



IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

e-ISSN: 2319-8753 | p-ISSN: 2320-6710



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 7, July 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569



9940 572 462



6381 907 438



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Handwritten Text Recognition Using OCR

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ABSTRACT : With the upgradation of technology, we now have systems capable of converting handwritten text into digital form. This helps in saving the time required for manually entering the data and also minimizes the errors caused due to human intervention.

Handwritten Text Recognition is the process of conversion of images of handwritten or printed text into machine text, whether from a scanned document, a photo of a document or from subtitle text superimposed on an image. HTR system uses Neural Network for recognizing texts in the images and converts them into digital format.

In our system, the image which contains the handwritten text is fed as input and is passed into neural network which recognizes the handwritten text present and displays it in the form of digital text.

KEYWORDS: Text Recognition, Neural Network, OpenCV, HTR, OCR

I. INTRODUCTION

In the majority of the foundations, information section is as yet done physically. This prompts wastage of time, and mistakes caused because of human mediation. The structures in the banks, schools and numerous different foundations stay in a similar configuration for a considerable length of time. The current innovation like OCR is fit for changing over writings from the archives to advanced structure. These innovations can be applied to these structures. The system for handwritten text recognition will make the task of the persons sitting in the office easier. Let's say the same admission form is filled by all the students from FE to BE every year. By automating this process of manual data entry for this form, it will reduce the chances of errors. It will also reduce the efforts and help saving time. OCR frameworks were utilized to be mechanical gadgets in the past which had the option to perceive characters yet with low precision and moderate speed. This issue was perceived in the extremely past when even PC was not known to individuals.

The earliest work on modern OCR was done was M. Sheppard in 1951, who invented a reading and robot GISMO. GISMO had capability to recognise only upto 23 characters at a time. It was able to read words and musical notation on a printed page one at a time. GISMO was also used to copy a typewritten page at that time. After this invention, a machine that was able to read capital typewritten English alphabets, one per minute by Rainbow in 1954

The prior OCR frameworks were inclined to blunders and had moderate acknowledgment speed. Because of absence of computational power during the 60's and 70's, very little research endeavors were done on it. The main improvements were done in different government organizations and huge partnerships like banks, papers and carriers and so on. To satisfy the interest of framework like OCR, it was felt that there is a need of general OCR text styles for calming the activity of acknowledgment for OCR. Thus, OCRA and OCRB gave relatively great acknowledgment rates that were made by ANSI and EMCA in 1970.

With the improvement of innovation and progression of computational power, similarly more research has been made on OCR in the previous 30 years. This has led to the presentation of record picture investigation (DIA), written by hand, multi-lingual and omni-textual style OCRs. In spite of such a significant number of research, still the current OCR frameworks slack in precision and speed too. Distinctive Artificial Intelligence systems are being applied these days to take care of this issue with better precision and quick speed. Neural Network is viewed as very amazing in learning designs. So applying Neural Network can build the exactness of HTR.

II. OVERVIEW

Optical Character Recognition(OCR)

Optical Character Recognition or optical character reader (OCR) is an electronic or mechanical conversion of images which is typed, handwritten or printed text into machine-encoded text or into digital text, whether from a scanned document, a pic of document, a scene-pic which contains the text on signs and billboards or from subtitle text

superimposed on an image (from a television broadcast).

OCR systems have two categories: online and offline, in online the input information is obtained through real-time writing sensors, in offline the input information is obtained through static information (images). For the offline category, there is recognition of typed and manuscript text

Classification of OCR.

Handwritten Text Recognition(HTR)

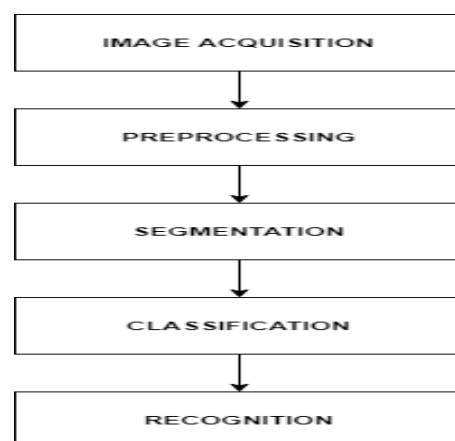
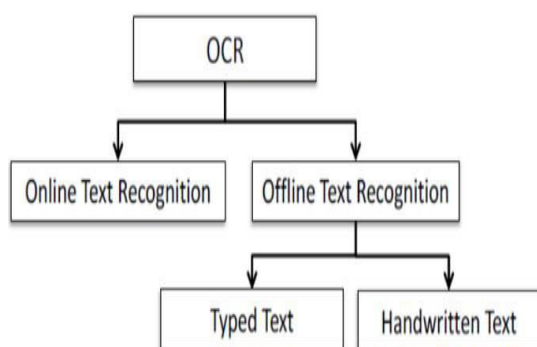
Handwritten Text Recognition is a technology that is much needed in this world as of today. Before having proper implementation of this technology we had relied on writing texts with our own hands which can result in errors. It seems difficult to store and access physical data with more efficiency. Manual labor is required to maintain proper organization of the data. Throughout the past, there has been severe loss of data because of the traditional method of storing data. Modern technology is letting people store the data over machines, where storing, organizing and accessing of data is relatively easier.

