

MANE 4962: Machine Learning for Engineering

Homework 5

Points:100

This homework is designed to test your understanding of convolutional neural networks and support vector machines. Use a Jupyter notebook to solve individual problems. You can submit a pdf printouts of the notebooks. Please include your name and RIN in the PDF. Please keep your notebooks and Python codes organized in your Github repository.

1. Construct a **convolutional neural network model** for classifying the CIFAR-10 dataset. Use the test set of the CIFAR-10 dataset as validation data for the model
 - (a) **(64 pts.)** Implement the convolutional neural network architecture given below.
 - i. The first layer is a 2D convolutional layer with 64 filters, each of size (5, 5), and uses the ReLU activation function. The input shape of the layer should correspond to the dimensions of the input image.
 - ii. The second layer is a max pooling layer of size (2, 2).
 - iii. The third layer is another 2D convolutional layer with 32 filters, each of size (3, 3), and uses the ReLU activation function.
 - iv. The fourth layer is another max pooling layer of size (2, 2).
 - v. The fifth layer is another 2D convolutional layer with 32 filters, each of size (3, 3), and uses the ReLU activation function.
 - vi. The sixth layer is a flattened layer which converts the output of the previous layer into a one-dimensional vector.
 - vii. The seventh layer is a dense layer with 64 neurons and uses the ReLU activation function.
 - viii. The eighth and final layer produces estimated probabilities to classify the CIFAR-10 classes.
 - (b) **(6 pts.)** Calculate and plot the training and validation accuracies of the network after 10 epochs with a batch size of 64.
2. Use the Scikit-learn breast cancer Wisconsin dataset and support vector machine classifiers to classify breast cancers. You must use worst compactness, worst concavity, and worst area features only to perform the classification.
 - (a) **(15 pts.)** What is the accuracy of the classification model with a linear kernel?
 - (b) **(15 pts.)** What is the accuracy of the classification model with a radial basis function kernel with regularization strength parameter, $C=2$?