Artificial Neural Network based Performance examination in Image Classification

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Abstract: **Imbalanced data is one of the inconveniences where information disparity yields a one-sided yield of a model independent how later the innovation is. In this way, in this paper, we will talk about the impact of concealed layers and information uniqueness in classes utilizing profound conviction arranges as the benchmark model and compare it with regular AI calculations, for example, back propagation neural systems with MNIST transcribed dataset. The trial outlines that although the calculation is steady and reasonable for numerous spaces, the imbalanced information dissemination still figures out how to influence the result of the regular AI calculations. The yield of approval misfortune and raining precision is increasingly effective with exactness of around 95% as the quantity of Epoch increments.**

Keywords: **Neural Network, Softmax, Tensorflow, Theano Backned, Mnist Dataset.**

I. INTRODUCTION:

Image Classifier looks at the numerical properties of a few picture includes and characterizes information into sorts. Characterization grasps two stages for example training and testing. The Image Classification framework involves a database that includes predefined designs that partner with an item to order to suitable classification. Image characterization assume significant job in different fields such remote detecting, biometry, biomedical pictures and robot route and so on. Profound Learning is a subfield of Machine Learning. Late advances in profound learning have made errands, for example, Image and discourse acknowledgment conceivable. Profound Learning deals with huge informational indexes. The exhibition of calculation is relying on the preparation dataset used to prepare the calculation alongside the quantity of parameters. This exploration work investigations the presentation of counterfeit neural system for these enhancement techniques: Gradient Descent, Batch Gradient Descent, Stochastic Gradient Descent, Adam.

II. PROBLEM FORMULATION:

In this research work a comparative analysis of optimization methods in artificial neural network for image classification process will be done. A deep learning approach is used to perform Image Classification. Deep learning consists of artificial neural network with two or more hidden layers to extract the features of image. Optimization methods increase the efficiency or processing (performance) of neural network. Here we compare the performance of different optimization methods on artificial neural network for image classification. This research work uses open datasets available on internet like MNIST etc.

IMAGE CLASSIFICATION

Image classification is a process of extracting information from image.This research work uses an artificial neural network for images classification.

Image Classification includes following steps:

a. **Image Acquisition:** acquire the image from dataset for image processing.

b. **Image Pre-Processing:** In preprocessing image transformation, noise removal, atmospherically correction techniques are used.

c. **Feature Extraction:** Extracting the important characteristics of the image.

DEEP LEARNING

Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. It works on neural network having one or more hidden layers for feature extraction.

Deep learning is a class of machine learning algorithm that:

- A multiple layers neural network used for feature extraction and transformation.
- Two types of learning manners:
  Supervised Manner (e.g., classification)
  Unsupervised Manner (e.g., pattern analysis)

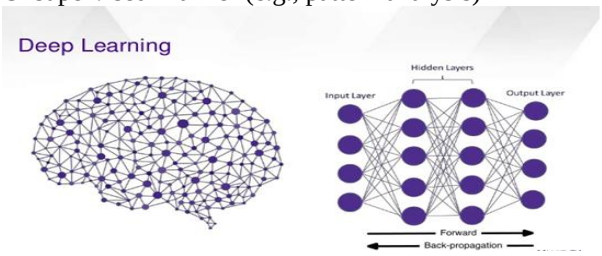

Fig. 1 Deep Learning

ARTIFICIAL NEURAL NETWORK (ANN)

Artificial neural network is a type of artificial intelligence that emits some functions of the human mind. Neural network refers to the interconnection between neurons present in various layers of a system. ANN has following three characteristics:

1. **The Architecture**: The number of layers and the number of nodes in each of the layers.
2. **The learning mechanism** which has been applied for updating the weights of the connections. (Supervised and Unsupervised Learning)
3. **The activation functions** used in various layers. An ANN has a sequence of layers.

The focus of this project is to analysis the performance of MNIST data set and compare the results of testing and training. By training the Softmax Regression, SVM, K-NN algorithm and CNN separately, we compute the accuracy and the running time for different models on the test dataset.

