Implementation of Deep Neural Networks on MNIST dataset

School Of Engineering And Applied Science, Ahmedabad University
Apexa,Parth Satodia[1401056],Pinak Divecha[1401098],Rushita Thakkar[1401004],Vatsal Patel[1401123]
Group-7 (5×5)

***Abstract*—The paper basically shows the classification problem on the hand written numbers from 0 to 9 (MNIST database)and classifying it into 10 respective classes using the concept of Deep Neural Networks.We also show the accuracy for the same for different cases.**

***Index Terms*—Deep neural network, classification, TensorFlow, MNIST.**

I. Introduction

Deep Neural Networks has more than 2 hidden layers in its network.This implies that the input passes through more number of layers and a better output is expected at the end.For MNIST data set, changing parameters like batch size, number of iterations for leanring and number of hidden layers accuracy for classification can be changed. But in some cases the time to compute may increase.

A. Deep Neural Networks

Neural networks are a set of algorithms and are designed to recognize patterns and classify them. The patterns they recognize are numerical, contained in vectors, into which all real-world data must be translated.The neural networks extract features that are fed to other algorithms for clustering and classification. Basically in simple neural network there is only one layer of hidden layer in addition deep neural network has more then one hidden layer,which gives more accuracy.

DNN basically has two main step
1] Feed Forward: In this step we raw input to the system then to the layers, to activation or sigmoid function to output.
2] Back Propogation: In this step we go backwards and begin adjusting weights to minimize loss/cost.

B. Convolutional Neural Networks

Convolutional Neural Networks is very effective in areas such as image recognition and classification. For example identifying faces, objects and traffic signs apart from powering vision in robots and self driving cars.

There are four main operations:

- Convolution
- Non Linearity (ReLU)(as most of real world data is non linear)
- Pooling or Sub Sampling
- Classification (Fully Connected Layer)

These operations are the basic building blocks of every Convolution Neural Network.

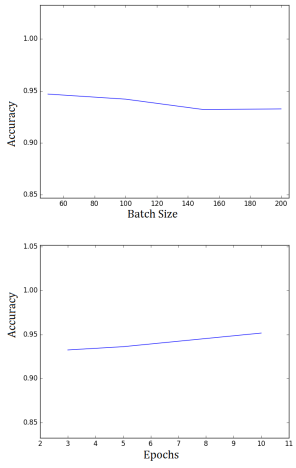
C. Implementation

MNIST consists of images of handwritten digits.It is split into three parts: 50,000 data points of training data ,10,000 points of test data of validation data . This split is very important: it's essential in machine learning that we have separate data which we don't learn from so that we can make sure that what we've learned actually generalizes.Each image is 28 pixels by 28 pixels. A softmax regression has two steps: first we add up the evidence of our input being in certain classes, and then we convert that evidence into probabilities. Classification done based on maximum probability.

In this implementation first of all, we are taking input image and multiplying it with some weight and then adding biases on it, output of first layer will be input of next layer with different weight and biases. After that we are using softmax, AdamOptimizer in back propogation that will change weight on each layer in order to minimize cost.

TABLE I: Accuracy with different no. of layers

Layer	2	3	4	5
Accuracy	0.9358	0.9415	0.9419	0.9423



From the above graph, we can see that as we increase our batch size, the number of variations increases, so we need to iterate more number of epoch to get higher accuracy.

References

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