

Hand Written Text Recognition Using Artificial Intelligence— A Review

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ABSTRACT

At present most of the scripts are handwritten due to the ease of using a pen tip in place of a keyboard, hence errors are common due to illegibility of the human handwriting. To avoid this problem handwriting recognition is essential. Offline handwritten Text recognition (OHTR) has become one of the major areas of research in recent times because of the need to eliminate errors due to misinterpretation of handwritten text and the need for automation to improve efficiency. The application of this system can be seen in fields like handwritten application interpretations, postal address recognition, signature verification, and various others. In this project, offline handwritten Text recognition is performed using CNN, LSTM which uses the architecture of RNN and CTC. The neural network is trained and tested using the handwritten English text. With the knowledge of current data about particular subject, machine learning tries to extract hidden information that lies in the data. By applying some mathematical functions and concepts to extract hidden information, machine learning can be achieved and we can predict output for unknown data. Pattern recognition is one of the main application of ML. Patterns are usually recognized with the help of large image data-set. Handwriting recognition is an application of pattern recognition through image. By using such concepts, we can train computers to read letters and numbers belonging to any language present in an image. There exist several methods by which we can recognize hand-written characters. We will be discussing some of the methods in this paper.

Keywords— Convolutional Neural Networks (CNNs) , Support Vector Machines (SVMs), Recurrent Neural Networks (RNNs) , K-Nearest Neighbor (KNN), Long Short-Term Memory(LSTM). Connectionist Temporal Classification(CTC)

I. INTRODUCTION

The most recent published approaches to solving the handwriting recognition problem. This paper is aimed at clarifying the role of handwriting recognition in accordance with today's maturing technologies. It tries to list and clarify the components that build handwriting recognition and related technologies such as OCR (Optical Character Recognition) and Signature Verification. The handwritten character recognition has been applied in variety of applications like Banking sectors, Health care industries and many such organizations where handwritten documents are dealt with in earlier days recognizing the character using a system is a very big problem later the concept of OCR is Introduced to Recognized the character, OCR stands for Optical Character Recognition. OCR Technology became popular in the early 1990s while attempting to digitize historic newspapers. Since then the technology was improved by several ways. Now a day's solutions deliver almost perfect with OCR accuracy. OCR plays a key role to convert handwritten text to digital text. It is used to recognize text inside images, such as scanned documents and captured photos. OCR technology is used to convert virtually any kind of image containing written text into machine-readable text data. Advanced methods like Zonal OCR are used to automate complex document based workflows. The advantage of OCR software handwriting recognition is considerable. Now, with advances in technology, it is possible to scan a page of structured handwritten document or text and the converting engine can quickly use OCR software handwriting recognition to convert it to a machine-readable document. In recent years, applications of handwriting recognition are thriving, widely used in reading postal addresses, language translation,

bank forms and check amounts, digital libraries, keyword spotting, and traffic sign detection. Image acquisition, preprocessing, segmentation, feature extraction, and classification are the typical processes of an HCR system, as shown in Figure 1. The initial step is to receive an image form of handwritten characters, which is recognized as image acquisition that will proceed as an input to preprocessing. In preprocessing, distortions of the scanned images are removed and converted into binary images. Afterward, in the segmentation step, each character is divided into sub images. Then, it will extract every characteristic of the features from each image of the character. This stage is especially important for the last step of the HCR system, which is called classification. Based on classification accuracy and different approaches to recognize the images, there are many classification methods, i.e., support vector machines (SVMs), RNN deep belief networks, deep Boltzmann machines, (KNN).

In the field of Machine Learning, recognition of objects or data has become most sought one. Some of the examples of object recognition are Face recognition, Hand write recognition, Disease detection etc. All these things can happen through large set of image data set. These image data set will contain both positive and negative data regarding that domain. This helps the algorithm to classify the unknown data in better ways. Hand write recognition is a new technology that will be useful in this 21st century. It can act as base functionality for the birth of new requirements. For example, a blind man cannot read news paper unless braille format exists. In this case we can train the algorithm to recognize characters in the news paper, store them as text and convert the text to speech. This can help lot of blind people to ease their daily work. The second application of hand write recognition could be language translation. In this case when a person is dealing with non-native language, he can just take a image of a document and send it to the hand write recognition algorithm. This algorithm can recognize the characters in image and convert them to text. Then the text can be converted to desired language of choice.

