

Implementing Kannada Optical Character Recognition on the Android Operating System for Kannada Sign Boards

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ABSTRACT: This paper focuses on an application that performs Kannada OCR (Optical Character Recognition) in hand held devices. The objective is to make use of the visual capabilities of the built in camera of Android devices to extract text from Kannada sign boards, newspapers etc., and use the same platform to implement the OCR technology with the help of kohonen's algorithm. Another aim of this application is to find the meaning of the word detected on the Internet. With the help of an initial, sample data, the Kohonen network is trained. The image taken is further processed by initially thinning the characters in the image using the Hilditch algorithm. The image is processed, eliminating small distortions present. The image is then converted to into a greyscale image, which is segmented and the result is displayed along with a vocal output. These characters may be edited by the user and its meaning is then displayed in English.

Keywords: Optical Character Recognition, JAVA, JVM, Android, Image Processing

I. INTRODUCTION

This paper will enable users to use the application developed for regular purposes. This will enable them to read and understand the various boards, advertisements, shop names, addresses, business cards etc. Extracting text from these require accurate recognition of the characters amidst different environmental conditions like luminosity, rotation, reflection, scaling among others. Since creating an algorithm with a one hundred percent correct recognition rate is almost impossible due to noise and different font styles, but one can design character recognition algorithms and develop applications with these failures in mind so that when mistakes are inevitably made they will at least be understandable and predictable to the person using them.

Recognizing characters present in an image makes the processing of various different kinds of data comparatively easier. The computing device can be outfitted with a camera so that software in the device can use this to take pictures of the data available like a hand written text and give the characters written as an output. Another aim of this application is to find the meaning of the word detected on the Internet. In order to find the meaning of recognized words and characters a link to a popular Kannada website is used. This takes Kannada words in English and displays the meaning accordingly. Proper user interface has to be created which should help the user to easily enter and accurately and obtain

meaning for any Kannada word present in a standard Kannada dictionary.

II. LITERATURE SURVEY

In day-to-day life there are a lot of situations where one is unable to understand scripts in other languages. An automated system for reading documents or cards has also gained importance in various fields. All of these can be addressed by optical character recognition software. The project will be useful mainly when it is extended to different regional languages. Android gives a platform where one can easily install applications and use them effortlessly. Most of the Android supporting devices also contain a built in camera, which are capable of taking good quality pictures. This project aims to make use of the Android platform [1] to develop an application for recognizing characters by taking pictures of them through built in camera with a relatively dependable efficiency.

OCR is crucial to the computerization of printed texts so that they can be electronically searched, stored more compactly, displayed on-line, and used in machine processes such as machine translation, text-to-speech and text mining. OCR is a field of research in pattern recognition, artificial intelligence and computer vision.

OCR has been in development for almost 80 years, a patent for an OCR machine was filed by a German named Gustav Tauschek in 1929, and an American patent was filed subsequently 1935. OCR has many applications, including use in the postal service,



language translation and digital libraries. Little or no development was done between the years of 1996 and 2006.

Early optical character recognition could be traced to activity around two issues: expanding telegraphy and creating reading devices for the blind. Later it was continued to develop OCR technology for data entry. It was proposed to be used in photographing data records and then, using photocells, matching the photos against a template containing the desired identification pattern. OCR software is analytical artificial intelligence systems that consider sequences of characters rather than whole words or phrases. Based on the analysis of sequential lines and curves, OCR make 'best guesses' at characters using database look-up tables to closely associate or match the strings of characters that form words.

An OCR engine was developed by Hewlett-Packard between 1985 and 1994. It is one of the most important applications of the OCR technology. It is most suitable for backend working. Apart from character recognition the software can also detect whether the text is mono spaced or proportional. Various papers have been presented on the OCR over the years. Some of them are:

The use of OCR for logo matching. The paper [2] gives an insight into logo matching where translation, scale and rotation of the image containing the images. The image is prepared by processing the image using various transformations. As the paper is dealing with logos and not characters of similar fonts and sizes they have used feature extraction for processing the image and for character retrieval. Various experiments like baseline technique, evaluation metrics are used to compare the accuracy of the application.

Paper [3] describes an accurate OCR for English. The paper mainly concentrates on business cards with fixed font and colour characters. The approach taken is a very simple one, comparing the characters with the one present in the database as English has only 26 alphabets. There is no use of any type of neural network like artificial or Kohonen neural network. The author uses a very soft approach but tries different experiments to prove that in OCR 100% accuracy is possible. This paper gives a very basic idea of the technology and introduces it to the beginners.

