ASSIGNMENT - 3

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TOPIC - HOUGH TRANSFORM FOR IMAGES

1. **Introduction and Problem Statement:** Detecting straight lines in an image is a common task in image processing, useful for tasks such as object detection, lane marking in autonomous vehicles, and document scanning

2. **Mathematical Model** : The Hough Transform is based on the polar coordinate representation of a line. A line in Cartesian coordinates y=mx+by = mx + by=mx+b can be represented in polar coordinates as:

   $$\rho = x\cos(\theta) + y\sin(\theta)$$

   Where ρ is the distance from the origin to the line, and θ is the angle between the line and the x-axis. This transform allows detection of lines in an image that are not necessarily aligned to the coordinate axes.

3. **Methodology**

   Step 1: Edge Detection
   Canny edge detection is applied to identify edges in the image.

   Step 2: Hough Transform
   For each edge point, the corresponding ρ\rhoρ and θ\thetaθ values are calculated, and votes are cast in a Hough accumulator array.

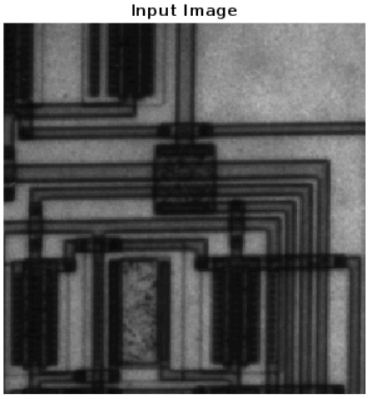
   Step 3: Peak Detection
   Local maxima in the Hough accumulator array are identified, which correspond to the most prominent lines.

   Step 4: Line Plotting
   Detected lines are plotted on the original image based on the extracted ρ and θ values.

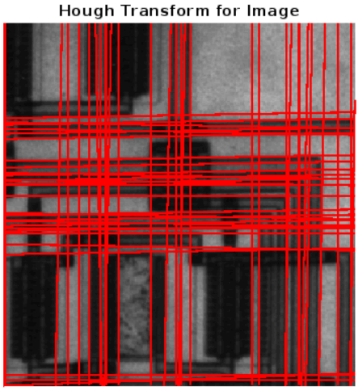
4. **TEST CASES:**

CASE 1: Circuit Image (threshold percent = 0.4, window size = 7)

Input Image

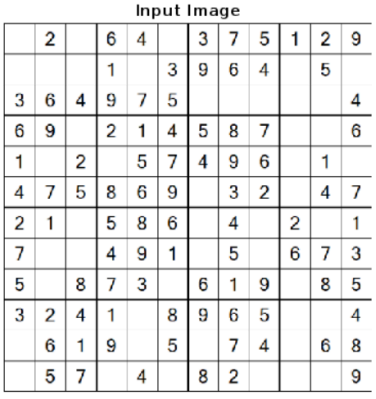


Hough Transform for Image

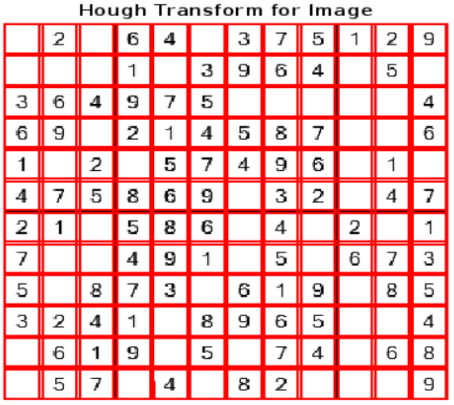


CASE 2: Sudoku Image (threshold percent = 0.3, window size = 10)

Input Image



Hough Transform for Image



CASE 3: Gantry crane image (threshold percent = 0.4, window size = 10)

Input Image

Hough Transform for Image