II. PROPOSED METHOD

Now days data plays a vital role, to acquire the data Most organizations use the documents to acquire information from the customers. These documents are generally handwritten. Such documents can be forms, checks, etc. For their easier retrieval or information collection documents are transformed and stored in digital formats.

common practice to handle that information is manually filling same data into computer. It would be tiresome and time consuming to handle such documents manually. Hence the requirement of a special Handwritten Character Recognition Software arises which will automatically recognize texts from image of documents. The process of extracting data from the handwritten documents and storing it in electronic formats has made easy by Handwritten Character Recognition (HCR) Software. Banking sectors, Health care industries and many such organizations where handwritten documents are used regularly. HCR systems also find applications in newly emerging areas where handwriting data entry is required such as development of electronic libraries, multimedia database etc.

handwritten characters there are difficulties like it differs from one writer to another, even when same person writes same character there is difference in shape, size and position of character. Latest research in this area has used different types of method, classifiers and features to reduce the complexity of recognizing handwritten text. In this proposed Method we have used CNN to recognize the text.



Fig-1 Diagram of Optical Character Recognition

Process of Proposed Method

Optical Character Recognition is used to recognize text inside images, such as scanned documents and captured photos. OCR technology is used to convert virtually any kind of image containing written text into machine-readable text data.

OCR Technology became popular in the early 1990s while attempting to digitize historic newspapers. Since then the technology has undergone several improvements. Nowadays solutions deliver almost perfect OCR accuracy. Advanced methods like Zonal OCR are used to automate complex document based workflows.

Now days The character Recognition can be done with the help of SVM(Support Vector Machines),

CNN (Convolutional Neural Networks) and Recurrent Neural Networks (RNNs). and K-Nearest Neighbor(KNN)

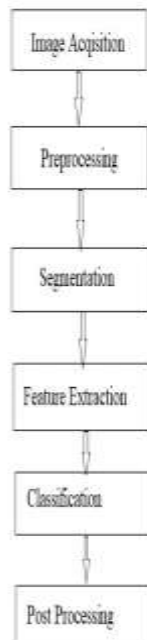


Fig-2 Block Diagram of Character Recognition

In first step we are acquiring the image ,once the image is acquired ,we will do preprocessing of the image and later we will do the segmentation ,once the segmentation of the image is done ,the feature extraction is done , after the extraction the classification of the character is done and final result will be given as post processing.

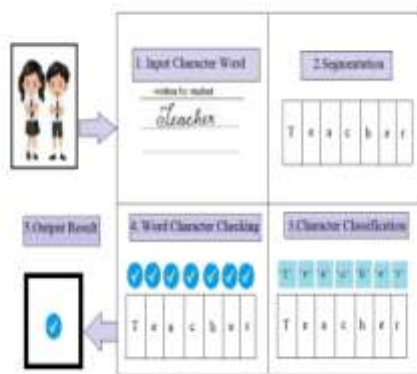


Fig- 3 Diagram of Character Recognition Using Artificial Intelligence

Steps in Optical Character Recognition:-

- 1) The Process of character recognition is done from the Extraction of Character boundaries from the given image of handwritten text.
- 2) Then we go for Building a Convolutional Neural Network (ConvNet) in remembering the Character images.
- 3) Once the building of ConvNet is done then the Loading of trained Convolutional Neural Network (ConvNet) Model will be started.
- 4) Then we get the result of Consolidating ConvNet predictions of characters as output.

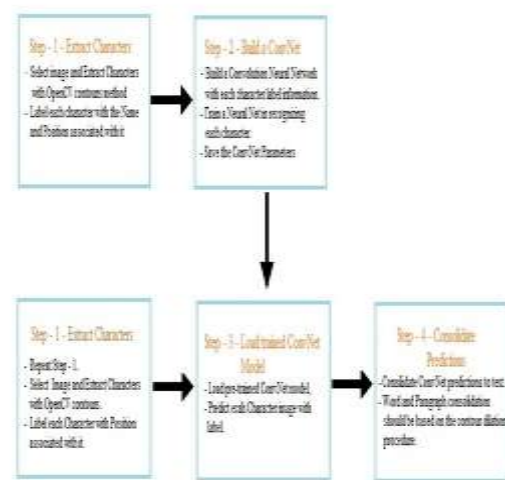


Fig- 4 Working Model

Step 1: Select any document or letter of having text information

Step 2: Extract Character boundaries: Contours can be explained simply as a curve joining all the continuous points (along the boundary). The contours are a useful tool for shape analysis and object detection and recognition. Here Contours explained in differentiating each individual character in an image with using contour dilation technique. Create a boundary to each character in an image with using OpenCV Contours method. Character recognition with the use of OpenCV contours method.

