

Handwritten Character Recognition to obtain Editable Text

Prof. Vaibhav. V. Mainkar

Department of Electronics and Telecommunication
Engineering
SSPM's College of Engineering
Kankavli, Maharashtra, India
vaibhav.mainkar26@gmail.com

Mr. Ajinkya B. Upade

Department of Electronics and Telecommunication
Engineering
SSPM's College of Engineering
Kankavli, Maharashtra, India
ajinkyapade14@gmail.com

Ms. Jyoti A. Katkar

Department of Electronics and Telecommunication
Engineering
SSPM's College of Engineering
Kankavli, Maharashtra, India
katkarjyoti123@gmail.com

Ms. Poonam R. Pednekar

Department of Electronics and Telecommunication
Engineering
SSPM's College of Engineering
Kankavli, Maharashtra, India
poonampednekar16@gmail.com

Abstract— Developing an android application for character recognition to read the text from an image is a big area of research. Nowadays, there is a trend of storing information from the handwritten documents for future use. A simple way to store the information is image capturing of the handwritten document and save it in image format. The method to transform handwritten data into electronic format is 'Optical Character Recognition'. It involves several steps including pre-processing, segmentation, feature extraction and post-processing. Many researchers have been used OCR for recognizing character. This system uses the android phone to capture the image of the document and further steps are done by OCR. The main challenge is to recognize the characters from different styles of handwriting. Thus, a system is designed that recognizes the handwritten data to obtain an editable text. The output of this system depends upon the data that has to be written by the writer. Our system offers 90% accuracy for handwritten documents and gives the easiest way to edit or share the recognized data.

Keywords— *android studio; OCR; handwritten character recognition*

I. INTRODUCTION

Nowadays demand increases to create a paperless environment[1]. Recognition of handwritten text is easy for a human but it is a complex task for computer systems. Many researchers have done work on this field but 100% accuracy is not achieved by the researchers[2]. Our eyes can figure out the handwritten character of different people but the computer cannot do this easily. 'Optical Character Recognition' is the solution to this problem. Optical Character Recognition (OCR) is one of the techniques that convert the scanned or printed image document into an editable text document[3]. The objective of this project to utilize this feature through an android app. Developing our interest in the mobile application

which is growing in the software industry. The android app gives access to the user to recognize the text from saved images from the gallery or capture image through the camera. It can make users to easily edit and store the written data in text file format. The app uses a camera of an Android mobile device to take input. Input is a binary image scanned by the camera. The OCR engine process on the image data and convert it into a text[4]. The technology behind the OCR is to first scan the document or image using a scanner. Once the image is scanned OCR software convert image into black and white version. Then the image is analyzed by dark and light areas. Where dark area identified as character and light area identified as background and the dark area is considered for further process.

I. PROPOSED METHODOLOGY

OCR technology allows the conversion of a captured image into machine editable[5]. OCR technology do the work in three stages first is scanning of the document. Second is recognition of character and third is storing the text in the desired format.

Optical character recognition is the electronic conversion of scanned image or printed text into machine editable text[6]. Open-source OCR-Tesseract software is used for our work. Tesseract is considered as one of the most accurate open-source engines. The steps followed by Optical character recognition are shown in the algorithm as follows,

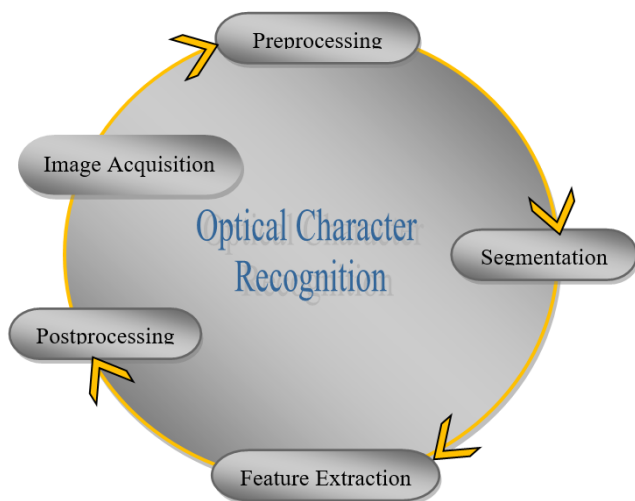


Fig.1. OCR Algorithm

A. Image Acquisition

The system i.e. OCR uses the android mobile. The camera helps to capture an image of handwritten documents. This is nothing but the scanning process. By scanning process, the original image can be made as a digital image. The original images are in the black colored text on a white colored background. This process makes the digital image as greyscale image[7].

