



Handwritten Text Recognition

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ABSTRACT

Handwritten Text Recognition is a noteworthy and important issue. As the manually written digits (0-9) and characters (A-Z) are not of a similar size, thickness, position and direction, in this manner, various difficulties must be considered to determine the issue of handwritten text recognition. Handwritten digit and character recognition can be performed using the Convolutional neural network from Machine Learning. The uniqueness and assortment in the composition styles of various individuals additionally influence the example and presence of the characters. It is the strategy for perceiving and arranging transcribed digits. It has a wide range of applications, for example, programmed bank checks, postal locations and tax documents and so on. The aim of this project is to implement a classification algorithm to recognize the handwritten digits and characters.

Keywords: Handwriting recognition, Deep Learning, Machine Learning, CNN.

1. INTRODUCTION

Pattern recognition research has traditionally focused on character recognition. Many experts and scholars have been studying and developing this subject in this sector since the middle of the past century. In particular, one of the problems with very high application value is the recognition of handwritten digits discussed in this article. For the recognition of numbers, everyone hopes that the higher the recognition accuracy, the better, because the recognition of numbers is slightly deviated, which may cause a big mistake, and the error cannot be detected through the context. So in some occasion, it may cause great losses, such as filling in checks and accounts in the financial industry.

Handwritten digit recognition system plays an important role in large-scale data statistics and the financial business, such as industry annual inspection, population census, mail sorting, financial statements, tax statements and checks, etc. The main problems that affect the accuracy of recognition most are the various personal writing habits and no logical connection in the digital context. In recent years, with the development of artificial intelligence technology, handwritten digit recognition system based on deep learning can achieve higher accuracy than traditional method.

2. METHODOLOGY:

Working of project

A Convolution Neural Network (CNN) was used in this study, which is a cutting-edge architecture for solving problems like pattern recognition in images. CNN is a type of Neural Network that is commonly used to solve visual imaging problems. In order to improve the recognition performance, the network was trained with a large number of standardized pictures to automatically learn the spatial characteristics of handwritten digits. For model training, according to the loss function, the convolutional neural network continuously updates the network parameters with the data set in MNIST, which contains 60,000 examples. For model test, the system used to capture the pictures composed of the images generated by the test data set of MNIST and the samples

of digits written by different people. The collected graphics are then continually processed, with the result refreshed every 0.5 seconds.

For characters(A-Z) training model, the dataset used is Chars74K dataset. The dataset contains 26 folders (A-Z) containing handwritten images in size 28x28 pixels, each alphabet in the image is centre fitted to 20x20 pixel box. Each image is stored as Gray-level.

3.SOFTWARE REQUIREMENTS:

DATASETS:

Two datasets are used in the proposed model which are MNIST and Char74K datasets. MNIST(Modified National Institute of Standards and Technologies) data includes around 60,000 images of handwritten digits from 0-9. As a result, it is a classification model of class 10. This dataset is split into two parts i.e. Training and Test dataset. Image representation as 28*28 matrix where each cell contains gray-scale pixel value.

Some of sample data in MNIST dataset shown in figure.

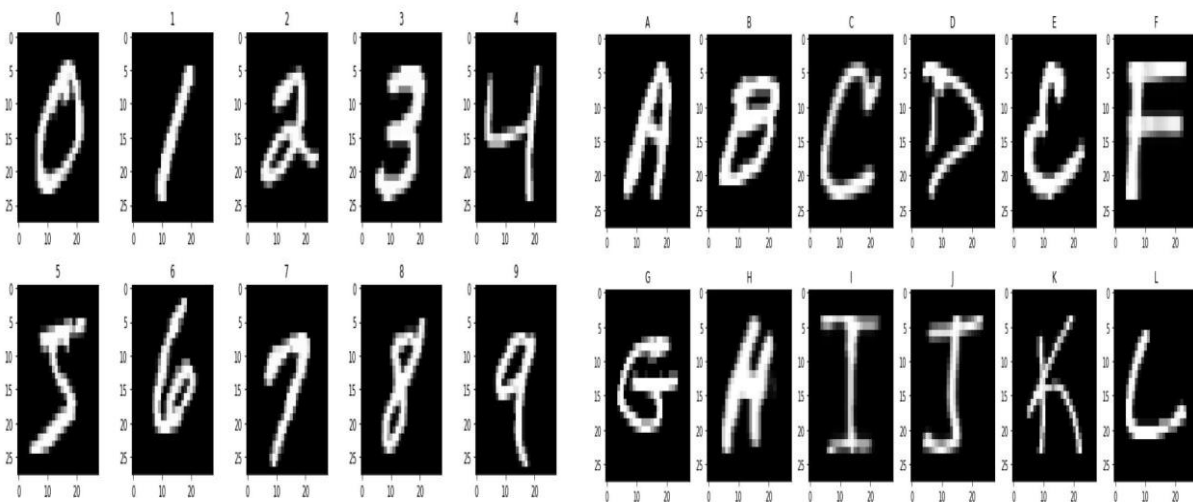


Fig: dataset

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4.MODEL AND ANALYSIS:

The CNN model constructs in a sequence of the input layer, hidden layers, and output layer.

