Assignment 2 Introduction

CSIT 5410 Recognition Systems

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Assignment 2

- This assignment consists of two sections: programming section and written section.
- Your should submit a compressed file containing:
  - all M-files and input images related to the programming section.
  - a PDF file for the written section.
  - a README.txt file indicating the programming software (Octave/MATLAB) that you are using for this assignment.
- The skeleton code is prepared in MATLAB and can be obtained from CANVAS.

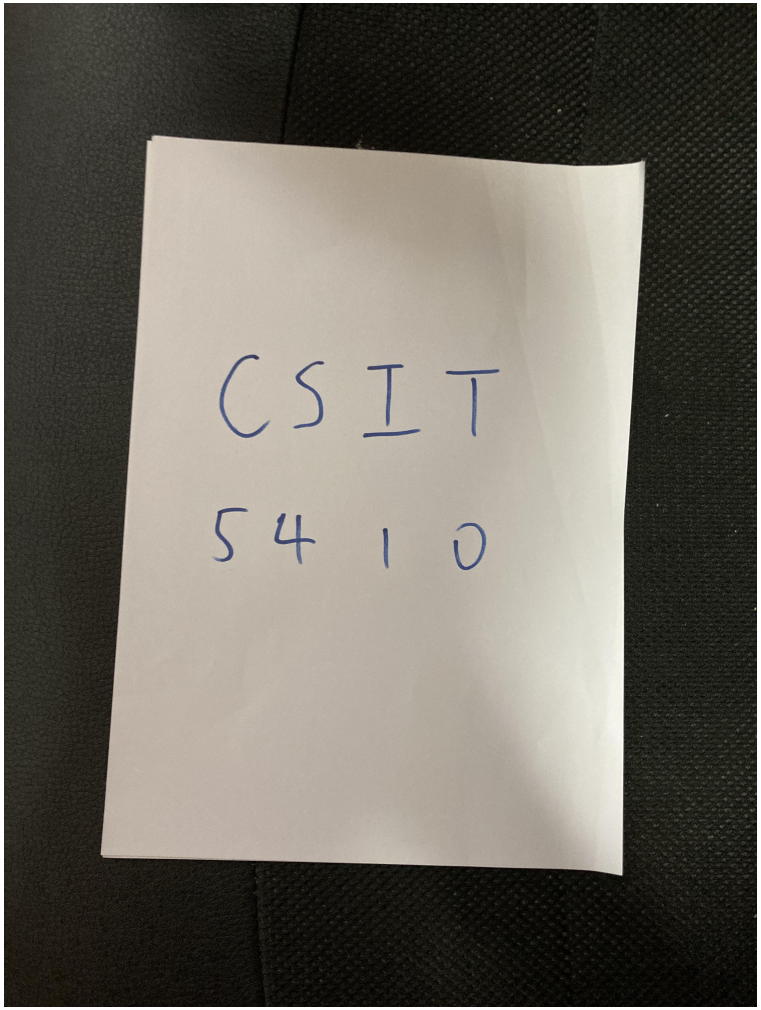
Programming section

Programming section:

- Q1: Hough Transform for Line Detection
- Q2: Fisher Linear Discriminant

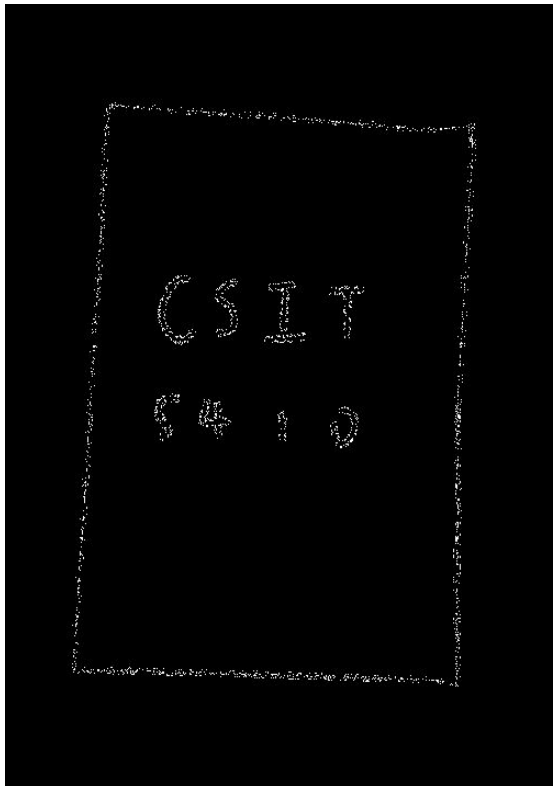
Q1: Hough Transform for Line Detection

The goal of Q1 is to segment a A4 paper in the input image. A 4-steps framework is provided in the skeleton code.