B. Preprocessing

Preprocessing is one of the most important stages in character recognition. It helps to make grayscale images more readable for software. It filters out the impurities from the images. Preprocessing is important for handwritten images that are more sensitive to noise. Preprocessing has various task are such as greyscale conversion, binarization, thinning, skewing and normalization[8].

C. Segmentation

The segmentation is the most important process. Segmentation is done to make the separation between the individual characters. First handwritten text segmented into line, Line is segmented into word and then the word is segmented into a character[9].

D. Feature Extraction

The feature extraction is the step in which OCR recognize alphabets based on different classes. Feature extraction is the transformation of the input data into the set of features. It extracts the features from the text image. Features are nothing but their characteristics. The alphabets are classified based on slant angle, height, curves etc. The selected text is matched with the standard database preloaded in the system and the dataset, the highest correlation is selected and declared as a character. Feature extraction is concerned with the representation of symbols[10]. Once the character is recognized based on classification it is converted into text.

Feature detection gives information about the features of numbers or letters individually for the recognition of characters in the document[11].

E. Post-processing

The extracted output is only understood by the computer. So, there is need to be stored in some proper format (.txt). The recognized data in ASCII formed[12].

Steps involved in this work are: -

1. Image acquisition by the android camera
2. Loading the image into created Graphical User Interface (GUI) in android studio.
3. Preprocessing of the image.
4. Extraction of features from the input image.
5. Recognized data converted into text format using OCR[13].

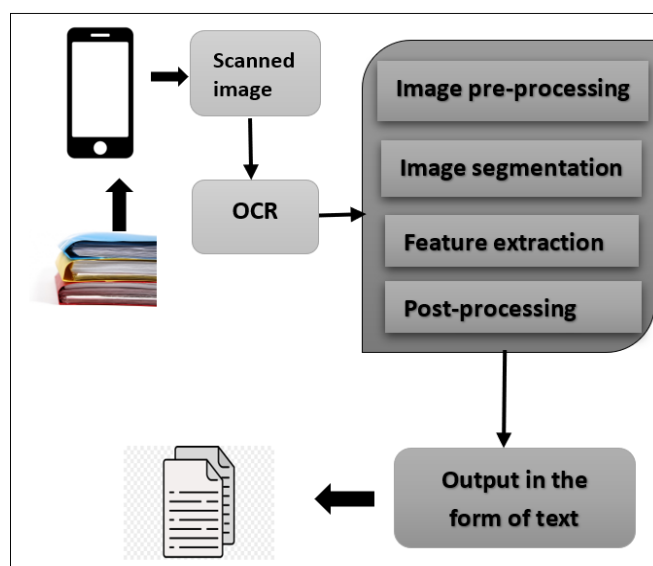


Fig.2. Architecture of proposed system

II. IMPLEMENTATION.

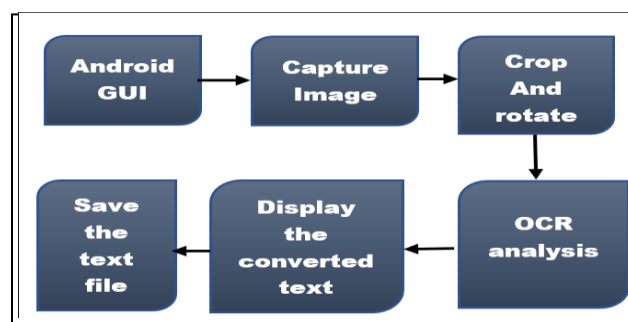


Fig.3. Architecture of proposed system

Firstly, an android app is being developed using android studio. The GUI provides the option to the user to capture the image[14]. The user can scan the images at the first stage. The

user will scan the document by the camera. Once there is an image in front of the screen the system functionality comes into the picture. The user has a choice to select the text to be recognized. Then the binary image is sent to the OCR engine for the further process[15]. The system is designed that can easily recognized handwritten characters as input data in a proper manner and can edit the recognized output and save the output in text format. Also, an option to share the output of the system which is in text format and save as pdf format.

