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Department of Biomedical Engineering

Course Name: 19ECT303 & Artificial Intelligence and machine learning

III Year : V Semester

Unit V–DEEP LEARNING

Topic : Convolutional Neural Networks

What is Convolutional Neural Networks?

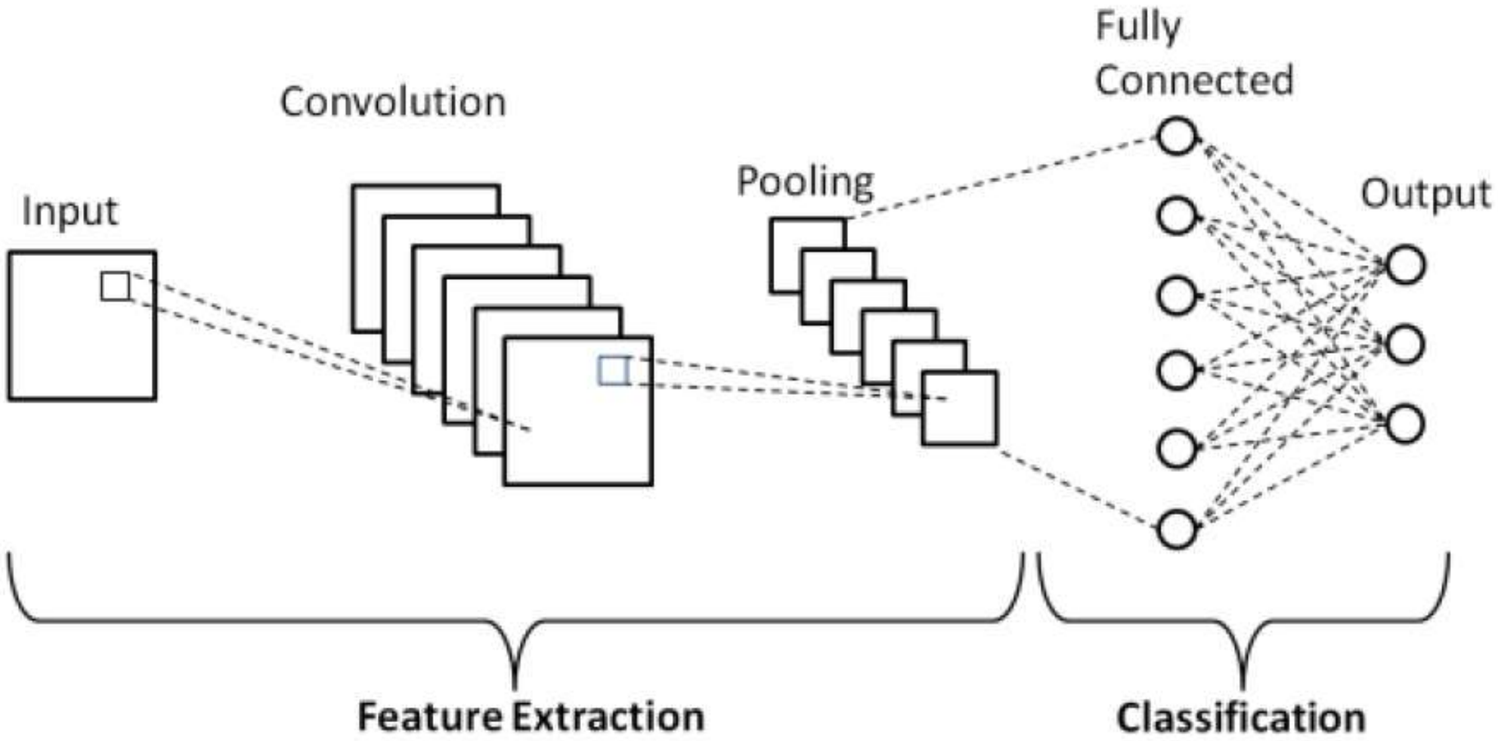
- A Convolutional Neural Network is a Deep Learning Algorithm that takes an image as an input, assigns various weights and biases to various parts of the image such that they are differentiable from each other.
- Once they become differentiable, using various activation functions the Convolutional Neural Network Model can perform several tasks in the Image Processing domain including Image Recognition, Image Classification, Object and Face Detection, etc.

• The fundamental of a Convolutional Neural Network Model is that it receives an input image. The input image can be either labelled (such as cat, dog, lion, etc.) or unlabelled. Depending upon this, the Deep Learning algorithms are classified into two types namely the Supervised Algorithms where the images are labelled and the Unsupervised Algorithms where the images are not given any particular label.

Input image as Matrix

•To the computer machine, the input image is seen as an array of pixels, more often in the form of a matrix. Images are mostly of the form h x w x d (Where h = Height, w = Width, d = Vision Title 3 Dimension). For example, an image of size 16 x 16 x 3 matrix array denotes an RGB Image (3 stands for the RGB values). On the other hand, an image of 14 x 14 x 1 matrix array represents a grayscale image.

Convolutional Neural Network Architecture



Layers of Convolutional Neural Network

• a CNN Model consists of several layers through which the input images undergo pre-processing to get the output.
• Basically, these layers are differentiated into two parts –
• The first three layers including the Input Layer, Convolution Layer and the Pooling layer which acts as the feature extraction tool to derive the base level features from the images fed into the model.

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- The final Fully Connected Layer and the Output Layer makes use of the output of the feature extraction layers and predicts a class for the image depending upon the features extracted.
- The first layer is the **Input Layer** where the image is fed into the Convolutional Neural Network Model in the form of an array of matrix i.e., 32 x 32 x 3, where 3 denotes that the image is an RGB image with an equal height and width of 32 pixels. Then, these input images pass through the Convolutional Layer where the mathematical operation of Convolution is performed.

Convolution process

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- The input image is convolved with another square matrix known as the kernel or filter.
- By sliding the kernel one by one over the pixels of the input image, we obtain the output image known as the feature map which provides information about the base level features of the image such as edges and lines.

Pooling process

Convolutional Layer is followed by the **Pooling layer** whose aim is to reduce the size of the feature map to reduce computational cost. This is done by several types of pooling such as Max Pooling, Average Pooling and Sum Pooling.

Fully connected layer

The **Fully Connected (FC) Layer** is the penultimate layer of the Convolutional Neural Network Model where the layers are flattened and fed to the FC layer. Here, by using activation functions such as the Sigmoid, ReLU and tanH functions, the label prediction takes place and is given out in the final Output Layer.

Where the CNNs Fall Short ?

- With so many useful applications of the Convolutional Neural Network in visual image data, the CNNs have a small disadvantage in that they do not work well with a sequence of images (videos) and fail in interpreting the temporal information & blocks of text.
- In order to deal with temporal or sequential data such as the sentences, we require algorithms that learn from the past data and also the future data in the sequence. Luckily, the Recurrent Neural Networks do just that.

THANK YOU !!!
HAPPINESS ISN'T OUTSIDE, ITS WITHIN