Istanbul Technical University- Fall 2018
BLG527E Machine Learning
Homework 3

Purpose: Bayes Decision Theory.
Total worth: 5% of your grade.
Handed out: Thursday, Dec 6, 2018.
Due: Wednesday, December 19, 2018 23:00. (through ninova!)
Instructor: Zehra Cataltepe (cataltepe@itu.edu.tr),
Course Assistant: Fulya Celebi Sarioglu (sarioglu16@itu.edu.tr),
Policy: Collaboration in the form of discussions is acceptable, but you should write your own answer/code by yourself. Cheating is highly discouraged for it could mean a zero or negative grade from the homework.
If a question is not clear, please let us know (via email, during office hour or in class).
Submission Instructions: Please submit through the class ninova site.
Please zip and upload all your files using filename studentID_HW3.zip. You must provide all functions you wrote with your zipped file. Functions you do not submit may cause you lose a portion of your grade. You must also include a .docx or pdf file with answers to the questions and how to call your python or matlab functions for each question so that we can run and check the results.

In order to be able to take the **final exam** for BLG527E you have to have a weighted average score of 30 (over 100) for midterm and the first 3 homeworks. Otherwise you will get a VF from the course.

PLEASE FILL, COPY AND PASTE THIS TABLE ON THE FIRST PAGE OF ANSWERS FOR YOUR HOMEWORK.

Question	Q1	Q2	Q3	Q4	Q5	TOTAL
MaxGrade	0.5	0.5	1	2	1	**5**
ExpectedGrade						

Optdigits data by Alpaydin and Kaynak, from UCI Machine Learning Repository:
ftp://ftp.ics.uci.edu/pub/ml-repos/machine-learning-databases/optdigits/
You need the files:

optdigits.names	explanation of data
optdigits.tra	training data
optdigits.tes	test data

Using your favorite machine learning library, classify train a classifier on the optdigits.tra train dataset using the following algorithms:
Q1) KNN
Q2) Parzen Windows
Q3) Decision Tree
Q4) Multilayer Perceptron
Q5) Support Vector Machine

For each question report:
a) the best test equal weighted accuracy for the test set and the corresponding training set equal weighted accuracy.
b) the train and test confusion matrices for the case in a)
c) precision for train and set sets for the case in a)
d) the name of the library, tool and the how to call your solution.

Hint: A sample confusion matrix for K=3 classes and the measures above are given as:

Actual	Predicted C1	Predicted C2	Predicted C3	Number of Instances in Each Class	Accuracy for Each Class
C1	N11	N12	N13	N1=N11+N12+N13	Acc(1)=N11/N1
C2	N21	N22	N23	N2=N21+N22+N23	Acc(2)=N22/N2
C3	N31	N32	N33	N3=N31+N32+N33	Acc(3)=N33/N3
#Instances Predicted	M1= N11+N21+N31	M2= N12+N22+N32	M3= N13+N23+N33		

Equal weighted accuracy : 1/K sum_{i=1..K} Acc(i)
Precision : Prec(i) = Nii/Mi :