

Assignment 4

* A letter in the alphabet consists of a pattern of points

* The pattern of the letter A, for example, is $P_A = \{P_1^A, P_2^A, \dots, P_n^A\}$ where P_i^A is coordinates of the i th point in this pattern and n is a sufficiently large number.

Deformed Patterns

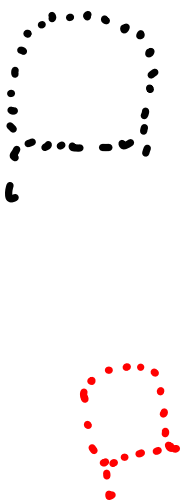
* A pattern of a letter can be deformed in many ways. A possible rotation, scaling, and translated pattern is given by

$$P = \{P_1, P_2, \dots, P_n\}$$

$$\text{where } P_i = r \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix} P_i + \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

\Rightarrow 4 unknowns in the translation.

Pattern Deformation



Our brains can determine the original letter by instantly solving the sequence of least squares problems

$$\min_x \sum_{i=1}^n \|p_i - \hat{p}_i\|^2$$

$$j = a, b, c, \dots, \quad x_j = [x \quad \theta \quad y_1 \quad y_2]^T$$

Required

* Write a matlab program that is given the patterns of 5 letters a, b, c, d, e.

* Through least square optimization, the program should identify the letter of a given deformed pattern by solving 5 least squares problem and selecting the letter with the minimum error at the solution.