Using an ANN for image classification would be incredibly expensive since the trainable parameters would grow extremely large.

Basics steps to be followed in CNN model are:

- Step 1:** Choose a Dataset.
- Step 2:** Prepare Dataset for Training.
- Step 3:** Create Training Data.
- Step 4:** Shuffle the Dataset.
- Step 5:** Assigning Labels and Features.
- Step 6:** Normalizing X and converting labels to categorical data.
- Step 7:** Split X and Y for use in CNN.
- Step 8:** Define, compile and train the CNN Model
- Step 9:** Accuracy and Score of model.

In these 9 simple steps, you would be ready to train your own Convolutional Neural Networks model and solve real-world problems using these skills.

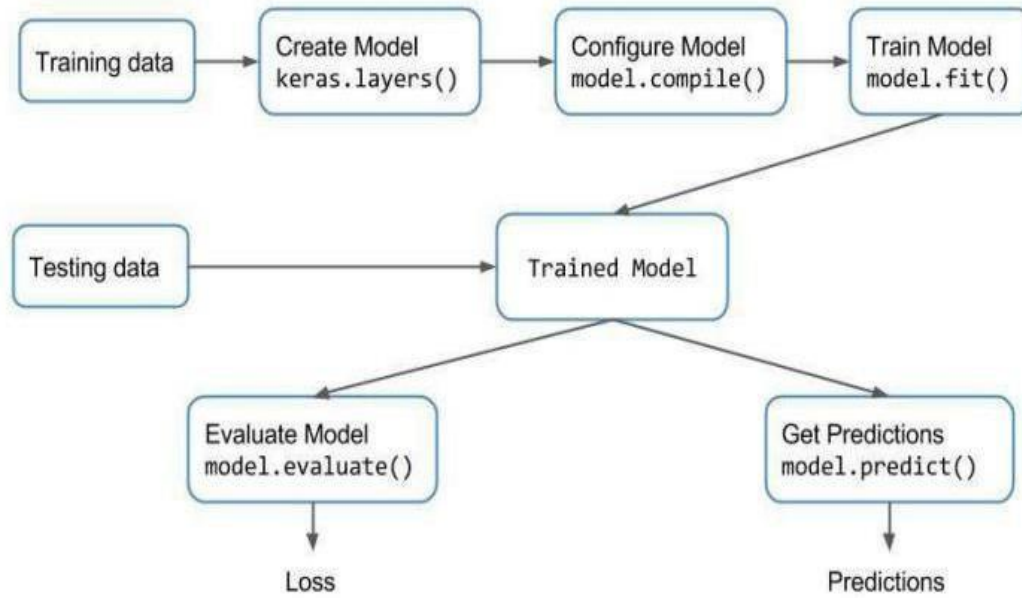


Fig :Content diagram

The testing data is provided to the trained model to evaluate and check the accuracy obtained to the external data. CNN is a cutting-edge architecture for solving problems like pattern recognition in images.

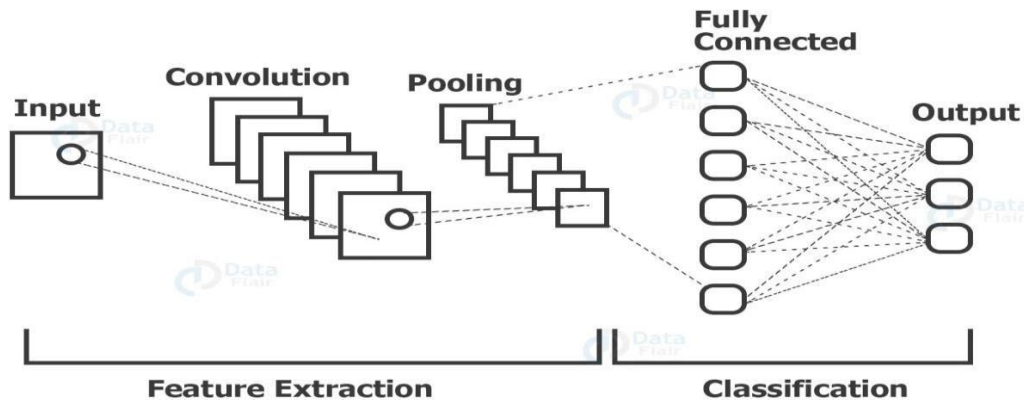


Fig : Model diagram

5.SIMULATION RESULTS

After loading the data to CNN model, the data is classified into groups based on labels. The data is classified and gives the information of categorized groups using Confusion matrices.