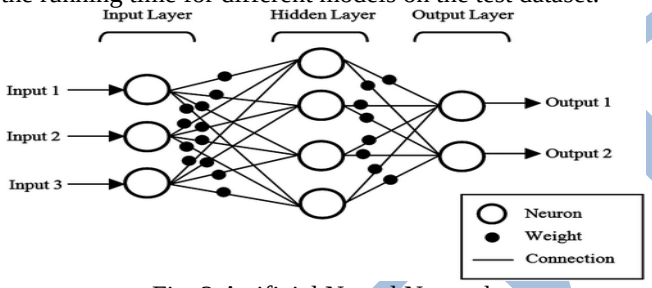

Fig. 2 Artificial Neural Network

The results for different models are compared with the baseline. The artificial neural network provides the best accuracy for classify the image in the test dataset, roughly 95%, which is far ahead of the accuracy of the baseline model. The linear SVM provide approximately 91% classification accuracy, which is worse than the accuracy of K-NN and CNN. Linear classifier might not be a good choice to solve this kind of problem, where the data are 28*28 pixels digit images from MNIST dataset. However, the running time of softmax regression is much shorter compared to KNN and CNN. K-NN takes more than thirty times running time than softmax regression takes. The short running time is one of the advantages of softmax regression model. It is notable that convolutional neural network provides the best results while the training cost is not too high, whose running time is much shorter than k-NN. Since CNN can be trained through GPU rather than CPU, the speed is reasonably fast.

III. RESULTS AND DISCUSSION

The two-layer neural network shows the less efficiency as compare to deeper hidden layer network because of less weight input in the two deep layer neural networks as compare to the more hidden layer network. The number of neurons in two deep layer neural network can be vary from 512 to other values like 2,4,8,16,32,128 etc. The run time of two-layer neural network is less as compare to multiple hidden layer networks because as the number of input function in the two-layer network is less for sigmoid function as compare to another neural network. 2- layer deep neural network epoch size can increase because it can run fast as compare to the multiple network.

