

## 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>