Middle East Technical University
Electrical-Electronics Engineering Department

EE 583 Pattern Recognition

Homework 1

Due Date: 22.10.2020, 23:55 via odtuclass.metu.edu.tr

Using MATLAB, attempt the questions below:

1) Execute the **Decision Boundaries** example at https://www.mathworks.com/help/stats/visualize-decision-surfaces-for-different-classifiers.html *step-by-step* via "Try This Example" option in your internet browser (or you may execute it in your local MATLAB software by using "View MATLAB Command"). Observe the resulting decision boundaries for 4 different classifiers (at this point, the algorithmic details of the classifiers are not of our interest). Comment on the boundaries of these 4 classifiers in terms of "Generalization-Memorization" criteria. State and clearly explain your preferred classifier.

2) Execute the **Bayesian Classifier** example at https://www.mathworks.com/help/stats/classification-probability-example-naive-bayes.html *step-by-step* via "Try This Example" option in your internet browser (or you may execute it in your local MATLAB software by using "View MATLAB Command"). Examine *Naïve Bayes* classifier function (i.e. class conditional feature covariance matrices are diagonal) at https://www.mathworks.com/help/stats/classificationnaivebayes.html. By modifying a priori probabilities to an arbitrary (but not equal to each other), plot and compare the posterior probability distributions using 3D surfaces for at least 3 different (arbitrary) a priori probabilities.

3) Execute the **Mahalanobis** example at https://www.mathworks.com/help/stats/mahal.html *step-by-step* via "Try This Example" option in your internet browser (or you may execute it in your local MATLAB software by using "View MATLAB Command"). Plot constant distance contours by using `fcontour` function (https://www.mathworks.com/help/matlab/ref/fcontour.html). Generate and plot with contours two Gaussian pdfs with arbitrary mean values and covariance matrices, consisting only 100 samples each. Determine and plot for every point on a grid the absolute Mahalanobis difference between two distances to these two Gaussian pdfs.

4) Execute **Plot ROC Curve for Classification Tree** example at https://www.mathworks.com/help/stats/perfcurve.html, *step-by-step* via "Try This Example" option in your internet browser (or you may execute it in your local MATLAB software by using "View MATLAB Command"). Plot 3 ROC curves for this 3-class problem for all 3 classes individually. (at this point, algorithmic details of `fitctree` classifier is not of our interest). Note that a posterior probability values that an observation belongs to a particular class is being compared to threshold values while obtaining ROC.

MATLAB Installation: Download METU-licensed MATLAB software with relevant toolboxes (Statistics and Machine Learning and Deep Learning Toolboxes) from https://yazilim.cc.metu.edu.tr/ .