

Hand-written Text Recognition

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Abstract— The proposed system presents an innovative method for handwritten character detection using deep neural networks. It is an image segmentation based Handwritten character recognition system. This system uses an OpenCV for performing image processing using Tensor Flow for training the Neural Network. This Neural Network model recognizes the text contained in the image of segmented words. As this words-image is smaller than the image of complete text-lines, the Neural Network can be kept small and training on the CPU is feasible. 3/4 of the words from the validation-set are correctly recognized and the character error rate is around 10%. This system is capable to recognize the text written by the hand of a person. The system is divided into two parts. The first one is the android module, which is used for generating the input for the system. The other one is a server, which will perform the main operation of detecting the character of the text. In the System, the android device takes the input in the image form and send it to the server. The server takes input and starts evaluation, classification and prediction for the image data to find the best match word of the text document. The server creates the text document at last as the output and sends it back to the device. Then the android device shows the output received from the server.

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I. INTRODUCTION

Offline handwritten text recognition is one of the most active areas of research in computer science and it is inherently difficult because of the high variability of writing styles. High recognition rates are achieved in character recognition and isolated word recognition, but they are still far from achieving high-performance recognition systems for unconstrained offline handwritten texts. Automatic handwriting recognition systems normally include several preprocessing steps to reduce variation in the handwritten texts as much as possible and, at the same time, to preserve information that is relevant for recognition. There is no general solution to preprocessing of offline handwritten text lines, but it typically relies on slope and slant correction and normalization of the size of the characters. With the slope correction, the handwritten word is Horizontally rotated such that the lower baseline is aligned to the horizontal axis of the image. This System presents new techniques to remove the slope and the slant from handwritten text lines and to normalize the size of the text images by using Artificial Neural Networks (ANNs) with TensorFlow Library in Python. Local extrema from a text image classified as belonging to the lower baseline by a Multilayer Perceptron (MLP) are used to accurately estimate the slope and the horizontal alignment. Slant is removed in a nonuniform way by also using ANNs. Finally, another MLP computes the reference lines of the slope and slant corrected the text to normalize its size. Hidden Markov Models

(HMMs) have been widely applied to offline handwriting recognition after their success in automatic speech recognition. The basic idea is that handwriting can be interpreted as a left-to-right sequence of ink signals which is analogous to the temporal sequence of acoustic signals in speech. In the off-line recognition, the writing is usually captured optically by a scanner and the completed writing is available as an image. But, in the on-line system, the two-dimensional coordinates of successive points are represented as a function of time and the order of strokes made by the writer are also available.

II. LITERATURE REVIEW

We have gone through some text recognition systems the overview of them are as bellows:

A. A Computationally Efficient Pipeline Approach to Full Page Offline Handwritten Text Recognition:

This paper describes offline handwriting recognition with deep neural networks is usually limited to words or lines due to large computational costs. In this paper, a less computationally expensive full-page offline handwritten text recognition framework is introduced. This framework includes a pipeline that locates handwritten text with an object detection neural network and recognizes the text within the detected regions using features extracted with a multi-scale convolutional neural network fed into a bidirectional long short-term memory network. This framework achieves comparable error rates to state of the art frameworks while using less memory and time. The results in this paper demonstrate the potential of this framework and future work can investigate production-ready and deployable handwritten text recognizers. In this paper, the author presented a full-page offline handwritten text recognition framework. This framework consists of a pipeline where the handwritten text is localized followed by converting images of words into strings. The results in this paper demonstrate the potential of this framework and future work can investigate different components of the pipeline for improved results. In this paper, we predict bounding boxes around the text using deep learning techniques of object detection. Given an image that contains multiple objects, object detection identifies bounding boxes that encompass the object along with the confidence of the class of the object. In this work, the Single Shot Multi-Box Detector framework was applied to text localization.

B. Offline Handwritten Quranic Text Recognition:

This paper provides an overview of offline handwritten Quranic text recognition systems. Further, the unique characteristics of the Arabic language and associated problems related to the offline handwritten text of the Quran have been discussed. The challenges in the recognition of handwritten text of the Quran have been elaborated with

examples. This paper aims to explain the recognition system for offline handwritten Quranic text. Arabic is an inherent language for Quranic text. The Arabic Handwritten text differs from others in writing styles, use of diacritics, ligatures and overlaps. These make the process of recognition handwritten Quranic text more challenging. An overview of the recognition system as well as, the associated problems in recognition of handwritten Quranic Arabic text is presented. This paper aims to discuss the main characteristics of Quranic writing, Stages of Quranic text recognition systems and the challenges in handwritten Quranic text recognition.

