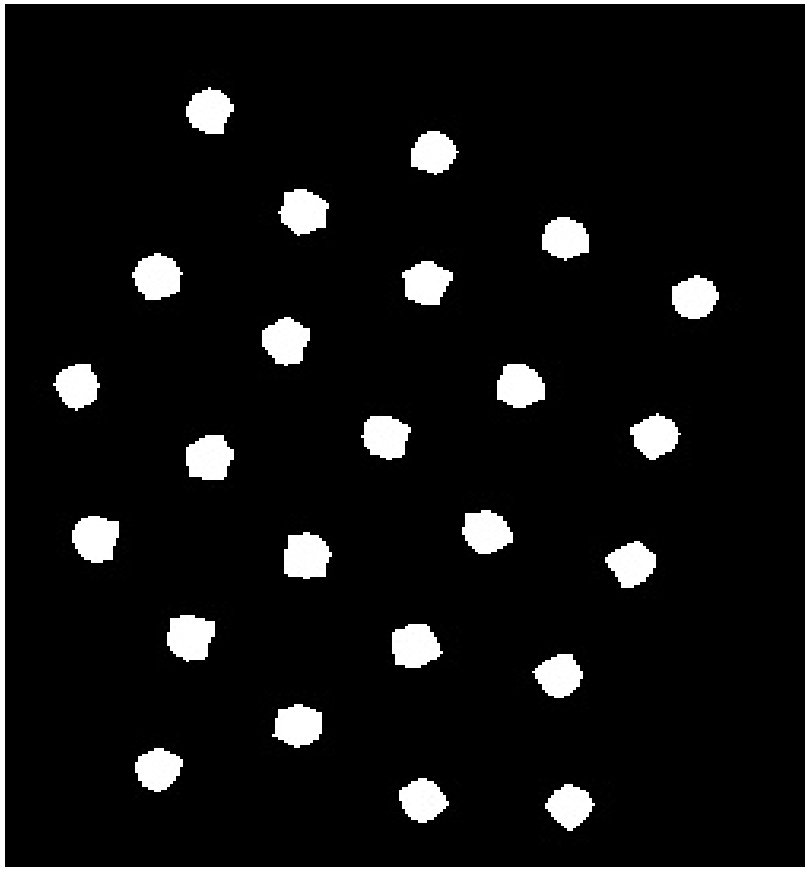
Step 1:



Task 2
Watershed Segementation

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

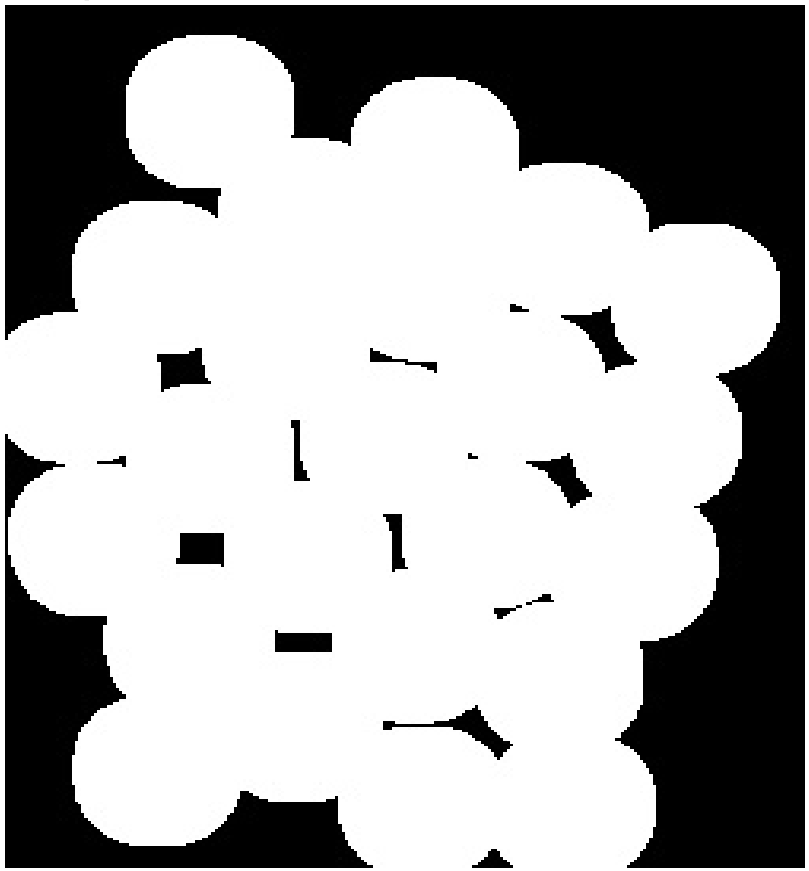
Step 2:



Task 2
Watershed Segementation

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Step 3:



Task 2
Watershed Segementation

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Step 4:

Task 3
Gradients

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Three commonly used methods to find gradients:

- Scharr
- Sobel
- Laplacian

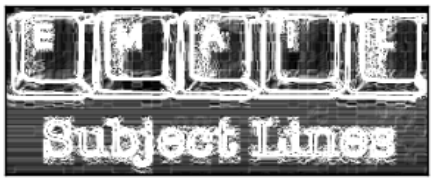
Task 3
Gradients

Original

Sobel

Laplacian

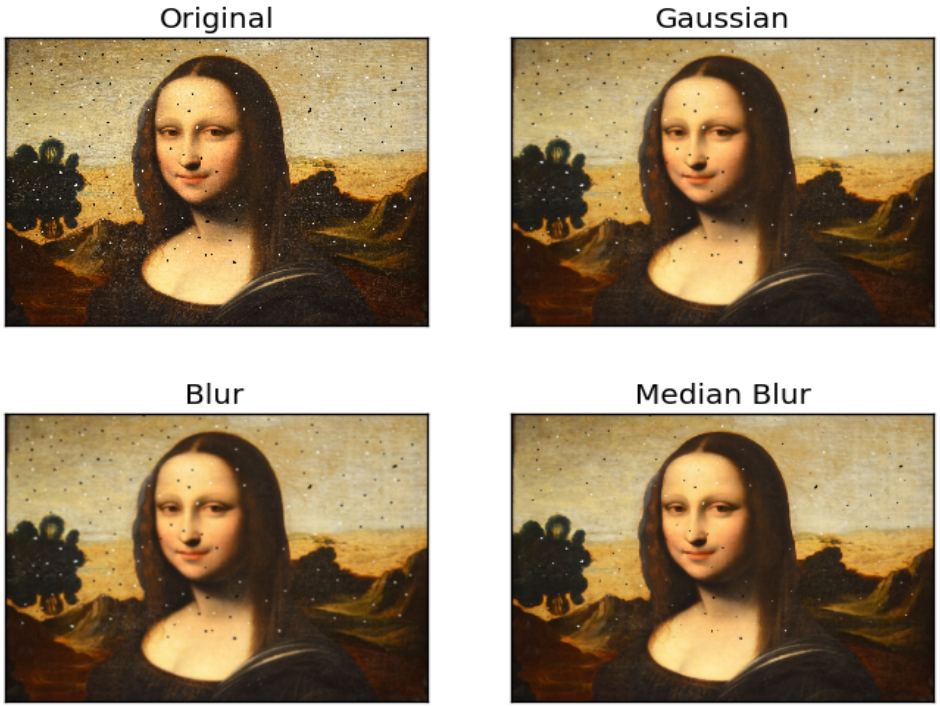
Scharr



Task 3
Blur

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

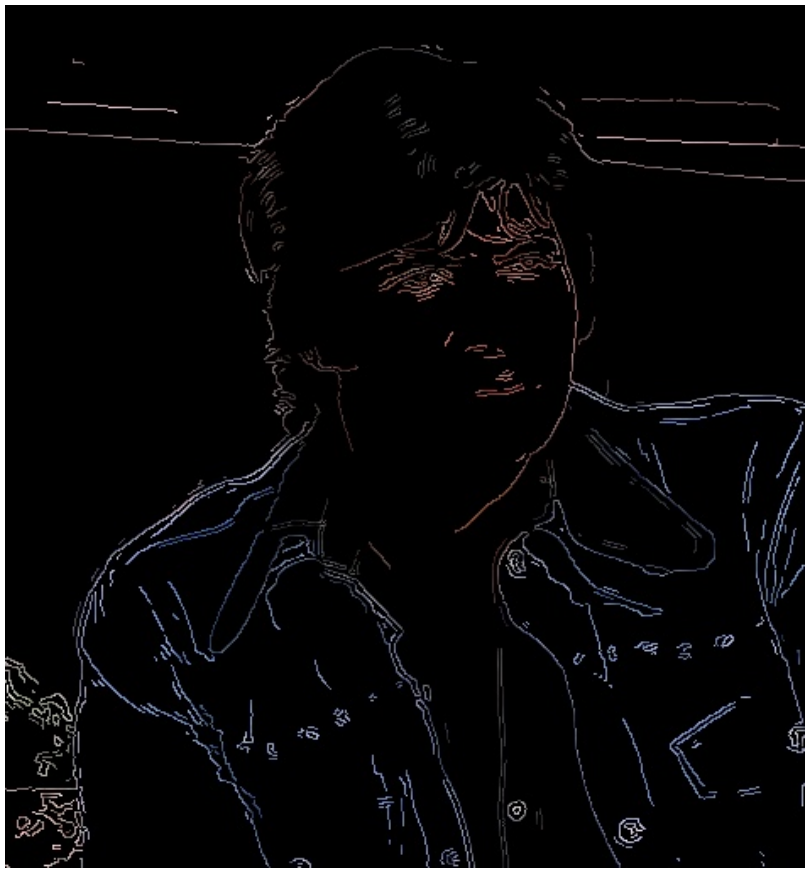
Types of blurring techniques:



Task 3
Line Detection

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

- **Canny Edge Detection**
  As the name suggests, this algorithm is used to detect the edges in an object image.



Task 3
Line Detection

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

And the answer is ...

Task 3
Line Transform

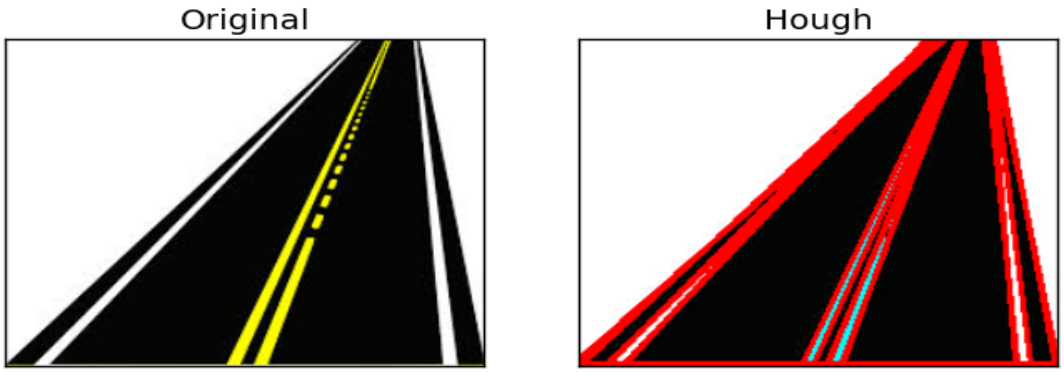
Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Hough Line Transform

- Feature extraction technique
- Purpose: Find imperfect instances of objects

How is the line detected?

- Intersections between curves

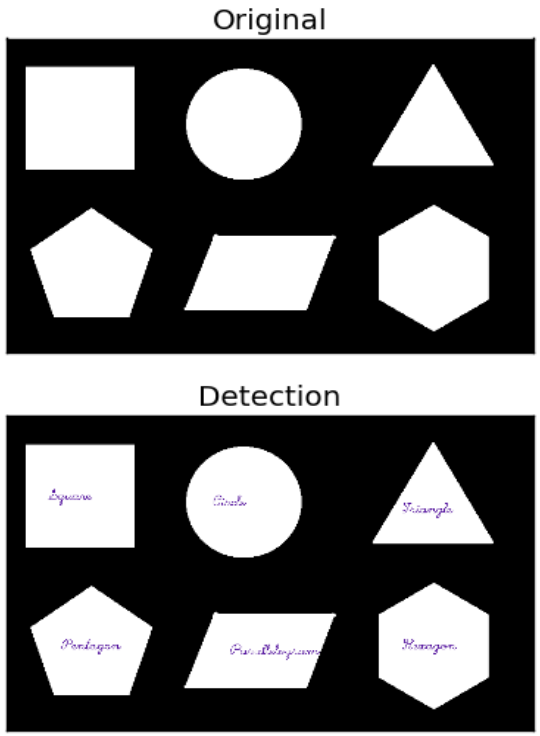


Task 4
Shape Detection

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

Detection and identification of various shapes by:

- Uses Hu moments to compare two objects
- Identifying the shape based on number of vertices



Challenges Faced

- Configuring wifi settings in Raspberry Pi
- Installation of opencv in MAC OSX
- Difference in bitness of Python and module to be installed(modules like matplotlib and numpy)
- Counting of overlapping object using watershed segmentation
- Lane detection with extraneous objects on the road

Future Plans

Niharika Jayanthi Dheeraj Kamath
Mentor: **Sanam Shakya**

By the next project presentation, we aim to accomplish the following:

- Develop marker detection and recognition algorithm
- Develop pose estimation algorithm by calibrating the camera
- Map the robot's position by the data obtained from the marker

Thank You

THANK YOU !!!

Any questions?