Assignment 1

Instructions

1.Part A has to be written stating the justifications, claims and steps clearly.
2.Part B has to be implemented in any programming/simulation software.
3.The due dates are clearly mentioned for each part separately.

PART A

1.Prove that Hellinger distance is a metric.

Hint: $D(X,Y) = \sqrt{1 - B(X,Y)}$

$B(X,Y)$: $Bhattacharya\ Coefficient$

2.Prove that edit distance is a metric.
3.How do you convert the cosine distance to a metric?
4.Calculate the distance between the two histograms, H_1 and H_2 using each of the following methods:
i) KL Distance
ii) Bhattacharya Distance

H1 = [0.24, 0.2, 0.16, 0.12, 0.08, 0.04, 0.12, 0.04]
H2 = [0.22, 0.19, 0.16, 0.13, 0.11, 0.08, 0.05, 0.02]

5. Given $(h_q - h_t)^T$ = (0.5 0.5 -0.5 -0.25 -0.25) and

$$A = \begin{pmatrix} 1 & 0.135 & 0.195 & 0.137 & 0.157 \\ 0.135 & 1 & 0.2 & 0.309 & 0.143 \\ 0.195 & 0.2 & 1 & 0.157 & 0.122 \\ 0.137 & 0.309 & 0.157 & 1 & 0.195 \\ 0.157 & 0.143 & 0.122 & 0.195 & 1 \end{pmatrix}$$

Find the quadratic form distance.

Due Date: 31/01/2019

PART B

1. Load grayscale lena image, plot its histogram.

2.Write a program to compute Mahalanobis distance for the following 14 observations (It can be verified with the example solved in class) each of which is a 4-d vector.

V_1 = 28 31 130.0 68.12

V_2 = 24 28 143.0 127.89

V_3 = 28 20 136.0 89.03

V_4 = 32 34 130.5 78.28

V_5 = 22 15 125.0 134.08

V_6 = 26 37 147.5 135.31

V_7 = 24 19 135.0 130.48

V_8 = 28 22 125.0 86.48

V_9 = 24 26 127.0 129.47

V_{10} = 30 21 139.0 82.43

V_{11} = 22 20 121.5 127.41

V_{12} = 30 38 150.5 71.21

V_{13} = 24 17 120.0 132.06

V_{14} = 26 20 125.0 90.85

Given three points, determine the one which is closest to the given observations:
X_1=30 20 133 189.6
X_2=22 30 100.06 126.0075
X_3=28.47 20.11 133.06 188.90

Display the intermediate results (mean and covariance matrix).

3.Given the following 3-d vectors:

P= [70,90,80]
Q= [40,6,6]
R= [10,20,30]
S= [32,43,55]
T= [70,60,40]

Compute the Euclidean distance and highlight the point which is closer to the vector X= [25,20,40] and obtain the 3-d plot for the same.

4.Compare two text files doc1.txt and doc2.txt using cosine distance.

doc1.txt

MATLAB is a program for solving engineering and mathematical problems. The basic MATLAB objects are vectors and matrices, so you must be familiar with these before making extensive use of this program.

doc2.txt

MATLAB works with essentially one kind of object, a rectangular numerical matrix. Here is some basic information on using MATLAB matrix commands.

Due Date: 04/02/2019