

Experiment No 2

Design and develop a shallow neural network to classify fashion products from Fashion MNIST Dataset.

Objective:

At the end of this practical session, student will be able to develop a shallow neural network using Keras after designing a neural network for digit classification.

Theory:

Machine Learning (ML) works on the principle: “searching for useful representations of some input data, within a predefined space of possibilities, using guidance from a feedback signal”. These algorithms transfer the input data into some meaningful data to learn useful representations that gets output closer to the expected output. In neural network, this representation is learned through layers. A neural network consisting of input with one hidden layer and one output layer is called as shallow neural network. Hidden layer learns the representation from input and forward to output layer. Output layer provides predicted output from the learned representation.

Keras is a deep-learning framework for Python that provides a convenient way to define and train almost any kind of shallow neural network and deep-learning model. Keras workflow for building model is as follow:

1. Define your training data: input and actual output.

Keras comes with many preloaded dataset like CIFAR10, CIFAR100, IMDB Movie reviews, and MNIST database of handwritten digits. These datasets provide training and testing set for classification task. We can load these dataset using `load_data()` for training and testing purpose. If we have our own dataset then it can also be given to a neural network after preprocessing.

2. Define a network of layers (or *model*) that maps your inputs to your targets.

A model is the core data structure of Keras. It represents a way to organize layers. The simplest type of model is the Sequential model. It is a linear stack of layers. Sequential model can be defined as: `model=Sequential()`. Layers in model can be added in stack using `model.add()`. In layers some data goes in, and it comes out in a more useful form. These layers extract representations out of the data fed into them. There are different types of layers in Keras like Dense, Dropout, Flatten, Conv1D, Conv2D, MaxPooling1D, MaxPooling2D, RNN, SimpleRNN, GRU, and Embedding.

3. Configure the learning process by choosing a loss function, an optimizer, and some metrics to monitor.

Once model definition looks good, it's learning process need to be configured for training. Configuration generally includes three components: loss function, Optimizer function and metrics. Loss function measures the performance of training data. It guides model to right direction. Optimizer function provides a mechanism through which the network will update itself based on the data it sees and its loss function. Metrics generally concentrates on accuracy. It measures fraction of correctly classified things.

4. Iterate on your training data by calling the fit() method of your model.

During training following things happen

1. Draw a batch of training samples x and corresponding targets y .
2. Run the network on x (a step called the forward pass) to obtain predictions y_{pred} .
3. Compute the loss of the network on the batch that is measure of the mismatch between y_{pred} and y .
4. Update all weights of the network in a way that slightly reduces the loss on this batch.

Evaluation of model is done on testing data with `evaluate()`. It returns loss and accuracy over testing set.

Keyword:

Shallow Neural Network, ML, Keras

Procedure:

1. Design a shallow neural network for classifying fashion product available in fashion MNIST dataset.
2. Load MNIST dataset and get training and testing images.
3. Create a model that maps your inputs to your targets.
4. Configure the learning process by choosing a loss function, an optimizer, and some metrics to monitor.
5. Iterate on your training data by calling the `fit()` method of your model.
6. Evaluate model on testing data to check model's accuracy.