

A Technical Review on Handwritten Expression Solver from Images

Hitesh Soni, Harsh Anand

Department of CSE

Poornima Institute of Engineering & Technology

Jaipur, 302022, India.

2016pietcehitesh038@poornima.org

2016pietceharsh033@poornima.org

Prof. Shruti Bijawat

Department of CSE

Poornima Institute of Engineering & Technology

Jaipur, 302022, India.

shrutibijawat@poornima.org

Abstract— Now a day, there are various researcher are actively working in the field of Text or Character recognition from images which helps in developing a computer application that helps to automatically fetch the text or character from images (Text or Character in images be either Handwritten or Computer Generated). At present, there is rapidly increasing demand for storing the information which are available on paper either in handwritten or computer text into a computer readable form for further use. It can be done with the help of scanning the documents. There are various difficulties to read the image contents line-by-line or word-by-word. Due to the difference in the font characteristics of the characters in the paper document, quality of the images and detecting the handwritten character (either operator or operand) with accurate result may get affected. Due to these above problems, computer system is unable to recognize the handwritten characters while reading them. So, there is a need of a system that recognize the handwritten character from the image for just to perform document image analysis by segmenting each handwritten character from image then assign the segmented character to correct character class and store all the segmented character in variable in electronic format or computer understandable format. In this paper, we have reviewed various different methods for Handwritten expression recognition and then solve that expression from the images. The main objective of this review paper is to use the well-known methods of Text recognition or handwritten character recognition for solve the handwritten expression.

Keywords: Handwritten Expression Solver, electronic format, Handwritten expression recognition, characteristics of font, model for detecting handwritten characters.

I. INTRODUCTION

As we all know, there is a lot of data present in the form of paper pages that can be of any books, thesis and various historical and mythological books. And due to change in atmosphere or due to the mishandling of the pages it is very difficult to store that valuable data and therefore it is a requirement of any software that can convert that data into the digital data. And after converting the data it would be very useful that can be shared with anyone without any distortion of the data. It means that we get the documents in form of line-by-line or word-by-word completely. This type of difficulty arises due to the difference in the font characteristics of the characters in the paper document and the characteristics of font for character in the image. There are many existing Optical Character Recognition solutions are commonly used.

However, there is a still challenging problem for recognition of handwritten text. This paper is proposing a one of the approach for detection the handwritten text using the convolution neural network (CNN) and OpenCV. We have used the dataset publically available NIST datasets which contains thousands of handwritten characters.

II. METHODOLOGY

In this section we have discuss about the architecture of Handwritten Expression Solver from Image as briefly describe in figure 1. A Handwritten Expression Solver system takes an input in the form of an image which has some expression in the handwritten form. The output for this model is in computer understandable form i.e. electronic format. Handwritten Expression Solver system can be divided in following models: (A) Image pre-processing Model (B) Text Recognition Model (C) Post-Processing Model.

A. Image Pre-processing Module

This step is required after the insertion of an image it is basically used to remove the noise using the filter so that it can be used further and in preprocessing we also use thresholding after conversion into grayscale which basically differentiates the darker area with the lighter area that's why the handwritten text is separated with its background. For improving the quality of the input image, we have to perform few operations for Image Enhancement such as normalization & binarization, noise removal etc.

1) Noise Removal

Noise removal process helps to improve the image quality and it will also reflect in the recognition process for handwritten text from images. It also helps the system to get more accurate result at the processing of the model. There are various methods are available for removing of noise from an image such as Gaussian filter, min-max filter, mean filter etc.

2) Normalization & Binarization

To obtain the characters of uniform size, slanted and rotated then we use Normalization method. For converting grey scale image into binary image we have used Binarization technique. First we have to convert the scanned image into gray scale image and then we apply Binarization technique.

B. Text Recognition Module

It is used for recognition of handwritten text in an image after pre-processing model and provide the result as data which are in computer understandable form, for this process there are various techniques are used.

1) Segmentation

As we used the thresholding in the pre-processing stage which basically classify the text and background after this we required a process which classifies the text for that we use the segmentation which divides the text into words and the words into the character.

