Modern Education Society's Wadia College of Engineering, Pune-01

Department of Computer Engineering

Name of Student:	**Class:**
Semester/Year:	**Roll No:**
Date of Performance:	**Date of Submission:**
Examined By:	**Assignment No: 3**

Laboratory Practice – V (Deep Learning)

ASSIGNMENT NO: 03

AIM: **Convolutional neural network (CNN)**

- Use any dataset of plant disease and design a plant disease detection system using CNN.
- Use MNIST Fashion Dataset and create a classifier to classify fashion clothing into categories.

OBJECTIVES: Students should be able to design and develop a plant disease detection system and fashion clothing classification system by using Convolutional neural network (CNN).

PREREQUISITE:

1. Basic of programming language
2. Concept of Machine Learning
3. Concept of Convolutional neural network (CNN)

THEORY:

Convolutional Neural Networks:

The goal of a CNN is to learn higher-order features in the data via convolutions. CNNs transform the input data from the input layer through all connected layers into a set of class scores given by the output layer. There are many variations of the CNN architecture, but they are based on the pattern of layers, as demonstrated in Figure A.

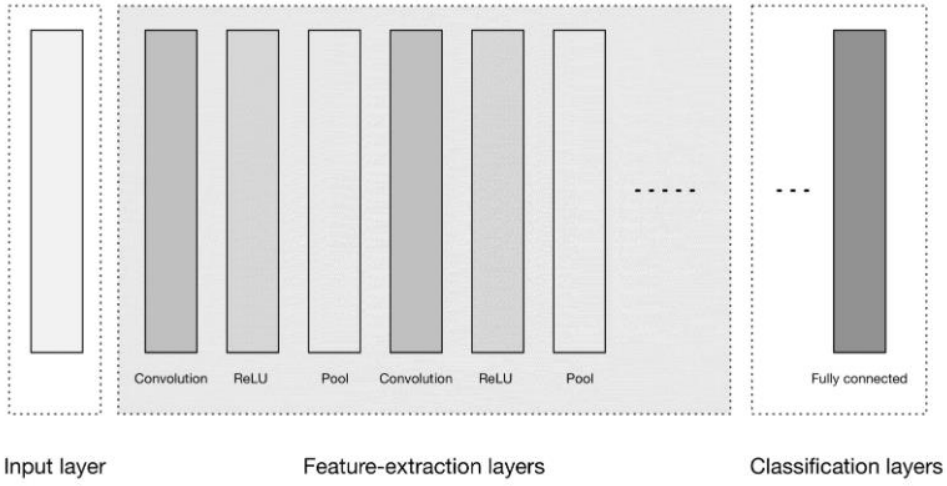

Figure A : High Level CNN Architecture

CNN depicts three major groups:

1. Input layer
2. Feature-extraction (learning) layers
3. Classification layers

The input layer accepts three-dimensional input generally in the form spatially of the size (width × height) of the image and has a depth representing the color channels (generally three for RGB color channels).

The feature-extraction layers have a general repeating pattern of the sequence:

1.Convolution layer

2. Pooling layer

Convolutional layers are considered the core building blocks of CNN architectures. As Figure B illustrates, convolutional layers transform the input data by using a patch of locally connecting neurons from the previous layer. The layer will compute a dot product between the region of the neurons in the input layer and the weights to which they are locally connected in the output layer. Figure B Convolution layer with input and output volumes The resulting output generally has the same spatial dimensions (or smaller spatial dimensions) but sometimes increases the number of elements in the third dimension of the output (depth dimension). Let’s take a closer look at a key concept in these layers, called a convolution.

