Istanbul Technical University- Spring 2018
BLG527E Machine Learning Homework 3
Purpose: Decision tree, MLP, HMM.
Total worth: 6% of your grade.
Handed out: Saturday, May 5, 2018. **Due:** Wednesday, May 23, 2018 22:00. (through ninova!)
Instructor: Zehra Cataltepe (cataltepe@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 .doc 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.
QUESTIONS:
Dataset:
Optdigits data by Alpaydin and Kaynak, from UCI Machine Learning Repository:
https://archive.ics.uci.edu/ml/datasets/optical+recognition+of+handwritten+digits
You need the files:
optdigits.names explanation of data
optdigits.tra,optdigits.tes training data, test data

Q1) [2 points] [Decision Tree, MLP]
Use built-in sci-kit functions to train a decision tree and a multilayer perceptron on the training set. Experiment with hyperparameters of the models to achieve models with different complexity. Report the training and validation accuracies for each class for different hyperparameters.
Indicate which decision tree and MLP models you would choose and why.
Do you see performance differences between classes?
How could you increase performance?

Q2) [2 points]
Use tensorflow to train a classifier on training data. Tutorial: https://www.tensorflow.org/tutorials/
Compute the training and validation confusion matrices for different hyperparameters and optimisation functions.
Show the visualization of the deep neural network that you have chosen.
Make sure that you plot the x=epochs, y=training/validation error graph for the best hyperparameter that you have selected.
Compare the performance of deep learning, decision tree and MLP both in terms of class accuracies and also training and prediction times required.

Q3) [2 points] [HMM]
Update the training and validation sets by taking the feature to be 0 if its value is less than 6 and 1 otherwise. Train an HMM for each class and classify the training and validation datasets. Compare the performance of HMM to the other methods you used.
You can use an implementation of the Baum-Welch algorithm, for example as in
https://www.math.univ-toulouse.fr/~agarivie/Telecom/code/index.php