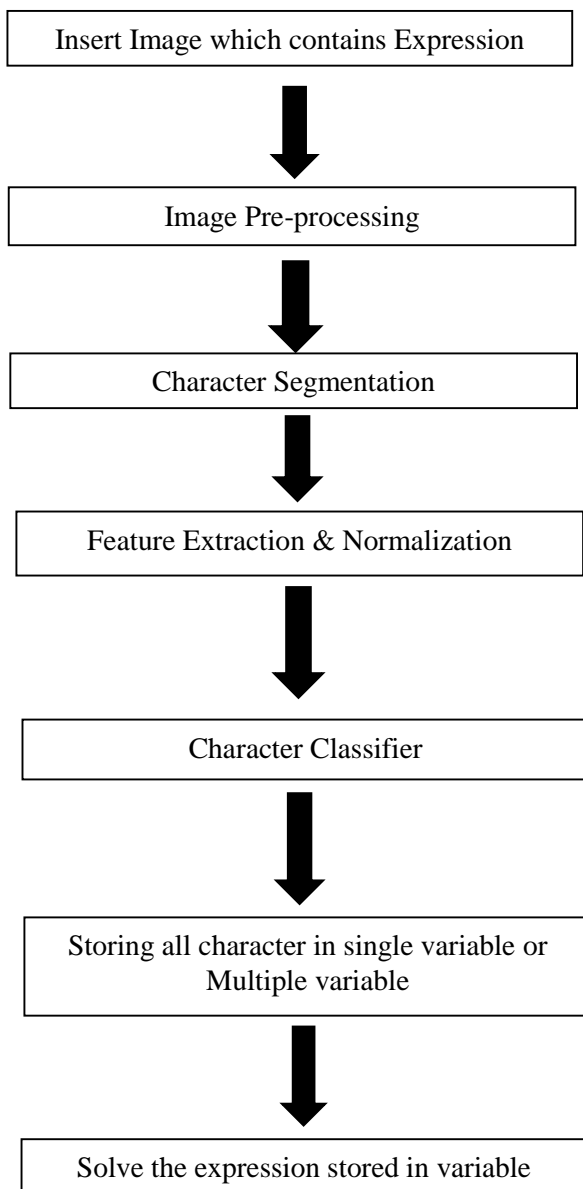


Figure 1 – Architecture of Handwritten Expression Solver

2) Feature Extraction & Classification

As we get the characters using the segmentation thus we required a process which basically extracts the features from the characters that mean here we used a process where the all same characters categorized as one character and so on for the rest of the character that will categorize all characters. Classification is the process that help us to identifying each handwritten character and assigning it to the its correct character class, so that the handwritten texts in images are converted into computer understandable form. There are various techniques are available that can be used for classification process such as Artificial Neural Network (ANN), Support Vector Matching (SVM), Convolution Neural Network (CNN) etc.

C. Post-Processing Module

It can be used after classification of handwritten text into its correct character class from output image and provide the result as output data which are in computer understandable form, so there is need to store the handwritten text identify by the above model for further processing the result. After storing the handwritten expression, it further process for solving the expression.

III. LITERATURE REVIEW

As we have discussing about handwritten expression recognition and provide result of that handwritten expression from scene images is very vast field and very innovative field, so that various researchers are working or attracted in the field of handwritten text recognition or text recognition. To address the issues related to handwritten expression, there are various many researchers that had proposed various different methodologies, each methodology has to address the different issues in various different ways that is used for detecting the segmented character from the image. In below section, we had present an overview of various survey approaches that has proposed various methodology for handling the issues related to handwritten text recognition.

Pratik Madhukar Manwatkar[1] has proposed a text recognition system which contains two different models for text recognition system. First model is Pre-Processing model which contain Noise removal, Normalization & Binarization which is used for scanning the paper document and converted in form of image. To increase the quality of Image and for better recognition of text from image they use Noise Removal method. To obtain the characters of uniform size, slanted and rotated they use Normalization method. For converting the scanned image into gray scale image and then grey scale image into binary image they had used Binarization technique. In this paper for Text recognition system, second model is Text Recognition model which contains Segmentation, Feature Extraction & Classification. Text Recognition model can be used for the

recognition of text from an image after applying pre-processing model i.e. Noise removal, Normalization, Binarization in the image and provide the result which are in computer understandable form. Segmentation is used for separating the character from its background between the individual characters of an image. To select the useful data from raw data they use Feature extraction process and for identifying each character they use Classification technique.

Savita Choudhary, Nikhil Kumar Singh, Sanjay Chichadwani[2] has proposed a Text Detection and Recognition from Scene Images using Maximally Stable External Regions (MSER) and CNN. To locate the smaller areas that contains text they had used canny edges with the help of MSER. For Segmentation of text into single character, they have applied algorithm on binary image. After that it has passed through the recognition model i.e. designed for unaligned and hazy characters. It follows two approaches Text region extraction for recognition of text area and Character Recognition for recognition of character using CNN.

Tan Chiang Wei, U. U. Sheikh, Ab Al-Hadi Ab Rahman [3] has proposed the Improved Optical Character Recognition with Deep Neural Network. For fetching of text information from images (based on pixels) to machine understandable text formats they have used Optical Character Recognition (OCR). There are certain problems are present in old or poorly printed documents, like characters that are printed on old or poorly documents are typically broken or blurred, so that the model used for character recognition are complex in nature. So that to reduce the complexity, they had used deep neural network using Inception V3. It is used to train and perform Optical Character Recognition (OCR). It follows two approaches i.e. OCR design model and Image Processing & Segmentation. OCR design model is splitted into four different blocks i.e. input acquisition & pre-processing, training, testing & validation. Image processing & Segmentation is used for extracting the segments like text character & symbols form the image and splitting the text character by character from its background. It has basically four steps i.e. grayscale conversion, binarization, dilation & segmentation.