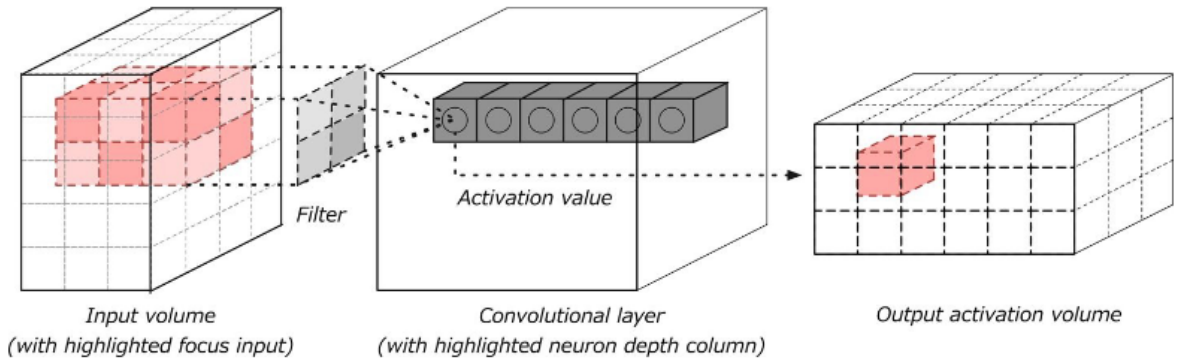

Figure B : Convolution layer with input and output volumes

A convolution is defined as a mathematical operation describing a rule for how to merge two sets of information. It is important in both physics and mathematics and defines a bridge between the space/time domain and the frequency domain through the use of Fourier transforms. It takes input, applies a convolution kernel, and gives us a feature map as output. The convolution operation, shown in Figure C, is known as the feature detector of a CNN. The input to a convolution can be raw data or a feature map output from another convolution. It is often interpreted as a filter in which the kernel filters input data for certain kinds of information; for example, an edge kernel lets pass through only information from the edge of an image.

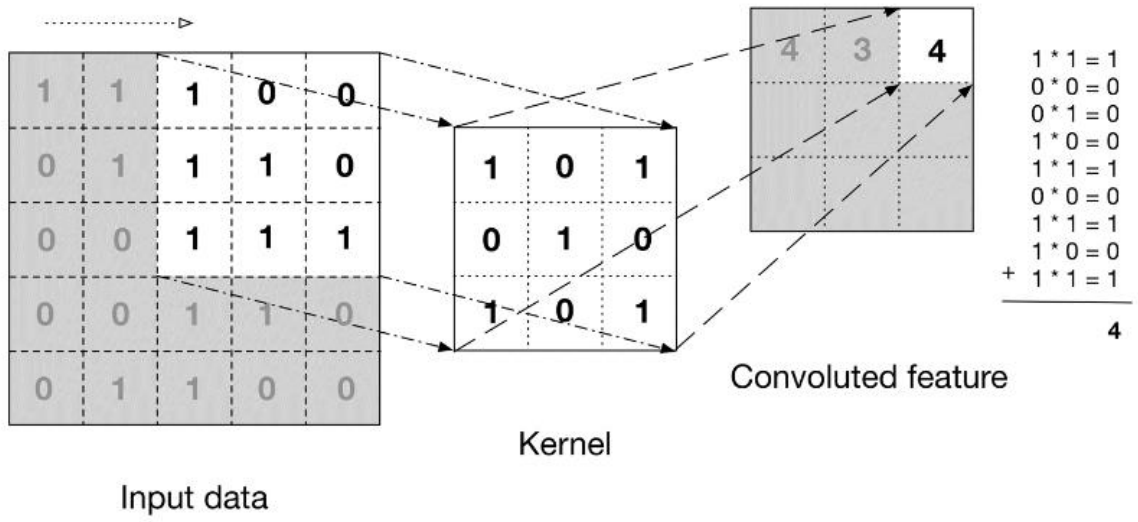

Figure C : The convolution operation

CONCLUSION:

We have successfully developed plant disease detection system and fashion clothing classification system by using Convolutional neural network (CNN).

QUESTIONS:

1. What is a Convolutional Neural Network?
2. Explain the following with diagrams (any one sub question) :
    i. LeNet5 and AlexNet
    ii. GoogLeNet and VGGNet
    iii. ResNet and MobileNet