Experiment No 6

Design and develop a convolutional neural network for image classification

Objective:

At the end of this practical session, student will be able to classify objects in different classes using convolutional neural network (CNN/ConNet).

Theory:

Convolutional neural network are a specialized kind of neural network for processing data that has a known, grid-like topology. Examples include time-series data, which can be thought of as a 1D grid taking samples at regular time intervals, and image data, which can be thought of as a 2D grid of pixels.

It includes two types of layers namely convolutional layer and pooling layer. Primary purpose of convolution layer in CNN is to extract features from the input image by applying convolution operation. It is a point wise multiplication of image part and sliding window (convolute/kernal) over an image. The response is called as feature map or activation map or convolved features. It learns spatial hierarchies of patterns and these patterns are invariant. The pooling layer progressively reduces the size of the representation to reduce the amount of parameters and computation in the network. It also helps to consider the important features for object classification and discard the remaining.

Stride is another important property with convolution operation. It represents distance between two successive sliding windows over the image. Default it is set to one. But, it is also possible to have stried convolutions where kernel convolutes with a stride higher than 1. Convolutions operate over 3D tensors. Two spatial (Height and Width) and one depth axis (also called as channels). In case of RGB image of size 1200 x 870, input size will be either (1200,870,3) or (3,1200,870).

Keyword:

Convolutional Neural Network, Object Classification

Procedure:

1. Load CIFAR-10 dataset
2. Preprocess the image
   2.2. Normalize the input image
   2.3. Convert actual output to one hot encoding
3. Design your CNN model
4. Build model and optimize during different hyperparamter
5. Track history of training and validation
6. Plot graph