C. A Database for Arabic Handwritten Text Image Recognition and Writer Identification:

In this paper, an Arabic Handwritten Text images Database written by Multiple writers is introduced. This database can be used for research in the recognition of Arabic handwritten text with open vocabulary, words segmentation and writer identification. The AHTID/MW contains 3710 text lines and 22896 words written by 53 native writers of Arabic. Also, ground truth annotation is provided for each text image. The database is freely available for worldwide researchers. In the field of Arabic handwritten text recognition, having a standard database is crucial for text image recognition and writer identification Researchers have prepared some databases for handwritten texts [6], Handwritten words [7] and bank checks [8]. To the best of our knowledge, only one database is available for Arabic handwritten texts-lines with open vocabulary [9]. However, it does not include a dataset of words and it seems difficult to have access to this database.

III. SYSTEM IMPLEMENTATION

Our System presents a new technique to remove the slope and the slant from handwritten text lines and to normalize the size of the text image by using Artificial Neural Networks with TensorFlow Library in Python. Local extrema from the text image classified as belonging to the lower baseline by a multilayer Perception are used to accurately estimate the slope and the horizontal alignment. Slant is removed in a nonuniform way by also using Artificial Neural Networks.

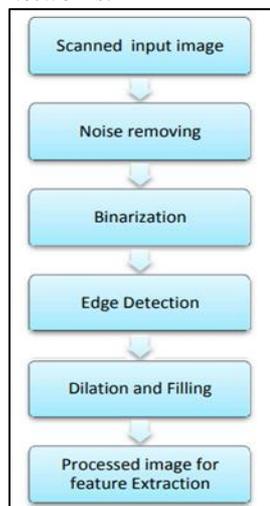


Fig. 1: Stages of Proposed System

Stages of Handwritten Character Recognition are as follows:

- 1) Scanned input image: At this stage, an image taken as input is scanned by the mobile camera. The input image should be a handwritten or text document.
- 2) Noise removing: In this stage, the software removes the noise from the input image. And make the image clear for further process.
- 3) Binarization: In this stage, each word from the sentence of the input image is identified by comparing with the database of the library. After recognition of the word, words are converted into machine-understandable binary format.
- 4) Edge Detection: In edge detection, the slopes and curve of each alphabet of a word are detected which helps to recognize the actual character.
- 5) Dilation and Filling: Dilation generally increases the size of objects, filling in holes and broken areas, and connecting areas that are separated by spaces smaller than the size of the structuring element. With grayscale images, dilation increases the brightness of objects by taking the neighborhood maximum when passing the structuring elements over the image. With binary image, dilation connects areas that are separated by spaces smaller than the structuring element and adds pixels to the perimeter of each image object.
- 6) Processing Image for Feature Extraction: The newly found handwritten character is identified first and then it will be stored in dataset library for feature extraction.

IV. CONCLUSION

A simple recognition system for recognizing handwritten English alphabet character using a new type of feature extraction, namely, diagonal feature extraction is proposed. The proposed handwritten character recognition system with superior recognition rates will be eminently suitable for several applications including handwritten name recognition and conversion of any handwritten document into structural text form.

REFERENCES

- [1] Jonathan Chung, Thomas Detail, "A Computationally Efficient Pipeline Approach to Full Page Offline Handwritten Text Recognition", International Conference on Documentation Analysis and Recognition Workshop (ICDARW), 10.1109/ICDARW.2019.40078, October 2019.
- [2] Arshad Iqbal, Asim Zafar, "Offline Handwritten Quranic Text Recognition: A Research Perspective", Amity International Conference on Artificial Intelligence (AICAI), 10.1109/AICAI. 2019.8701404, October 2019.
- [3] Anis Mezghuani, Salim Kanoun, Maher Khemakhem, "A Database for Arabic Handwritten Text Recognition and Writer Identification", International Conference on Frontiers in Handwritten Recognition, 10.1109/ICFHR.2012.155, October 2012.
- [4] <https://towardsdatascience.com/build-a-handwritten-text-recognition-system-using-tenserflow-2326a3487cd5>

- [5] <https://www.javatpoint.com/python-tutorial><Python Tutorial>

