

# Handwriting Character Recognition using CNN with GUI

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**Abstract** - Handwriting recognition is highly researched area from several years with different techniques. In handwriting recognition technique there are two methods one is online method and other is offline method. Image recognition is main aspect of handwriting recognition process. In image recognition size of image, angle of image and quality of the image these are the things taken care of precisely. To make machines more intelligent, the developers are dividing into technologies like machine learning and deep learning techniques. A human can learn to perform a task by practice and repeating it again and again so that it memorize how to perform the task. Then the neurons in his brains automatically trigger and they can quickly perform the task they have learned. Deep learning is also very similar to this. It uses different types of neural network architecture for different types of problems. Convolution neural Network(CNN) is very effective technique when it comes to image recognition and handwriting.

**Key Words:** Handwriting Recognition, Human Intelligence, Deep Learning, Machine Learning, CNN

## 1. INTRODUCTION

Handwriting Recognition is the ability of machine to recognize and predict the human handwritten character. It is a very tedious task for machine because handwritten letters, digits or characters are not perfect and can be made with many different flavors. So this paper is solution in which handwritten characters are recognize and predict with accuracy. Handwriting Detection is a technique or ability of a Computer to receive and interpret intelligible handwritten input from source such as paper documents, touch screen, photo graphs etc. Handwritten Text recognition is one of area pattern recognition. The purpose of pattern recognition is to categorizing or classification data or object of one of the classes or categories. Handwriting recognition is defined as the task of transforming a language represented in its spatial form of graphical marks into its symbolic representation. Each script has a set of icons, which are known as characters or letters, which have certain basic shapes. The goal of handwriting is to identify input characters or image correctly then analyse to many automated process systems. This system will be applied to detect the writings of different format. The development of handwriting is more sophisticated, which is found various kinds of handwritten character such as digit, numeral, cursive script, symbols, and

scripts including English and other languages. The automatic recognition of handwritten text can be extremely useful in many applications where it is necessary to process large volumes of handwritten data, such as recognition of addresses and postcodes on envelopes, interpretation of amounts on bank checks, document analysis, and verification of signatures. Therefore, computer is needed to be able to read document or data for ease of document processing.

There are many techniques by using them we can achieve recognition. It involves Convolutional Neural Network(CNN), Semi Incremental Method, Incremental Method, Line and Word Segmentation etc., One of the most effective and prominent way of handwriting recognition is convolutional neural network(CNN). It is a part of deep learning. CNN is most commonly used in analyzing visual imaginary. Convolutional Neural Network(CNN) are composed of artificial neurons.

## 2. LITERATURE REVIEW

Handwriting recognition is a wide field of research. The research on this particular topic is done by many researchers in order to get utmost results. Different researchers used different techniques for image recognition and character recognition.

Kartik Dutta, Praveen Krishnan, Minesh Mathew and C.V. Jawahar [1], This paper proposes framework for annotating large scale of handwritten word images with ease and speed. This paper benchmark major Indic scripts such as devanagri, bangla and telagu for the tasks of word spotting and handwritten recognition using state of the art deep neural architectures. It uses Word Spotting using CNN-RNN hybrid network.

Nikita Singh [2], This paper proposes an approach for recognition of handwritten Devanagari character recognition. The proposed approach is based on the classification of individual characters by using ANN (Artificial Neural Network). The proposed approach may be useful in the application for blind people to read the handwritten contents.

Roshan Fernandes, Anisha P Rodrigues [3], This paper proposing two techniques to recognize handwritten Kannada script, which yields high accuracy. The first technique is by 1. Tesseract tool, and second is by using 2. convolution neural network (CNN). With tesseract tool have achieved 86% accuracy and through convolution Neural Network we achieved 87% accuracy.

Bhawna Jain, Paramveer Singh, Ruchika Goel [4], This paper focuses on the offline character recognition of Marathi language. This paper presents a convolutional neural network (CNN) approach to make computer recognize the diversified Marathi language characters.

