IJCSE International Journal of Computer Sciences and Engineering Open Access
Technical Paper Volume-04, Issue-02 E-ISSN: 2347-2693

Implementation of OCR Based on Template Matching and Integrating it in Android Application

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www.ijcseonline.org

Received: Jan /19/2016 Revised: Feb/02/2016 Accepted: Feb/12/2016 Accepted: Feb/29/2016

Abstract: Smart lens is an implementation of OCR in an android application which is an augmented reality meaning application. It uses built in camera on smart phones to quickly scan an image to find and recognize the word and then displays the meaning of the given word on the device's display. Its main component is optical character recognition (OCR), which is used to identify words in that image and uses a dictionary to provide the meaning. Optical character recognition is an electronic or mechanical process which converts handwritten, typed or printed text into machine encoded text. The desired word is extracted and the word undergoes various processes like filtering, gray scaling, binarization, feature extraction and character recognition. In this paper we present a way to build an OCR which can be used to read the text and thereby integrating it into the android application which will provide the meaning for the word using the inbuilt dictionary.

Keywords: Android application, Augmented reality, Optical Character Recognition (OCR)

I. INTRODUCTION

Suppose while reading a newspaper or a book, we come across a particular word which is new to us and we want to know the meaning or definition of that particular word. The task of finding the meaning or definition of that word by searching it in the dictionary or typing the entire word in mobile dictionary is time consuming. This relatively lengthy process can be minimized by simply clicking the image of the required word and the meaning or the definition will be displayed using the application on the screen itself.Smart Lens application will provide an on-the-go service to the user which will recognize the words from the image and find its meaning without any active connection to the network. The application will read an input from the devices' camera, will recognize the word using OCR, find the meaning of the word present in the image frame and will display it on the devices' screen.[1]

II. METHOD

The OCR application will first click the image and select the required portion of the image using resizable window and process it for character recognition. The main part of this application is OCR which consists of the following five stages:

1. Image filtering
2. Gray scaling
3. Binarization
4. Connected Component Labelling/Segmentation
5. Feature Extraction and character recognition.

After the OCR, the meaning of the extracted word is searched using the inbuilt dictionary and is displayed on the screen.

1. Image filtering:
   - The first step in OCR is image filtering. Image filtering is used to remove the noise from the image and for the smoothening purpose. The algorithm that has been used to perform image filtering is median filtering. Median filter is a popular algorithm used to remove unwanted noise. It is a typical pre-processing step which improves the results of latter processing.

2. Gray scaling:
   - The second stage involves gray scaling of the image. Gray scaled images have many shades of gray. A gray scaled image is a result of measuring intensity of each pixel. In order to achieve accuracy, input document should be gray scaled. To convert a color from a color space based on an RGB color model to a grayscale representation, following function is used,

$$Y = 0.2126R+0.7152G+0.0722B \text{ [4]}$$

3. Binarization:
   - In binarization process the gray scaled image is converted to binary image which consists of only black and white pixels, each pixel of the gray scaled image is converted to either black or white pixel using the histogram. Histogram decides the threshold based on which the pixel is characterized as either background (white) or foreground (black).

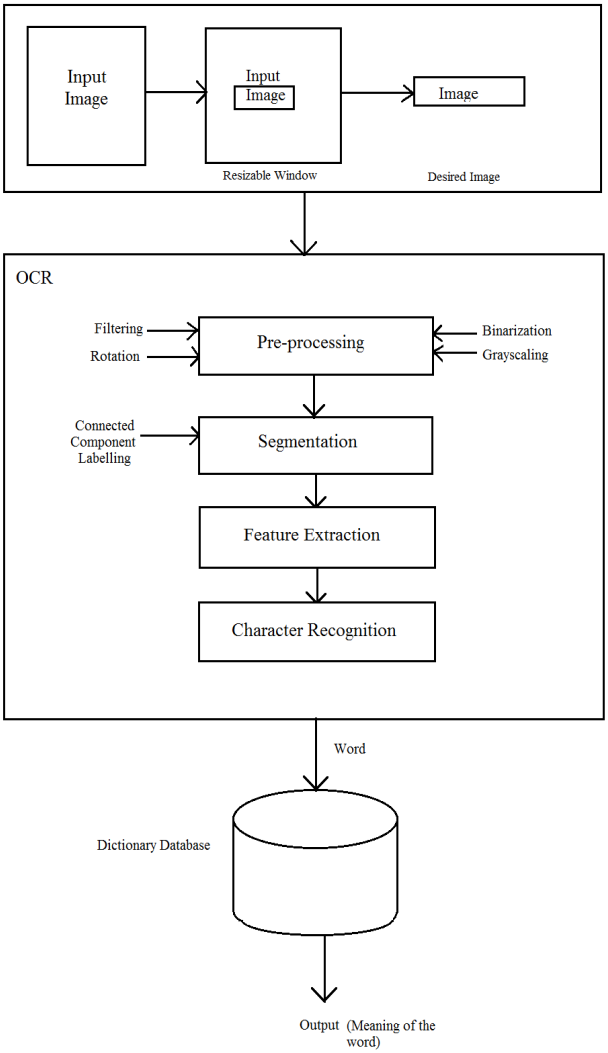
4. Connected Component Labeling:
   - Connected component labeling is a next part of the OCR where each letter is uniquely numbered, the relevance of numbering is that the each connected portion of the image can be processed separately. This process takes place in two phases, in first phase the initial label counter is maintained. If the pixel is a background pixel then it is labeled as 0; while if pixel is foreground pixel and none of its adjacent pixels are labeled then it is labeled with the label counter value and the label counter value is incremented by one. But if the adjacent pixels are labeled then pixel takes the least value form the adjacent pixels.
   - There can be instances where there is the same connected portion that might have more than single label value, hence in second pass each pixel is re-labeled with the lowest value of its adjacent pixels which ensures that each connected component has a unique label.[1]

5. Feature Extraction and Character Recognition:
   - Once each connected portion of the image is uniquely labeled, it is possible to recognize the letter from image by performing the cross correlation for each connected portion with the Template of alphabets. By performing cross correlation we can find out for which letter in the template the cross correlation value is optimum and corresponding letter can be recognized.

After the above steps, the meaning of the word is searched through the inbuilt dictionary in the application and the resulting definition or meaning is displayed on the screen window. [1]

III. WORKFLOW

The entire OCR process is described in the given flowchart indicating the five main stages necessary for OCR functioning.



IV. TECHNOLOGIES ASSOCIATED

1. Java is widely used object oriented programming language which we have used in component designing.
2. Android is a mobile operating system based on Linux kernel which has been used to build the application.

V. FUTURE SCOPE

1. Currently we have developed our project only for English text, in future we are thinking of extending it to other languages as well.
2. Our project currently deals with displaying the meaning of only a single word at a time, in future

we can extend this to displaying the meaning of the entire sentence.

3. The above project can be built on any of the mobile operating systems like iOS, android, windows or on desktop applications.

VI. CONCLUSION

Thus, we have proposed to build our own OCR using template matching algorithms that will run on the android application. Various tasks such as gray scaling, binarization, connected component labeling followed by feature extraction and character recognition has been efficiently implemented. The proposed system will hence enable the user to quickly find the desired meaning of the word using this application.

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