

ASSIGNMENT #3

1. Implement Hidden Markov Model (HMM) for classification using Python for the following UCI datasets:
 - a. UCI datasets (can be loaded from the package itself):
 - i. Wine Dataset: <https://archive.ics.uci.edu/ml/datasets/wine>
 - ii. Ionosphere Dataset: <https://archive.ics.uci.edu/ml/datasets/Ionosphere>
 - iii. Wisconsin Breast Cancer Dataset: [https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+\(Diagnostic\)](https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+(Diagnostic))
 - b. Compare the performance the following HMM classifiers for all the three datasets and show the classification results (Accuracy, Precision, Recall, F-score, confusion matrix) with and without parameter tuning:
 - i. _BaseHMM
 - ii. GaussianHMM
 - iii. GMMHMM
 - iv. MultinomialHMM
 - c. Also, compare the performance results with that of a trained ANN.

Apply different values of train-test set splits and report the corresponding results for all the classifiers.

Generate the image (heat map) of the confusion matrix for the best case of every classifier. Also, generate the images of training & loss generation curves. For each dataset, generate an image illustrating Receiver Operating Characteristic (ROC) curve and Area Under Curve (AUC) for the best case of every classifier only.

Try to achieve accuracy $\geq 90\%$.

Show the performance comparison among classifiers in a table.

2. Construct a Deep Learning model using Convolutional Neural Network (CNN) for classification on the following four standard datasets:
 - a. CIFAR-10: <https://www.cs.toronto.edu/~kriz/cifar.html>
 - b. MNIST: <http://yann.lecun.com/exdb/mnist/>
 - c. SAVEE: <http://kahlan.eps.surrey.ac.uk/savee/Download.html>
 - d. EmoDB: <http://www.emodb.bilderbar.info/navi.html>
3. Experiment with the following Deep Learning models on the above the four datasets and show the performance comparison among the models along with that of CNN:
 - a. VGG-16: <https://github.com/fchollet/deep-learning-models/blob/master/vgg16.py>
 - b. ResNet-50: <https://github.com/fchollet/deep-learning-models/blob/master/resnet50.py>
 - c. Recurrent Neural Networks (RNN): <https://github.com/WillKoehrsen/recurrent-neural-networks/tree/master/models>
 - d. AlexNet: <https://github.com/eweill/keras-deepcv/blob/master/models/classification/alexnet.py>
 - e. GoogLeNet: <https://gist.github.com/joelouismarino/a2ede9ab3928f999575423b9887abd14>

Apply different values of train-test set splits and report the corresponding results for the Deep Learning models.

Generate the image (heat map) of the confusion matrix for the best case of every Deep Learning model. Also, generate the images of training & loss generation curves. For each dataset, generate an image illustrating Receiver Operating Characteristic (ROC) curve and Area Under Curve (AUC) for the best case of every Deep Learning model only.

Try to achieve accuracy $\geq 90\%$.

Show the performance comparison among Deep Learning models in a table along with a detailed discussion.

Save the assignment in a single pdf file with the naming convention “Full Class Roll No_Full Name.pdf” and upload the report by using the Google form link:

<https://forms.gle/8cZ3JayhsGHkB7cx6>

Submission Deadline: 13th September 2022 Tuesday (11:59 pm) EOD