Deepak Chaudhary, Kaushal Sharma [5], This paper proposed a Deep Convolution Neural Network (DCNN) for Hindi handwritten character recognition. In this paper they have used 96000 character sets. This paper used Deep Convolution neural Network technique.

### 3. METHODOLOGY AND IMPLEMENTATION

To achieve the recognition of handwritten character or letters we proposed a system which includes recognition through Convolutional Neural Network(CNN). This process is categorized into two phases first is learning of model, in which model is trained and saved and later used when it needed to recognition. Second phase is actual working of model where we get expected result through GUI.

#### 3.1 Learning of Model

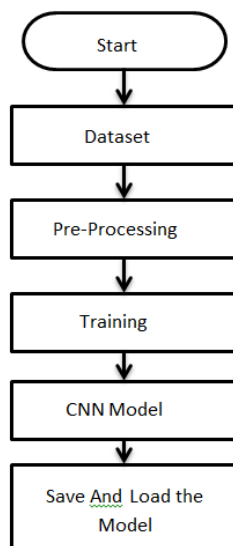


Fig. 1: Learning of Model

Fig. 1: shows different phases of includes in learning process of model.

##### 1.Dataset

For recognising handwritten forms, the very first step was gather data in considerable amount for training. The NMIST dataset of hand printed forms and characters database is used. The dataset we used contain 26 folders (A-Z) containing handwritten images in size 28\*28, each alphabet in the image is centre fitted to 20\*20 pixel box. Each image is stored as Grey-level.

#### 2.Preprocessing

It is a process which is used for transformation of raw data into useful and efficient format. This process called Pre-processing consists of different operations which are used to performed on input images. In this process images are reshaped. The rearrangement of form of the data without changing the contents of the data. Different kinds of arrangements done in this process according to the parameters which are needed to carry on till further process.

#### 3.Training of Dataset

Training and Testing is a method to measure the accuracy of model. In this process the data is set into two sets , training and testing. 80% data is used for training and 20% are used for testing. In this system, it has been trained using CNN. Training accuracy we achieved is 0.9885 training loss is 0.04737 and Testing is achieved is 0.98607 and Testing loss is 0.06844.

#### 4. CNN modelling

Convolutional Neural Network(CNN) is a part of Deep Learning. CNN is very efficient and effective way to achieve handwritten recognition till date. Convolutional Neural Network that are used to extract the features of images using several layers of filters.

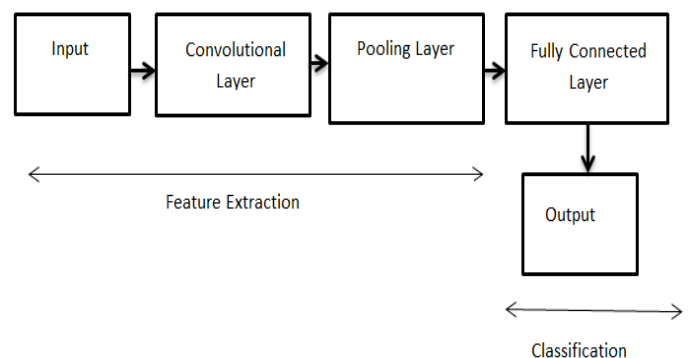


Fig. 2: Layers of Convolutional Neural Network(CNN)

Generally there are three layers included in CNN and are:

##### 4.1 Convolutional Layer

It is a basic layer to build CNN model. In this layer , mathematical operations were performed on the image which applied as input and resize the image into particular format M\* M. The output of this layer, tells the features of the image that is mapping of edges and corners or called as feature map. And next, this information applied to the next layer.

##### 4.2 Pooling Layer

It is connecting layer between convolutional layer and fully connected layer. This layer is used to reduce the parameters and computation in the network.

This layer provides two approaches are max pooling and average pooling. Most commonly used approach is max pooling.