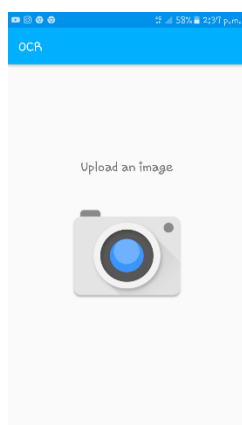


Fig. 4. The home screen of app

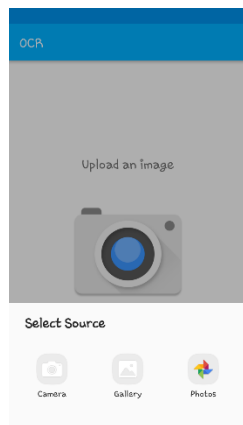


Fig. 5. Options for images

The user can use the GUI for capturing the handwritten document.[10] The user can load the image from the gallery or capture by camera. On clicking the camera icon shown in fig.4 a sub-window open. The sub-window shows three icons. First showing the camera second showing the gallery and third showing photo applications. On clicking any of these three icons, the image is selected to process.

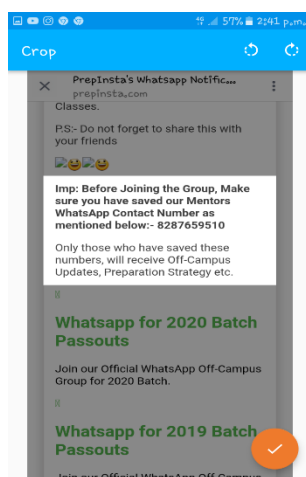


FIG. 6. CROP AND ROTATING

After opening the image, changes can be done like cropping and rotating and clicking on the done button, the cropped image is sent to the OCR engine. The cropped image is shown in fig.6

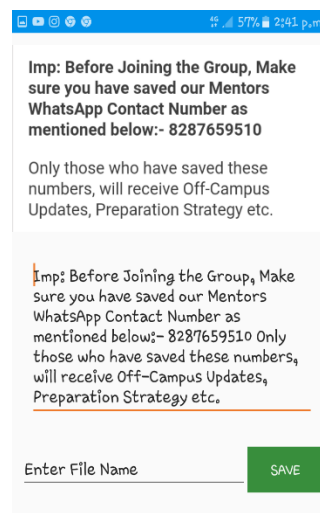


Fig. 7. Displaying converted text

The text converted from the image is displayed on the screen. This text is in editable form. Next, an option to save this converted text as text file(.txt) as shown in fig.7.

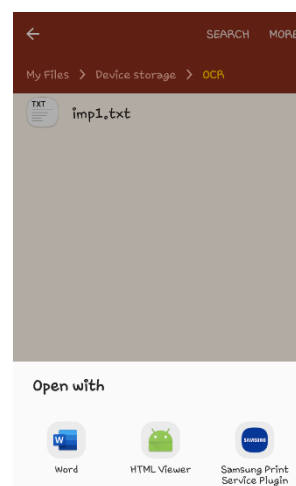


Fig. 8. Displaying converted text

This text file which consists of converted text will be saved in the OCR folder which would be created in the internal storage of the device. After finishing all the process, can open, edit and save that text file any time in future. This text file can also be saved as a pdf file.

III. RESULT

As shown in the result below, the image is captured using a camera. The captured image is converted into text using developed android application. The converted text is saved as a text file, which can be edited in future whenever required. The advantage of our system is that no internet connectivity is required for character recognition.

