Assignment-5 (Open Book)

Delhi Air Quality Index Forecasting using Deep Learning Models with Feature Fusion

[a-d] Question Carries 22.5 Marks each & [e] Question Carries 10 Marks

1. Implement deep multilayer perceptron neural network models with following specifications using TensorFlow for predicting the Delhi Air Quality Index. Train the model on the training set (First 60% of the data), use validation set (next 20% of the data) and evaluate its performance on the test set (remaining 20% of data). Write modularized code and call it 5 times and compute the mean of test accuracy for each of the following models [Model-1, Model-2, Model-3, Model-4]. Note: Normalize the data before processing it using the Deep Learning model and de-normalize the model outputs and compute the Root Mean Square Error on Test Set.
    a. Model-1: Add a fully connected layer with 32 neurons with sigmoid activation and glorot uniform kernel initializer. Add a fully connected layer layer with 16 neurons, relu activation and he uniform as kernel initializer. Add a fully connected layer with 1 neuron, relu activation function and he uniform as kernel initializer. Use Adam optimizer with batch size 16, learning rate 0.01 and epochs set to 20.
    b. Model-2: Add a fully connected layer with 32 neurons with sigmoid activation and glorot uniform kernel initializer. Add a fully connected layer layer with 8 neurons, sigmoid activation and glorot normal as kernel initializer. Add a fully connected layer with 1 neuron, relu activation function and he uniform as kernel initializer. Use Adam optimizer with batch size 8, learning rate 0.01 and epochs set to 20. Extract the features from second last fully connected layer (having 8 neurons) and model it using a Support Vector regressor.
    c. Model-3: Extract the deep features from Model-1 (from 2^{nd} layer) and Model-2 (from 2^{nd} layer) stack the features horizontally and model it using a Support Vector Regressor.
    d. Model-4: Extract the deep features from Model-1 (from 2^{nd} layer) and Model-2 (from 2^{nd} layer) stack the features horizontally, reduce the dimension to either 8, 10 or 12 using principal component analysis (PCA) and model the reduced features using a Support Vector Regressor. Identify the best number of reduced components of PCA.
    e. Draw conclusions on the best model among the above four models for predicting the Delhi Air Quality Index.