#### 4.3 Fully Connected Layer

The output of the previous layer i.e., pooling layer is fed to fully connected layer. In this layer, process of classification takes place.

#### 5. Load and save the model

After completion of model building the model is load and saved in model.h5 file format. It is file format to store structured data it is not model by itself. This file format is used to load and save the models and it is imported to compile the loaded model before it is used.

### 3.2 Working

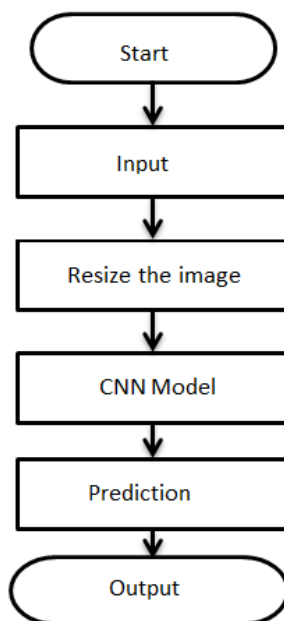


Fig. 3: Working of Model

The working of the system is shown in Fig. 3,

In actual working, the input is provided through GUI. Now, for the GUI, we have created a new file in which we build interactive window to draw character on the canvas and with a buttons through which we can recognize the character.

For generating GUI we have used the Tkinter library for python. Tkinter is a standard GUI library for python. It provides fast and easy way to create GUI application. After providing the input it proceed to prediction through the model we load and saved model.h5 file. The given input is advances further in order to resize in particular format to get actual prediction. Next the resize image is moved further for prediction model where feature extraction of given input is takes place. After that the modelling results in prediction that

represents the probability of the target variable based on estimated significance from the set of input variable.

The expected results are shown on GUI application. The output will contain expected characters with position in order to 0-26 and accuracy of predicted output.

### 4. RESULTS

Following are results of handwritten character recognition. The results are shown on GUI where it shows the predicted character with position and accuracy of prediction.

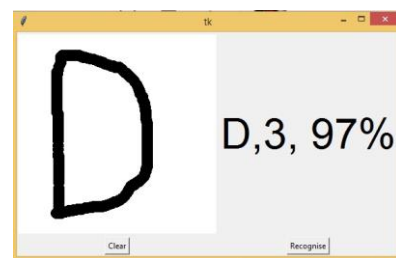


Fig. 4: Output of the Character D

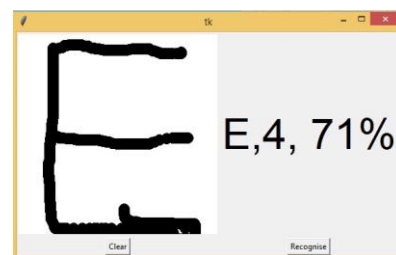


Fig. 5: Output of the Character E



Fig. 6: Output of the Character A

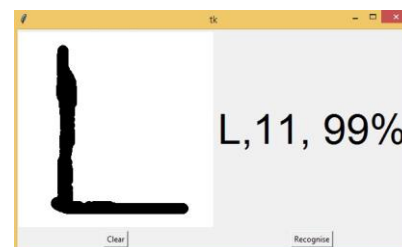


Fig. 7: Output of the Character L

## 5. CONCLUSIONS

The project presented a Convolutional Neural network approach to recognize the various handwritten characters. In this project classification of characters takes place. The project is achieved through the conventional neural network. The accuracy we obtained in this is above 90%. This project will provide both the efficiency and effective result for the recognition. The project gives best accuracy for the text which has less noise. The accuracy completely depending on the dataset if we increase the data, we can get more accuracy. If we try to avoid cursive writing then also its best results. In future we are planning to extend this study to a larger extent where different embedding models can be considered on large variety of the datasets. The future is completely based on technology no one will use the paper and pen for writing. In that scenario they used write on touch pads so the inbuilt software which can automatically detects text which they writing and convert into digital text so that the searching and understanding very much simplified.

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