Assignment-7

Image Classification using Deep Feature Modeling

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

1. Implement convolutional neural network (CNN) 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 5 times and compute the mean of test accuracy for each of the following models [Model-1, Model-2, Model-3, Model-4].
    a. Model-1: Add a convolution layer with 32 3×3 filters with stride 2 and relu activation. Add a maxpooling layer with kernel size 2×2 with stride 1. Add a convolution layer with 16 4×4 filters with stride 2 and relu activation. Add a maxpooling layer with kernel size 4×4 with stride 2. Flatten the output and add a fully connected layer with 8 neurons with relu activation. Add a fully connected layer with 10 neurons and softmax activation.
    Extract the features from second last fully connected layer (having 8 neurons) and model it using a Random Forest classifier. Use Adam optimizer with batch size 128, learning rate 0.01 and epochs set to 5.
    b. Model-2: Add a convolution layer with 32 3×3 filters with stride 2 and relu activation. Add an average pooling layer with kernel size 2×2 with stride 1. Add a convolution layer with 16 4×4 filters with stride 2 and relu activation. Add an average pooling layer with kernel size 4×4 with stride 2. Flatten the output and add a fully connected layer with 8 neurons with relu activation. Add a fully connected layer with 10 neurons and softmax activation.
    Extract the features from second last fully connected layer (having 8 neurons) and model it using a Random Forest classifier. Use Adam optimizer with batch size 128, learning rate 0.01 and epochs set to 5.
    c. Model-3: Extract the deep features from Model-1 and Model-2 stack the features horizontally and model it using a Random Forest classifier.
    d. Model-4: Extract the deep features from Model-1 and Model-2 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 Random Forest classifier. Identify the best number of reduced components of PCA.
    e. Draw conclusions on the best model among the above four models for classifying MNIST dataset.