Rohan Vaidya, Darshan Trivedi, Sagar Satra, Mrunalini Pimpale [4] has proposed Handwritten Character Recognition Using Deep-Learning Algorithm. In this they present an offline model for detecting the handwritten character using deep neural network. In this, they have designed a system which contains image segmentation which is based on Handwritten character recognition. For this system, they have used OpenCV for working on Image processing areas and Tensorflow & Keras for train the Neural Network. Convolution Neural Network (CNN) is used Tensorflow & Keras for train the model. Before training of model they have follow some steps involved in processing of images i.e. Image Pre-Processing, Conversion to Grey-Scale, Thresholding & Image Segmentation.

J. Pradeepa, E. Srinivasana, S. Himavathib [5] has proposed Neural Network Based Recognition System with Integrating Feature of Extraction and Classification for English Handwritten text. In this, for classification and handling of every individual English Handwritten text character they have to resize the image into 30 x 20 pixels. In the post handling stage, the characters which are perceived and they have changed the characters over to ASCII position. There are 600 neurons are present in Information layer which are equivalent to the number of pixels of the image. There are 26 neurons are present in Yield layer as equivalent to English Alphabet that has 26

letter.

IV. RESULTS

Handwritten text recognition system enables scan documents i.e. image which converted into computer readable documents. The benefit of this technology is the people not required to get manually retype the expressions which are present in the image. Handwritten recognition system extracts exact relevant information or expression from image automatically.

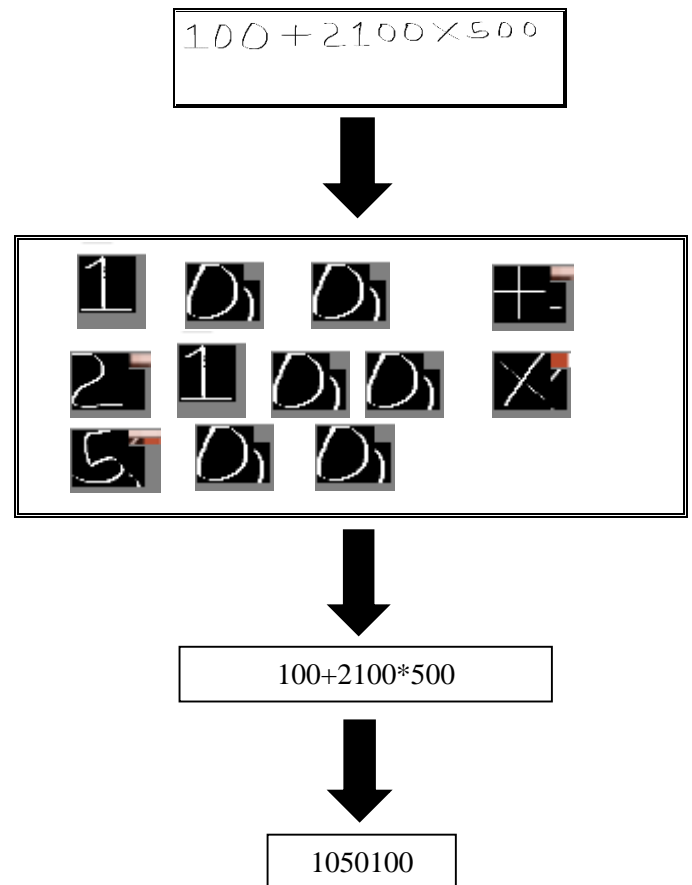


Figure 2 – Result of Handwritten Expression Solver

Above Figure 2 shows that we have taken handwritten expression in the form of image, after pre-processing the image it segmented the expression into character by character and after that it classifies each character and store in variable. After storing handwritten expression in the variable it solves the expression and shows the result.

V. CONCLUSION

In this paper we have reviewed various research paper about various different methods to find handwritten text expression from scene images. A lot of researches is already done in the field of Text recognition or Optical character recognition with the help of various different languages. It is very vast field and very innovative field, so that various researchers are working or attracted in these fields. We have chosen one of the method i.e. CNN that is used for train the model to detect the segmented character from the image and then after detection of character store it in variable and the solve that expression.

REFERENCE

- [1] Pratik Madhukar Manwatkar, Dr. Kavita R. Singh “A Technical Review on Text Recognition from Images” in 9th International Conference on Intelligent Systems and Control (ISCO) ,2015.
- [2] Savita Choudhary, Nikhil Kumar Singh and Sanjay Chichadwani “Text Detection and Recognition from Scene Images using MSER and CNN” in Second International Conference on Advances in Electronics, Computer and Communications (ICAECC), 2018.
- [3] Tan Chiang Wei, U. U. Sheikh, Ab Al-Hadi Ab Rahman “Improved Optical Character Recognition with Deep Neural Network” in IEEE 14th International Colloquium on Signal Processing & its applications (CSPA), 2018.
- [4] Rohan Vaidya, Darshan Trivedi, Sagar Satra, Mrunalini Pimpale "Handwritten Character Recognition Using DeepLearning " in 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018.
- [5] J. Pradeepa, E. Srinivasana, S. Himavathib, "*Neural Network Based Recognition System Integrating Feature Extraction and Classification for English Handwritten,*" International journal of Engineering, Volume 25, May 2012.