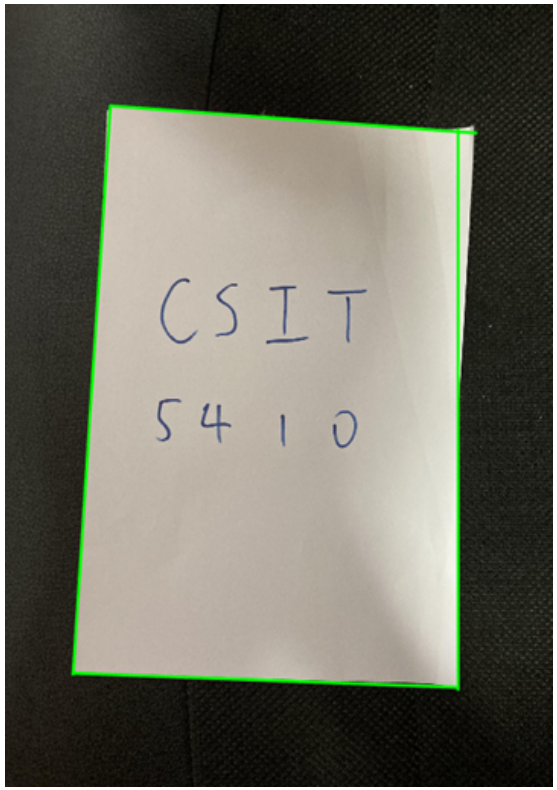
Framework for Q1

- Step 1: Pre-processing. Perform denoising on the input image. Gaussian filter is suggested in the skeleton code. You can apply any other filter.
- Step 2: Edge extraction. You can use the edge extraction function that you developed in assignment 1, or simply use the built-in function edge().



Framework for Q1

- Step 3: Hough transform. Use Hough transform to find four straight lines that segment the A4 paper. **You CANNOT use the built-in functions related to Hough transform**.
- Step 4: Output. Plot the four sides of the A4 paper in green color.



Q2: FLD

The goal of Q2 is to develop a function for FLD.

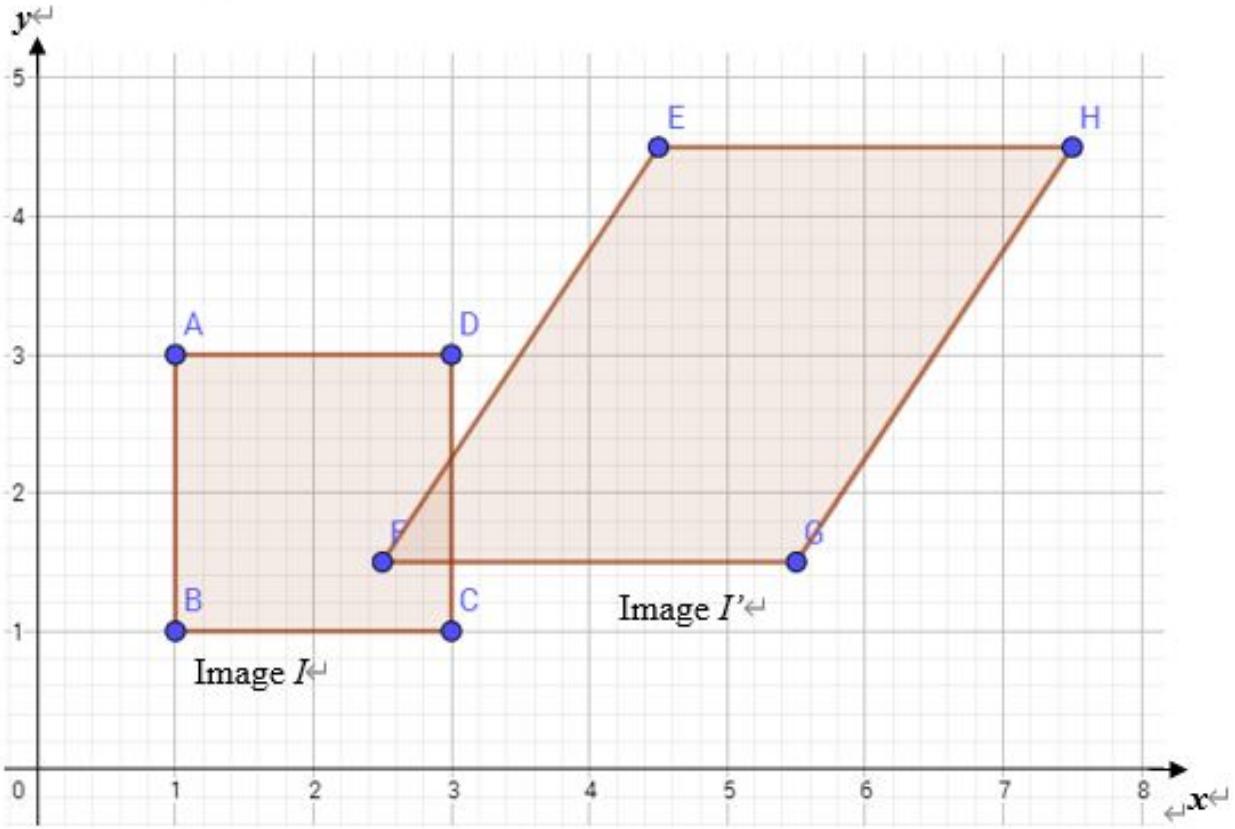
- Input:
  - class1_ samples: Containing $N1$ data points in dimension N.
  - class2_ samples: Containing $N2$ data points in dimension N.
  - input_ sample: Containing one data point in dimension N.
- Output:
  - w: weight vector.
  - class: the decision of FLD (either 1 or 2).

