Assignment-4

Image Classification

1st Question Carries 80 Marks & 2nd Question Carries 20 Marks

1. Implement deep multilayer perceptron (MLP) models with following specifications using TensorFlow for classifying the MNIST dataset. Train the model on the MNIST training set and evaluate its performance on the test set. Write modularized code and call it 10 times and compute the mean of test accuracy for each of the following 4 Sequential models.
    a. Model-1: 4 hidden layers having 128, 64, 32, 16 number of neurons respectively with activation function sigmoid, tanh, relu and selu respectively and dropout rate set to 0.5, 0.4, 0.3, 0.1 respectively. Use optimizer as SGD with batch size set to 32.
    b. Model-2: 4 hidden layers having 128, 64, 32, 16 number of neurons respectively with activation function sigmoid, tanh, relu and selu respectively and dropout rate set to 0.5, 0.4, 0.3, 0.1 respectively. Use optimizer as Adam with batch size set to 32.
    c. Model-3: 4 hidden layers having 128, 64, 32, 16 number of neurons respectively with activation function sigmoid, tanh, relu and selu respectively and dropout rate set to 0.5, 0.4, 0.3, 0.1 respectively. Use optimizer as AdamW with learning rate 0.1 with batch size set to 32.
    d. Model-4: 4 hidden layers having 128, 64, 32, 16 number of neurons respectively with activation function sigmoid, tanh, relu and selu respectively and dropout rate set to 0.5, 0.4, 0.3, 0.1 respectively. Use optimizer as Nadam with learning rate 0.1 with batch size set to 32.
2. Tune the hyperparameters using kerastuner to select the best learning rate among the set {0.1, 0.01, 0.15} with batch size varying between {4,8,16} and first hidden layer neurons varying between 250 to 260 with a step value of 2. 2nd, 3rd and 4th hidden layer contains 16, 8, 4 numbers of neurons respectively. The four layers have activation function sigmoid, tanh, relu and selu respectively. Use optimizer as SGD and find the best hyperparameters to predict the MNIST test data.