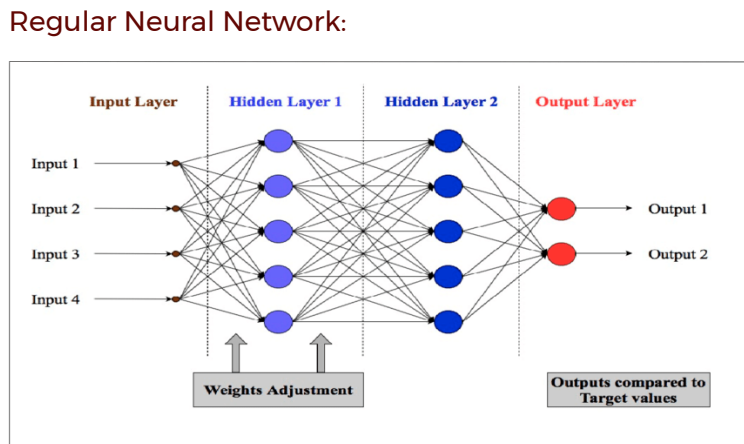


Day 7: Convolutional Neural Networks (CNNs)

Neural Networks & Types



Feedforward

Input Layers

We give input to our model

No. of Neuron = total number of features in our data

Hidden Layer

There can be many depending on our model and data size

Each hidden layer, different number of neurons (usually > input layer)

Output Layer

output from the hidden layer --> into a logistic function like sigmoid or softmax --> converts into the probability score

Back propogaiton

calculate the error using an error function eg: cross-entropy, square loss error, etc.

To measure the performance of the network

calculating the derivatives

basically is used to minimize the loss

CNNs

Speacilise in Image Classification

RNNs(LSTMs)

Specialize in predicting sequence of words

Example Types

What are CNNs?

A kind of neural networks specially designed for working with images and videos

Formal Definition CNNs: "Convolutional networks are simply neural networks that use convolution in place of general matrix multiplication in at least one of their layers"

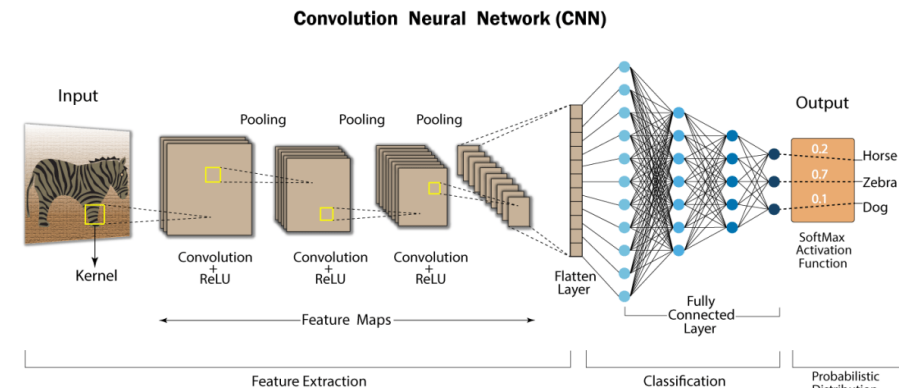
Steps involved:

1. Takes images as inputs

2. Extracts and learns features of the images

3. Classifies them based on the learned features

CNN architecture



Consists of multiple layers like:

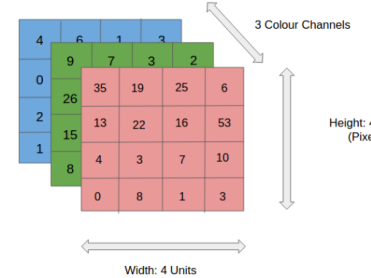
Input layer

Input image can be Grayscale or RGB

Every image is made up of pixels - range [0,255]

We need to normalize them, [0,1] - before passing them

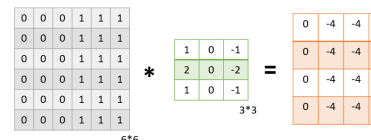
Example input image - Size 4\*4; 3 channels (RGB); pixel values



Filter is applied to the input image - extraction of its features

Filter is applied multiple time - creates feature map(helps in classifying the image)

Example!:

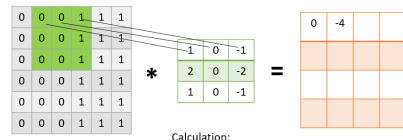
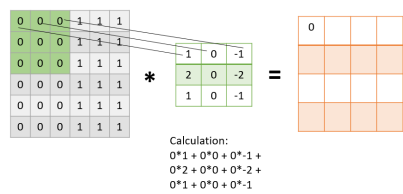


Applied 3\*3 filter on a 6\*6 input image and got a 4\*4 feature map

Like this, many filters are applied to extract all the features

Convolutional layer + Activation Function

Math:



Once we get out final feature map, we apply our activation function

Used to reduce the dimensions of the feature map

To preserve only the important features and reduce computation time

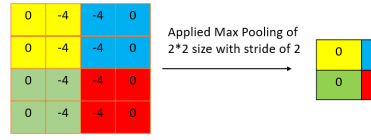
When pooling is done, lower resolution version of input is created

Still contains important elements

Pooling layer

Common types: Max Pooling and Average Pooling

Max-pooling on our feature map



The final layers in a CNN

Each neuron is connected to every neuron in the previous layer

Makes the final classification decision based on the features extracted by the convolutional and pooling layers

Project: Training a CNN on CIFAR-10