OpenCV code implementation in differentiating the words with the use of contours

Python Code:

```
ret.mythresh1 = cv2.threshold(img1,180,255,cv2.THRESH_BINARY_INV)
kernel = np.ones((5,5),np.uint8)
dilated = cv2.dilate(thresh1,kernel,iterations = 2)
_,contours, hierarchy = cv2.findContours(dilated,cv2.RETR_TREE,cv2.CHAIN_APPROX_SIMPLE)
coordinates = []
for cnt in contours:
    x,y,w,h = cv2.boundingRect(cnt)
    coordinates.append((x,y,w,h))
    #bound the images
    cv2.rectangle(im,(x,y),(x+w,y+h),(0,255,0),1)

cv2.namedWindow('BindingBox',
cv2.WINDOW_NORMAL)
cv2.imwrite('data/BindingBox4.jpg',im)
```

Step 3: Naming Convention followed (Labelling) :
 The extracted text characters should be labeled with the Original character name associated with it. Naming convention followed here is, last letter of file name should be the name associated with the character for pre-processing the images data.

Step 4: Pre-processing

1. The raw data depending on the data acquisition type is subjected to a number of preliminary processing steps to make it usable in the descriptive stages of character analysis. The image resulting from scanning process may contain certain amount of noise
2. Smoothing implies both filling and thinning. Filling eliminates small breaks, gaps and holes in digitized characters while thinning reduces width of line.

- (a) The noise reduction
- (b) The normalization of the data and
- (c) The compression in the amount of information to be retained.

Step 5: Build a ConvNet Model :(Character Recognition Model)

Convolution Network of 8 layers with 2*4 layers residual feedbacks used in remembering the Patterns of the Individual Character Images.

- 1st Model will train on the Individual Character Images with direct Classification to predict the Images with softmax Classification of Character Categories.

- 2nd Model is same model with last before layer as predictor which will Calculate a Embedding of specified Flatten Neurons (The Predicted flatten Values will have Feature Information of Receipt Images).

3) Load Trained ConvNet OCR model:

- Optical Character recognition last step involves preprocessing of image into specific word related contours and letter contours, followed by prediction and consolidating according to letter and word related contours in an image.
- once after training the model, we can save and load the pre-trained Optical character recognition model.

Figure -1: Proposed Method Steps

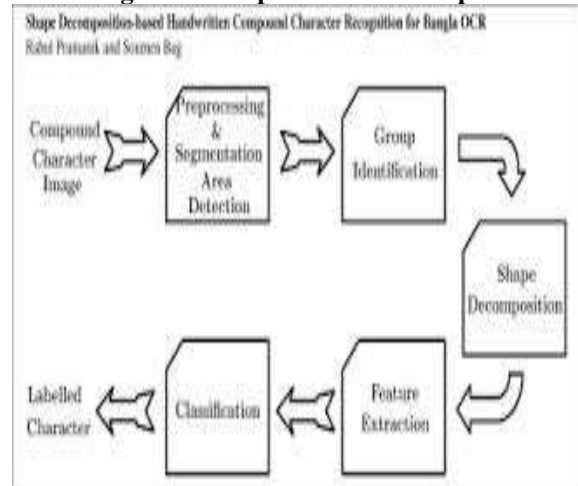


Figure-5: Over all view of the Proposed Method

Results

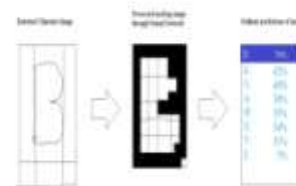


Figure-6: Results

III. CONCLUSION AND FUTURE WORKS

Now day's there are so many approaches for hand writing recognition. Some of them are incremental, Zoning, Convolutional Neural Network (CNN), semi-incremental segmentation, slope and slant correction. Among these methods, highest accuracy is achieved from Convolutional Neural Network (CNN) and the least accuracy is achieved from Slope and Slant Correction method. When the images are trained with CNN, we will achieve good accuracy and this is one of the successful method for hand writing recognition and only disadvantage with this method is that training time of the model is too high because lot of image samples are included. In Zoning International Journal of Computer (IJC) (2020) Volume 38, No 1, pp 93-101 method, if zones which are achieved after dividing input image and if the count of these zones are lesser then accuracy will decrease. Main disadvantage of this method is that developers will face lot of problems while segmentation process but this method is too simple for hand writing recognition. This method only sees the Later and which makes it simple. Hand writing recognition is very challenging because all the individuals have different hand writing and it becomes more complex to detect when these are compared to that of computer. Immense work and research has been done in the handwritten separate character recognition. But so far 100% accuracy is not achieved which gives scope of further work in this direction. Separate characters give good accuracy but word recognition is affected by different writing style. Holistic method eliminates the complicate segmentation but they use limited vocabulary. Segmentation based method due to its complexity acquire less accuracy. Good accuracy is observed in the classifier where scope of words is limited to fix numbers as it has to deal with limited number of variation.

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