Assignment-3 report on

Convolutional neural network

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INTRODUCTION:

In this assignment, we will learn the working of CNNs and their different models. And find which model gives better results.

Convolutional neural networks(CNN) are deep feed-forward artificial neural networks. They are widely used in deep learning. Convolutional neural networks works on the basic fact that a vision system will use the similar knowledge at every position in the given image. This process is accomplished by giving the weights of feature detectors so we can use the features that are learned at one location, at different locations. Convolutional neural networks uses Gradient descent , back-propagation, max pooling etc. Convolutional neural networks consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a Convolutional neural networks typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers.

Applications of CNN are Image Classification, Speech Recognition, Robotics etc.

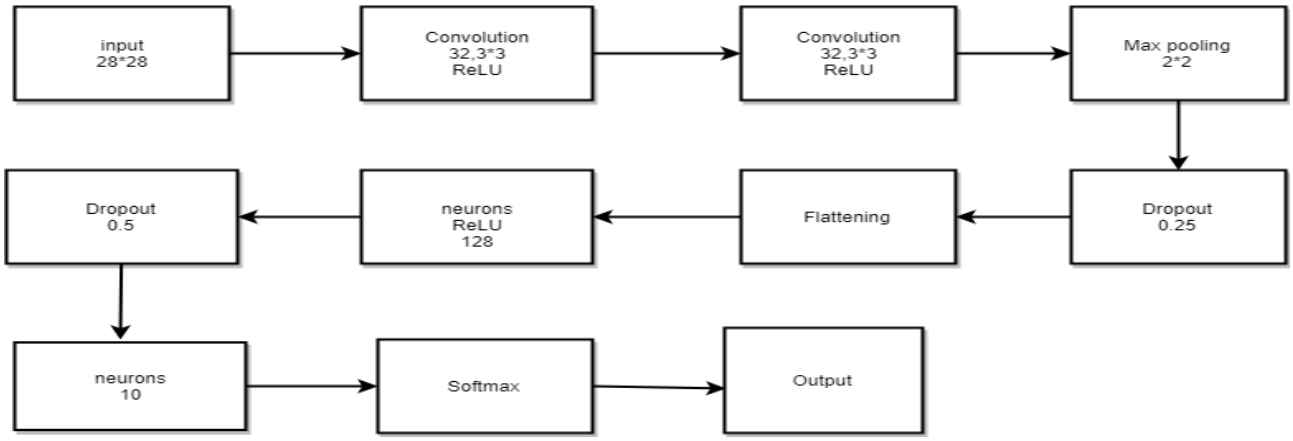
ARCHITECTURE:

We are using MNIST dataset to know the working of CNNs. MNIST dataset is of handwritten digits that is commonly used for training various systems. It consists of 60,000 training images and 10,000 testing images. There are 10 classes in MNIST.

Following is the architecture of CNN used:-

We have created a simple Convolutional Neural Network.

It takes a 28×28 dimension image as input from MNIST dataset.



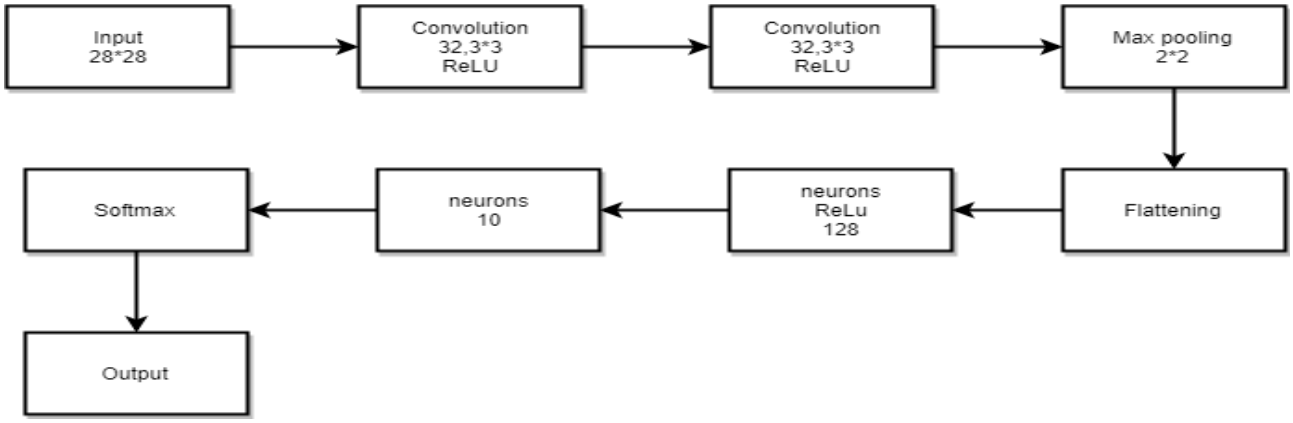
Our architecture consists of two convolutional layers with 32 filters and each filter of size 3×3. And then we apply ReLU activation function to the convoluted image in both the convolutional layers, which eliminates the negative values and non-linearity. Then, we applied max pooling with filter size of 2×2 and with stride of 2.