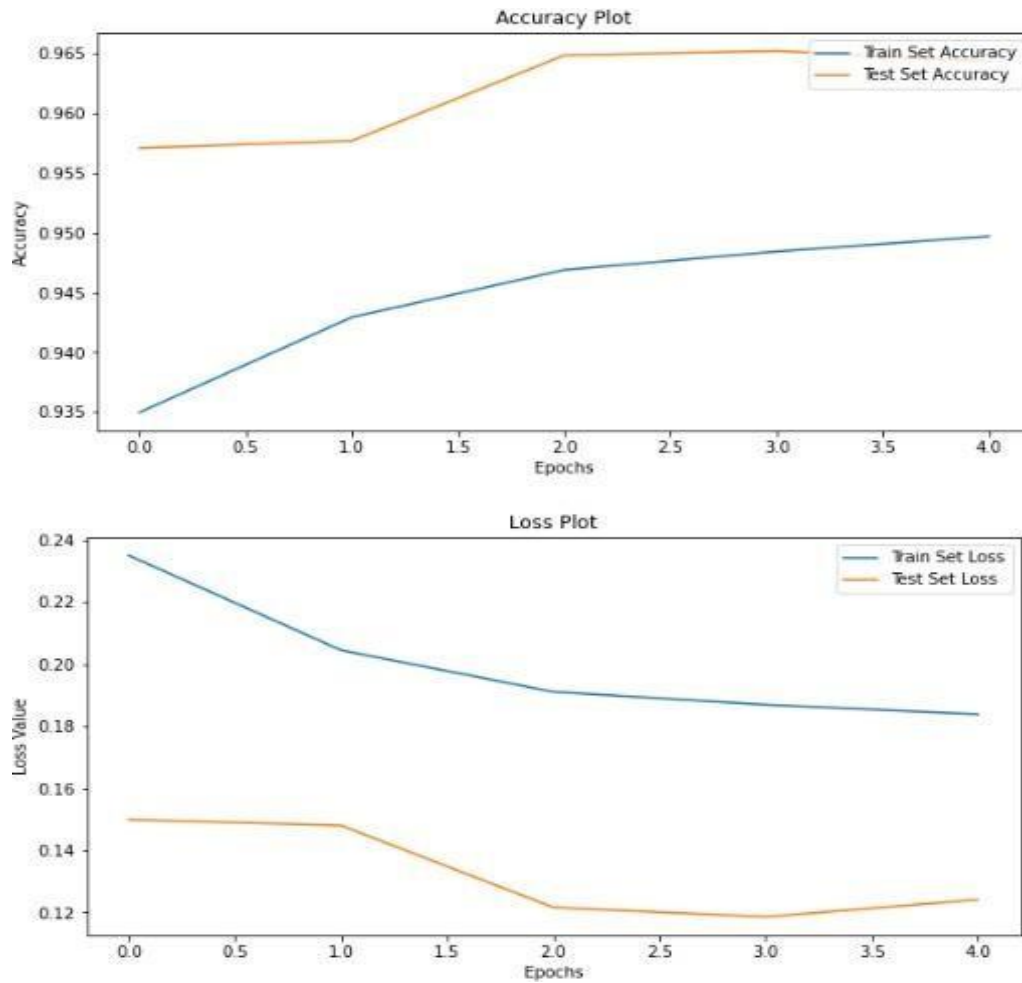


Fig :Accuracy and loss plot



Fig: Output of Model

The models are successfully designed to recognize digits and characters separately with the accuracies 99.5% and 98.67%. Then the two models are combined to design a single CNN model which can recognize both digits and characters with accuracy of 96.54%.

6.CONCLUSION

The proposed model has shown better accuracy in detecting various Handwritten Text. The most difficult aspect was developing the models and conducting adequate training. This was initially due to the large amount of resources required, as well as the fact that the model was frequently too sophisticated or too basic to detect patterns in data. Training, overfit regulation, and convergence were all difficult at first, and it is a never-ending process. However, once a model begins to converge, increasing accuracy and decreasing loss, it is simply a matter of time and fine tuning to improve it. of course, we can always make changes to the model. we'll have to figure out when it's good enough for our needs because there isn't a clear end point. Deep learning approach significantly reduces the time cost of training negative samples, ensures the balance of positive and negative samples, and improves the accuracy of the SoftMax classifier.

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