A. Handwritten Text

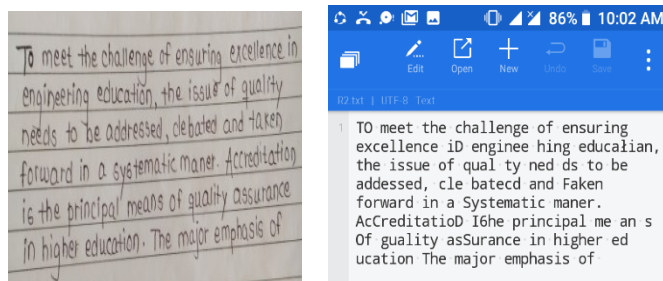


Fig.9. Displaying converted handwritten text

B. Printed Text

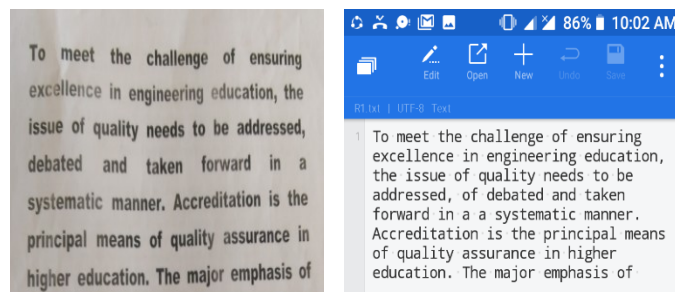


Fig.10. Displaying converted printed text

TABLE I. **TEST RESULT**

Input	Total Character	Recognized Character	Accuracy
Handwritten text	221	208	94.12%
Printed text	221	221	100%

CONCLUSION

This implementation gives conversion of Handwritten Character Recognition into editable text using the android app. The image is captured by the camera and loaded into the android app and choice is provided to the user to select a part of an image which is to be converted. Further processing is done by OCR engine and produces the converted text on the screen. The recognized text is saved in text format. To edit the recognized text a choice is given and save them in a proper location. More accuracy is achieved when text is in printed form rather than in handwritten.

ACKNOWLEDGMENT

Would like to thank all authors of the paper mentioned about their valuable information and would also like to thank our Department of Electronics and Telecommunication Engineering for their support and help during the entire journey of the project.

REFERENCES

- [1] Manwatkar, Pratik & Singh, K.. (2015). A Technical Review on Text Recognition from Images. 10.1109/ISCO.2015.7282362.
- [2] Sharma, Ankit & Chaudhary, Dipti & Ahmedabad, & India,. (2013). Character Recognition Using Neural Network.
- [3] Robby, G. & Tandra, Antonia & Susanto, Imelda & Harefa, Jeklin & Chowanda, Andry. (2019). Implementation of Optical Character Recognition using Tesseract with the Javanese Script Target in Android Application. Procedia Computer Science. 157. 499-505. 10.1016/j.procs.2019.09.006.
- [4] Vasudeva, Nisha & Parashar, Hem & Vijendra, Singh. (2012). Offline Character Recognition System Using Artificial Neural Network. International Journal of Machine Learning and Computing. 449-452. 10.7763/IJMLC.2012.V2.165.
- [5] Sarkar, Deepayan. (2004). Optical Character Recognition using Neural Networks (ECE 539 Project Report).
- [6] Chaudhuri, Arindam & Mandaviya, Krupa & Badelia, Pratixa & Ghosh, Soumya. (2017). Optical Character Recognition Systems. 10.1007/978-3-319-50252-6_2.
- [7] Liang, Jian & DeMenthon, Daniel & Doermann, David. (2008). Geometric Rectification of Camera-Captured Document Images. IEEE transactions on pattern analysis and machine intelligence. 30. 591-605. 10.1109/TPAMI.2007.70724.
- [8] Ahmed, Muna & Abidi, Ali. (2019). REVIEW ON OPTICAL CHARACTER RECOGNITION.
- [9] Sharma, Ankit & Chaudhary, Dipti & Ahmedabad, & India,. (2013). Character Recognition Using Neural Network.
- [10] N. Venkata Rao, Dr. A.S.C.S.Sastry, A.S.N.Chakravarthy, Kalyan Chakravarthi "optical character recognition technique algorithms", Journal of Theoretical and Applied Information Technology, Vol.83. No.2, 20th January 2016.
- [11] Manoharan, Samuel. (2019). A SMART IMAGE PROCESSING ALGORITHM FOR TEXT RECOGNITION, INFORMATION EXTRACTION AND VOCALIZATION FOR THE VISUALLY CHALLENGED. Journal of Innovative Image Processing. 1. 31-38. 10.36548/jiip.2019.1.004.
- [12] Chirag Patel, Atul Patel, Dhamendra Patel, "Optical Character Recognition by Open Source OCR Tool Tesseract A Case Study", International Journal of Computer Applications Volume 55- No.10, October 2012.
- [13] Metcalf, T..(1986). Automatic character recognition system. Patent Department of the Navy, Washington, DC..
- [14] Tiwari, Usha & Jain, Monika & Mehruz, Shabana. (2019). Handwritten Character Recognition—An Analysis. 10.1007/978-981-13-0665-5_18.
- [15] Kaur, Dalvir & Sharma, Sukesha. (2019). Various Feature Extraction and Classification Techniques. 10.1007/978-981-10-8234-4_51.