Modern Education Society's 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.

OBJECTIVES: Students should be able to design and develop a plant disease detection 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:

Machine learning:

Machine learning is programming computers to optimize a performance criterion using example data or past experience. A model is defined up to some parameters, and learning is the execution of a computer program to optimize the parameters of the model using the training data or past experience. The model may be predictive to make predictions in the future, or descriptive to gain knowledge from data, or both.

Learning:

A computer program is said to learn from experience E with respect to some class of tasks T

and performance measure P, if its performance at tasks T, as measured by P, improves with experience E.

Classification :

Classification is a supervised machine learning method where the model tries to predict the correct label of a given input data. In classification, the model is fully trained using the training data, and then it is evaluated on test data before being used to perform prediction on new unseen data.

Binary Classification :

In a binary classification task, the goal is to classify the input data into two mutually exclusive categories. The training data in such a situation is labeled in a binary format: true and false; positive and negative; O and 1; spam and not spam, etc. depending on the problem being tackled. For instance, we might want to detect whether a given image is a truck or a boat.

Multi-Class Classification :

The multi-class classification, on the other hand, has at least two mutually exclusive class labels, where the goal is to predict to which class a given input example belongs to. In the following case, the model correctly classified the image to be a plane.

Convolutional Neural Network :

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.

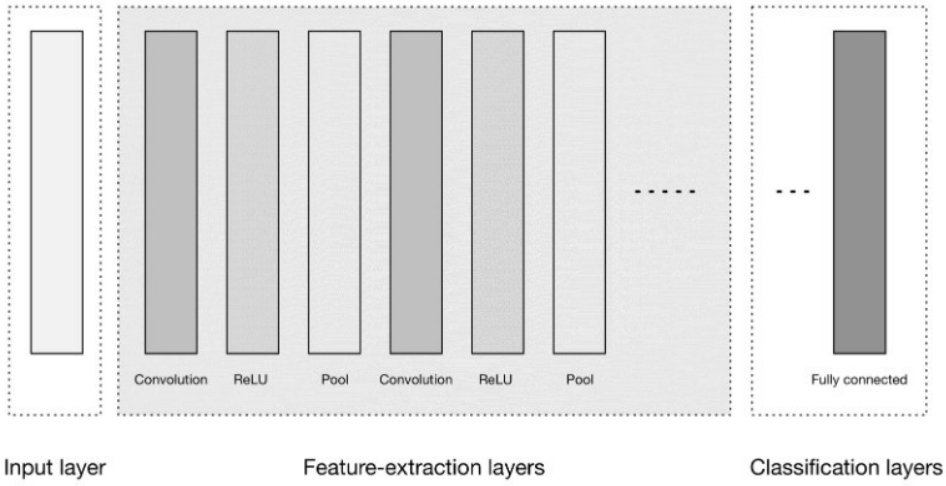

Figure A : High Level CNN Architecture

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.

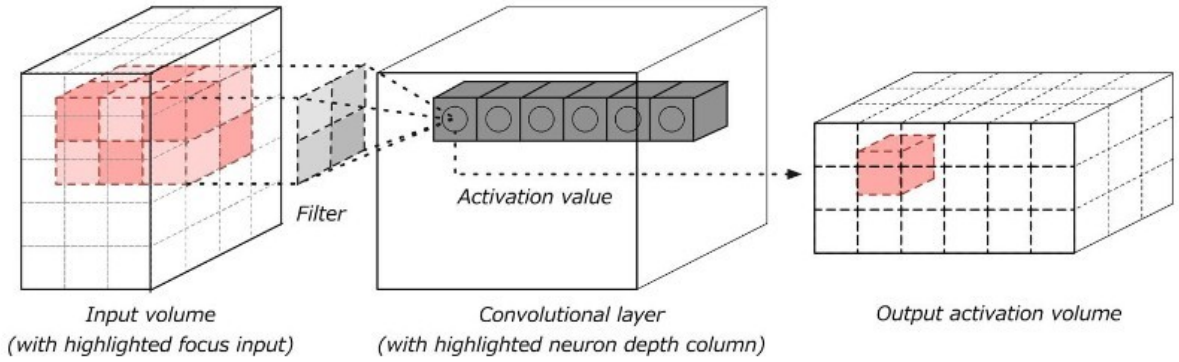

Figure B Convolution layer with input and output volumes

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.

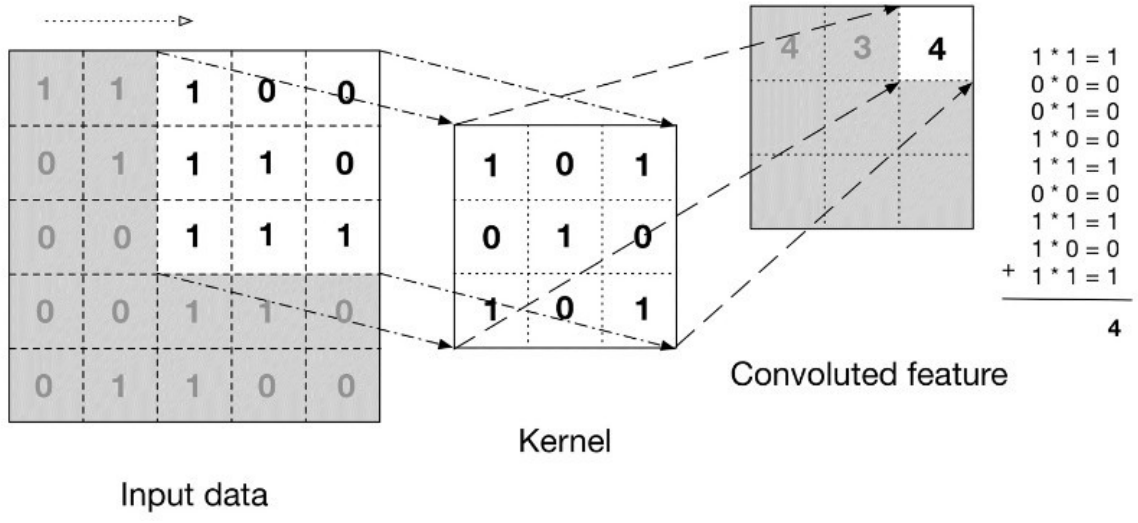

Figure C The convolution operation

CONCLUSION:

A plant disease detection system is developed successfully by using Convolutional neural network (CNN) . It will help to predict the disease using CNN.

QUESTIONS:

1. What is Binary Classification?
2. What is a Convolutional Neural Network?
3. Enlist and Explain Convolutional Neural Network Layers in detail.
4. What is the difference between Machine Learning and Deep Learning?
5. Write Short Note on Feature Extraction in CNN.