Framework for Q2

- Step 1: Obtain $N1$, $N2$, and N from the input.
- Step 2: Compute $w = S_w^{-1}(\mu_a - \mu_i)$. In this assignment, you do not need to consider the cases where the matrix S_w is badly scaled, singular or nearly singular.
- Step 3: Compute the separation point for decision making by $\frac{1}{2}w^T(\mu_a + \mu_i)$. Then output the decision for input_ sample.

Written section

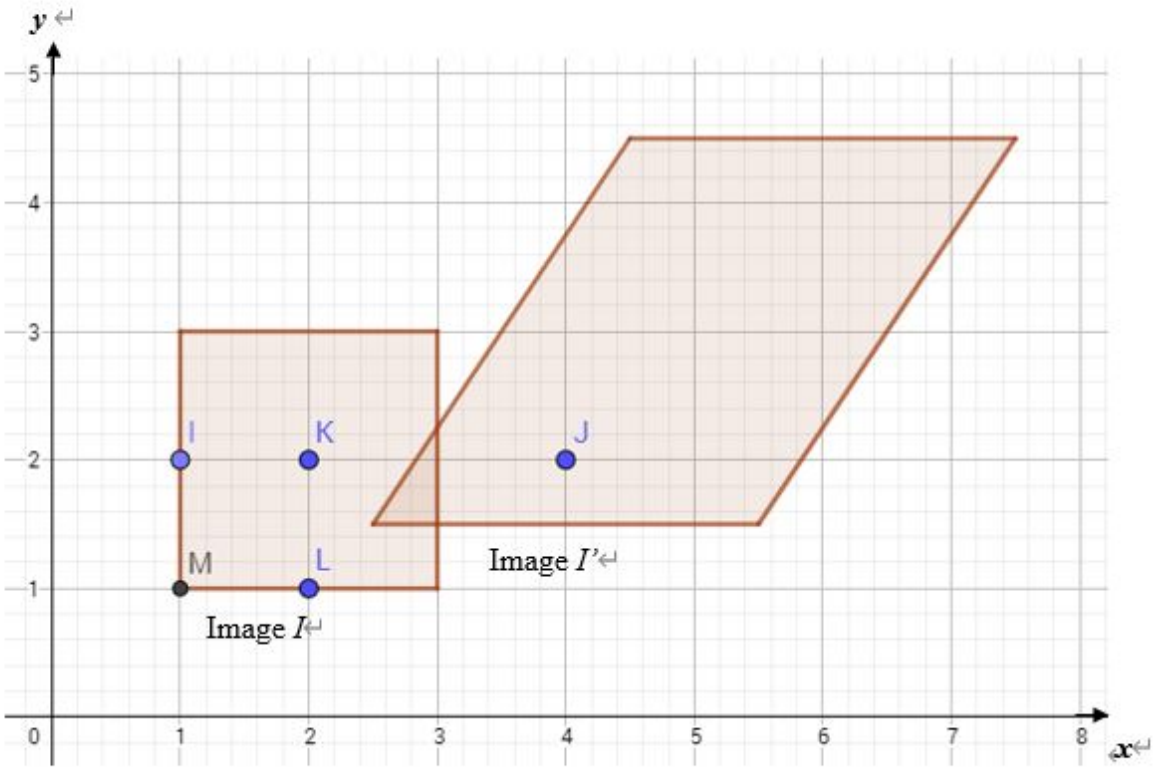
There is an image I shown as follows. The transformation is defined as $T(\vec{x}) \equiv \overleftrightarrow{S}\vec{x}$, where $\overleftrightarrow{S} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and $\vec{x} = \begin{pmatrix} x \\ y \end{pmatrix}$. After the transformation using T, point A, B, C and D are transformed to point E, F, G and H respectively. Find the transformation matrix $\overleftrightarrow{S}$.



Written section

Suppose the intensity values of point I, K, L and M are 4, 10, 18 and 30 respectively.

Find the intensity value of point J using Bilinear Interpolation.



Hint: Bilinear Interpolation: $g(x, y) = ax + by + cxy + d$, where a, b, c and d are coefficients.

Thank you!