Experiment No 4

Identifying effect of different hyperparameters and parameters on neural network in optimization task.

Objective:

At the end of this practical session, student will be able to optimize a deep neural network by tuning different hyperparameter after building a deep learning model.

Theory:

In deep neural network, weights and bias are searched with the help of loss function and optimization algorithm during training phase. These weights and bias are called parameters. While, a hyperparameter is a parameter whose value is set before the learning process begins. Some of the hyperparameters are learning rate, hidden units, mini batch size, beta, number of layers, learning decay rate, number of units in each layers. These hyperparameter need to set with correct values to avoid overfitting and underfitting.

For tuning deep neural network with different hyperparameters, following methods can be used:

1. Manually setting values

In this method, we have to set hyperparameter values manually. Based on output we have to update the hypeparameter values for next run. In keras, epochs and batch sizes are set as an argument to model.fit(). While other hyperparameters are set with optimizers module. For example, setting hyperparameter for SGD optimizer can be done as follows:

sgd = optimizers.SGD(lr=0.01, decay=1e-6, momentum=0.9, nesterov=True)

2. Grid Search method

Grid search is a traditional way to perform hyperparameter optimization. It works by searching exhaustively through a specified subset of hyperparameters. Using sklearn's GridSearchCV, we first define our grid of parameters to search over and then run the grid search.

3. Random Search method

Random search searches the specified subset of hyperparameters randomly instead of exhaustively. The major benefit being decreased processing time. There is a tradeoff to decreased processing time, however. It did not guarantee to find the optimal combination of hyperparameters. Sklearn's RandomizedSearchCV provides searching space in random search.

Keyword:

Deep Learning Model, Neural Network, Keras

Procedure:

1. Develop a deep learning model using Keras library.
2. Manually setting values:
    a. Set different hyperparameter with some values.
    b. Identify effect of different hyperparameter values on neural network.
    c. Display hyperparameters that provides accurate result.

3. Using grid search method
    a. Define a grid to specify search space for different hyperparameter.
    b. Display the best set of hyperparameter to get accurate result.