Then we will take dropout layer with probability of 0.25. Then, we will flatten the output of dropout layer to convert it to vector form. Then it will be taken as input for dense layer which has 128 neurons and we apply ReLU function. And then output is sent to another dropout layer with probability of 0.50 and apply ReLU function. Again output will be sent to the dense layer which have 10 neurons and after applying the softmax activation function we get the desired output and class will be identified for the image.

EXPERIMENTS:

We have done several experiments with the architecture. We changed the number of layers.

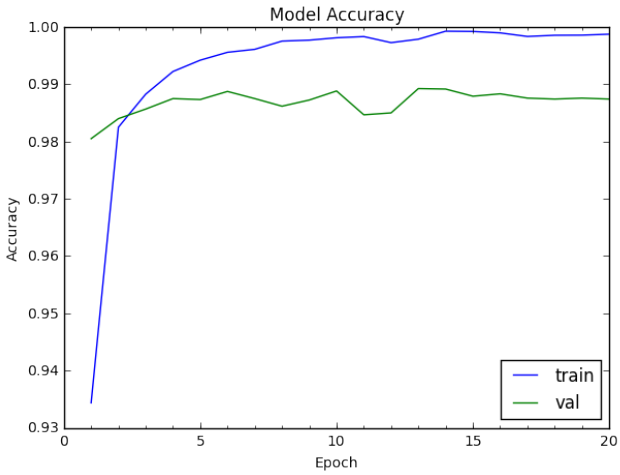
Following is the experiment with architecture:-

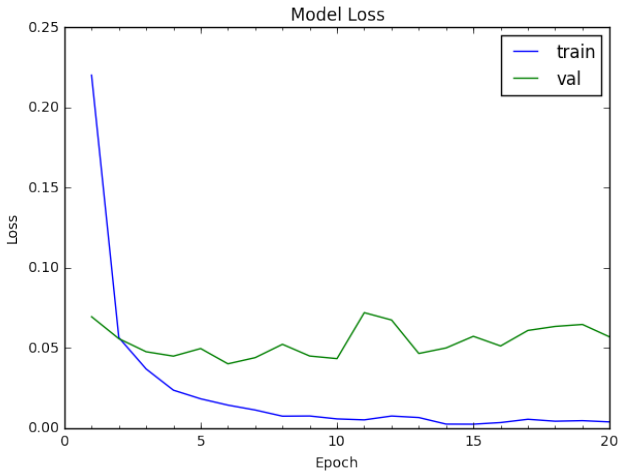


In this architecture, we removed dropout layers and we add one more convolutional layer with same filter size. We increased the network depth by adding multiple layer. So, by adding more convolutional layers we may get better results.

ANALYSIS:

1. In the architecture with multiple convolutional layers.

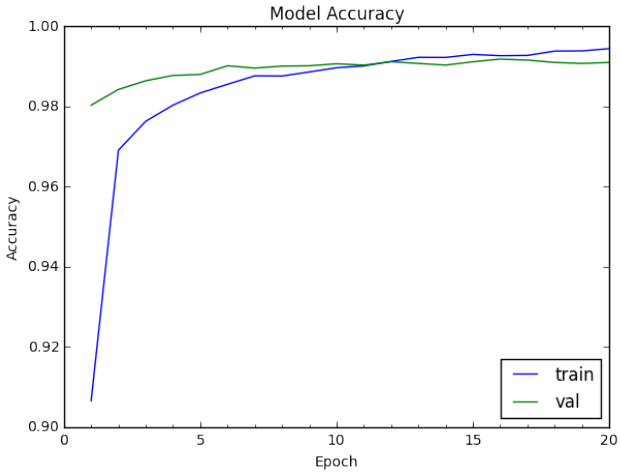


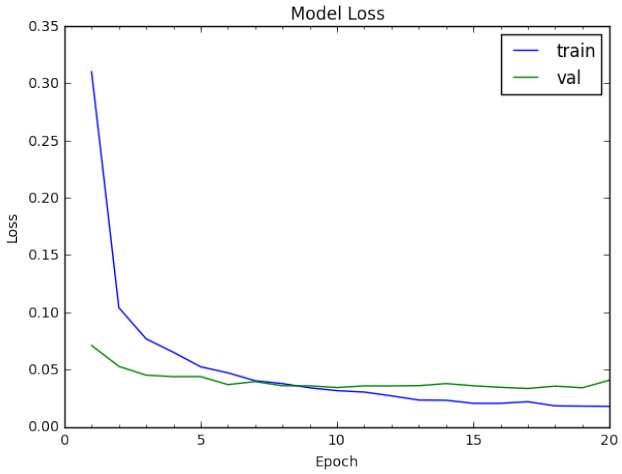


Training time: 137.12 seconds

Accuracy: 98.78

2. In the architecture with dropout layers we get more accurate results. Adding dropout layer increases the test accuracy while increasing the training time. Dropout is used to reduce overfitting.





Training time: 141.79 seconds

Accuracy: 99.21

CONCLUSION:

We concluded that by adding dropout layer gives us the best test accuracy than adding more convolutional layers. But, it also leads to more training time than other architectures.

REFERENCES:

Code is taken from the below link.

http://parneetk.github.io/blog/cnn-mnist/