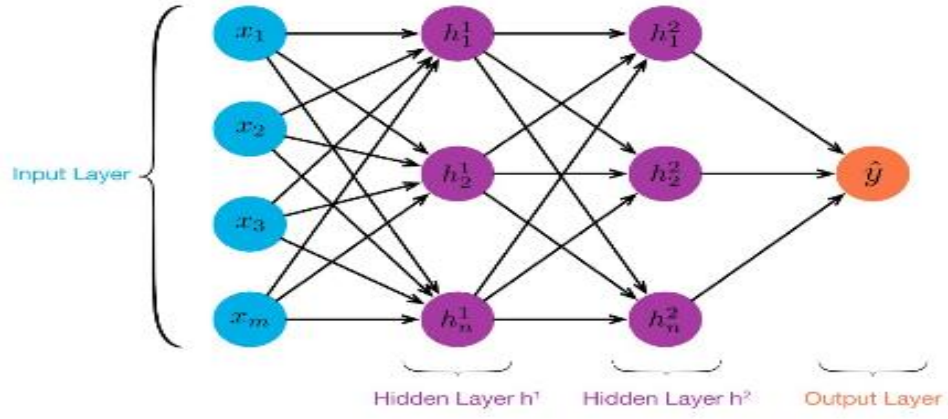

Fig. 3 Layer Deep Neural Network

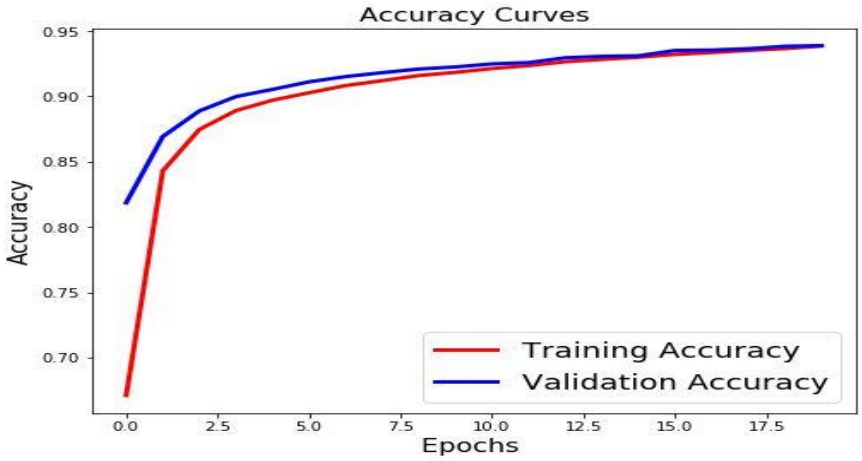

Fig. 4 Training accuracy v/s validation curve of 2-layer neural Network

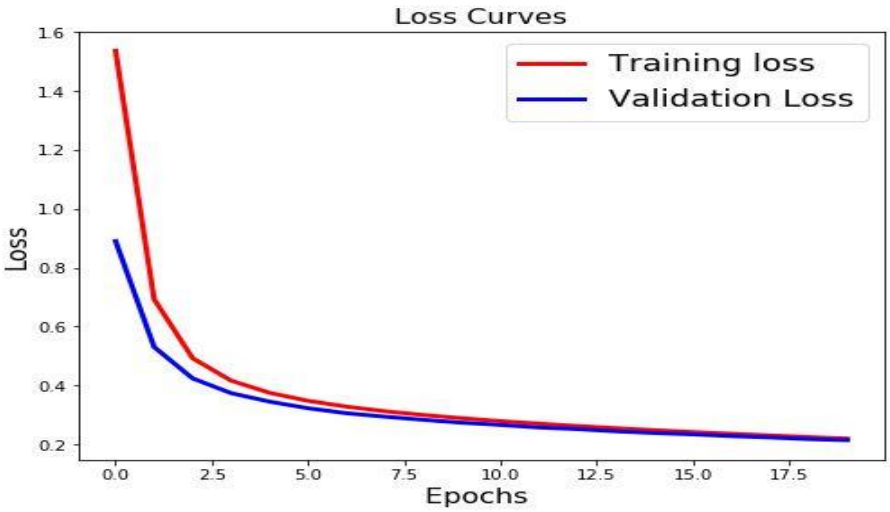

Fig. 5 Loss curve for training loss and validation loss with Number of Epochs

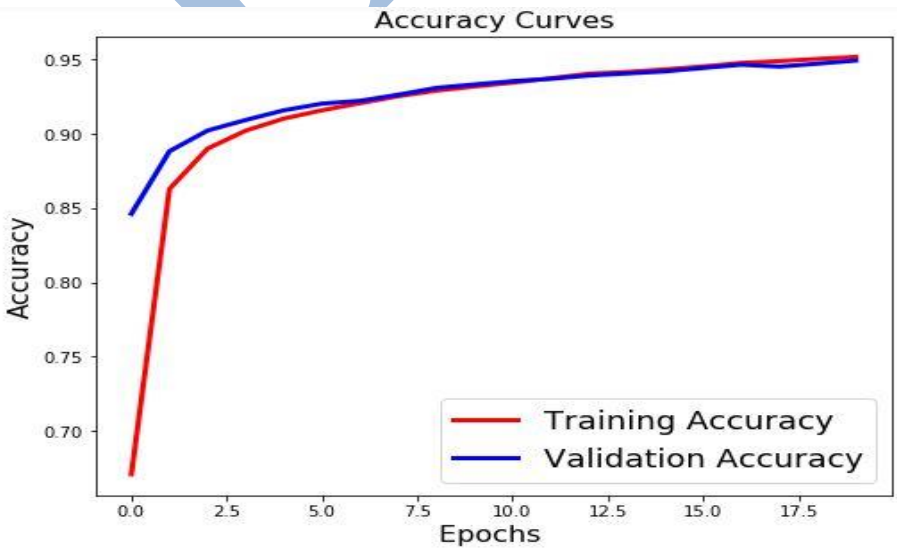

Fig. 6 Training accuracy v/s validation curve of 3-layer neural

Network

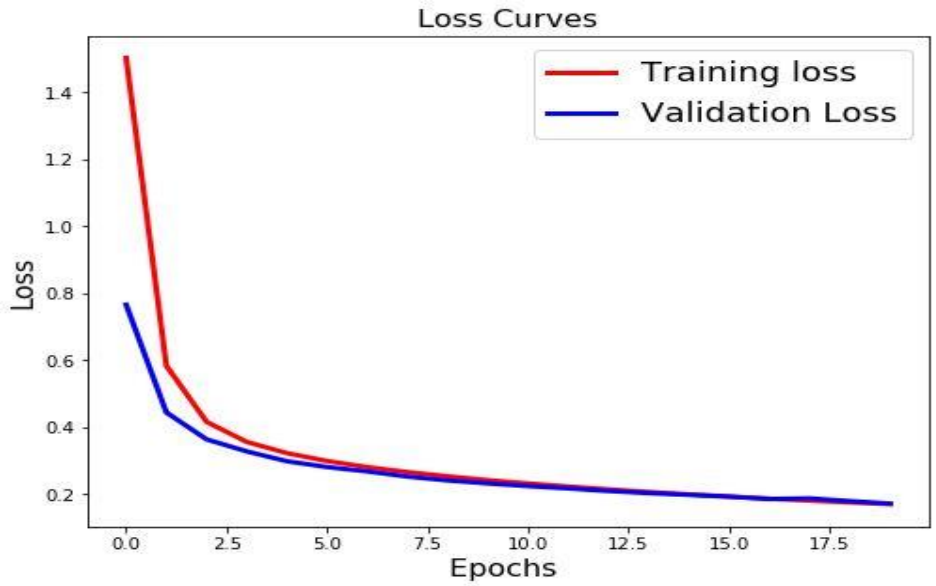

Fig. 7 Loss curve for training loss and validation loss with no. of Epochs

IV. CONCLUSION

Supervise learning procedure utilized for preparing reason may decrease acknowledgment blunder and Increasing number of hidden layers to reduces recognition error

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