Handwritten Text Recognition is a field of research in artificial intelligence, computer vision, and pattern recognition. A computer handwriting recognition system is able to acquire and detect characters in paper documents, pictures, touch-screen devices and other sources and convert them into machine-encoded form or in digital form. Application related to this is found in optical character recognition, transcription of handwritten documents into digital documents and

III. FLOWCHART

Image acquisition:

In Image acquisition, the input image is provided to the cognition system. The input can be either in an image format such as JPEG, PNG, BMT etc. or scanned image, digital camera or any other suitable digital input device or one can draw on the canvas provided on the user interface.



Preprocessing:

It is a series of operations performed on the input image. Pre-processing is the entry method for recognition of character and very important in deciding the recognition rate. Preprocessing works to normalize the strokes and also remove variations that can reduce the rate of accuracy. Preprocessing mainly works on the various distortions like the irregular text size, points missed during the pen movement, jitters, left-right bend and uneven spaces.

Segmentation:

In the segmentation stage, an image of sequence of characters is decomposed into sub-images of individual character. Segmentation is used to convert input image consisting of many characters into the individual characters. The techniques used are word line and character segmentation. It is generally performed by dividing all characters from the word picture.

Classification:

The CNN consists of a series of layers which help improve the robustness of the network and help in making the output more efficient and accurate.

INPUT>Conv.Layer>ReLu>Pooling>Conv.Layer>ReLu>Pooling>Fully Connected

The second layer takes the activation map of the first layer and

processes it and tries to extract the low level features from this activation map. The last layer is the most important layer as it helps in determining the class to which the output belongs to. This layer is also called as the Logits or the Dense Layer. The Output layer of Neural Network provides output for input image.

Recognition:

In the Recognition part, the output of the classification part is applied to the CTC loss & decoding layer which recognize the image and gives the output in the text format.

Implementation:

First we have collected the data set for the model. IAM Handwriting Database was used which contains plenty forms of handwritten English text which can be used to train and test handwritten text recognizers and to perform writer identification and verification experiments. The database which contains forms of unconstrained handwritten text, which are scanned at a resolution of 300dpi and saved as PNG images with 256 gray levels. The figure below provides samples of a text line and some extracted words.

In Second step we have downloaded and installed the software requirements like Anaconda Navigator, IDE- Pycharm, Jupyter, Python 3.x, Tensor Flow, Numpy & all other libraries.

In Next step we start the actual implementation of our HTR model, where we first create one module where we have to prepare the images from IAM dataset for the NN and we named that module as sample processor where we prepares the images from dataset and do the preprocessing part on the image like normalization.

After the first module we are creating second module where we reads the input samples after that we are putting that samples into batches and provides an iterator- interface to go through the data and we named that module as data loader and we have to divide dataset for training and testing purpose

After the preprocessing part and preparing the images into batches we are creating our third module where we have to create actual model for our text implementation part where we import first 2 modules and manages the tensor flow sessions and provides an interface for training and inference and we named this module as model

In the last part of the implementation where we have to create one module named as main where all first 3 modules are imported and in this main module we have to define training and testing part and also we have to define decoders which we are using for the CTC operation which is best path search or beam search. After this 4 modules we have to train our IAM dataset by using the command `python main.py—train`

shows the training part of the IAM dataset at epoch 25 where we can see that after the training validation is also takes placed where we get the character error rate is reduced to 12.47% and word accuracy is increased 70.52%.

Testing

After Training the dataset we have to validate it by using the command `python main.py—validate`

Results:

Input



Output:

```
C:\Users\AMIT\Anaconda3\python.exe C:/Users/AMIT/HTRNN/build/main.py
Validation character error rate of saved model: 11.494714%
Init with stored values from ../model/snapshot-25
Recognized: "are"
Probability: 0.9056404
```


Input:



Output:

```
C:\Users\AMIT\Anaconda3\python.exe C:/Users/AMIT/HTRNN/build/main.py
Validation character error rate of saved model: 11.494714%
Init with stored values from ../model/snapshot-25
Recognized: "little"
Probability: 0.8072314
```

In the above result we have seen that the image is not recognized and it gives probability of recognition because our model is capable of recognizing only 32 Characters and above we have the validation character error rate of our trained model

IV. CONCLUSION

Handwritten Text Recognition from images is very essential these days. Character Recognition from images uses feature of extraction techniques. The extraction methods feature have performed well in classification which when fed to the neural network and preprocessing of image using edge detection and normalization technique which are the ideal choice for degraded noisy images. The method of training neural network with extracted features from sample images of each character has detection accuracy to a great extent. NN which is now able to recognize text in images. The NN consists of 5 CNN layers and 2 RNN layers and outputs a character-probability matrix. This matrix is either used for CTC decoding or CTC loss calculation. This system is developed and evaluated for a set of sample images containing handwritten text. This model is trained with the word accuracy rate of 71.39 % and character error rate of 11.49%.

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