Paper [4] describes the application of OCR in scanning books. The main aim is to make the technology useful for reading e-texts and e-books. The unique words in vocabulary of the book are lined up against the outputs of the OCR. This is done repetitively till the number of such words become very less. Distance based alignment algorithm is used for alignment of the text. This is used

for character recognition of books written in Spanish, French, English and German.

Paper [5] explains the optical character recognition using neural network for Bangla characters. The paper gives an object oriented modelling framework of a Kohonen based character recognition system. The paper provides an insight into the regional language, the challenges faced and the feature extraction method, which is used for the character detection. The paper helps to learn the implementation of OCR to Indian regional languages, as the number of characters including vowels, consonants and complicated letters are very much similar to most of the other Indian languages.

III. ALGORITHMS USED

Kohonen Neural Network Algorithm:

The Kohonen neural network differs from other networks as it is an unsupervised network i.e. only the input of the network is initialized and the output of the network is not set. In Kohonen neural network one of the neurons decides the output as it becomes the winning neuron. The weights associated with the input nodes are set between 1 and -1. The input is normalized by using the vector length of the input data. For each neuron the output is calculated and the best neuron is selected as the winner. Thus every time a winner is selected and the network is adjusted using the weights such that the possibility of the winning neuron increases for the same input in future. The network is initially trained using the sample data. Any Kohonen network consists of five parts. They are training set, Kohonen network, network, and neural reportable and sample data. The application being developed makes use of the sample data to train the network when the application launches and then for each character the network provides a winning neuron which helps to recognize the characters.

Image processing using Hilditch algorithm: The Hilditch algorithm is used during the image processing of the picture taken. It makes the image thinner by minimizing the dimensions of the characters. The algorithm tries to find the bounds to the image present. Every pixel of the image obtained from the Hilditch algorithm is compared with a threshold value, based on which the pixel is made either black or white. This makes the image more contrasting and helps to distinguish between the characters present in the image and the background.

IV. SYSTEM ARCHITECTURE

General Constraints:

1. End-user environment: The built in camera should be able to take good quality images so



that the processing of it does not lead to ambiguous or undesired result

2. Standards compliance: The API's used to develop the application should comply with the standard general API's of the Android version 2.1.
3. Interoperability requirements: Any device that will use or improve or integrate the application must comply with the standards, operating system and library requirements.
4. Memory and other capacity limitations: Very limited memory is needed. RAM should be of enough to run the application and also to process the image taken by mapping with the back end letters.

Development Methods:

The optical character recognition is being done using the Kohonen [6] neural network. A preliminary design of the network is done with number of input and number of output nodes. In the network an input is given but the output expected is not mentioned. With the help of some standard data the network is trained. With every character recognized the probability of detection of the characters increases. Different packages are used for implementing different activities like camera, result, meaning etc. The processing of image is designed and improved iteratively to reach a state from where the recognition can be done relatively easily. A module to be developed to find the meaning of meaningful words by taking the input in English. Unit testing is carried at each level after the development of each module and integration testing is carried out to localize the errors and to debug them. Various features of Android like DDMS containing logcat is used extensively to localize the errors. The application development was started with limited functionality but later much additional useful functionality were introduced like TTS based methods for vocal output or meaning finder using a standard dictionary link.

Data flow diagram:

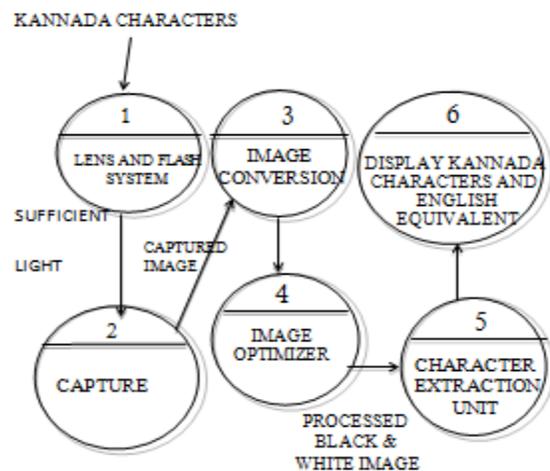


Figure 1. Data-flow Diagram

The data flow diagram explains the character recognition process. The input images are optimized to get the best results and then they are compared with the characters in the character extractor unit, various characters are recognized and they are displayed along with their equivalent English meaning. i.e., the camera consisting of the lens and flash system captures an image of the Kannada script if sufficient light is present. The captured image is then processed and optimized, i.e., the characters are made thinner and excess noise present in the form of shadows, creases etc. are removed. It is then made into a black and white image. The Kannada characters present can now be extracted in the character extraction unit. The characters are converted into English characters and are displayed.

V. IMPLEMENTATION DETAILS

The working of the application is as follows:

- With the help of the sample data the Kohonen network is trained after initializing the network with input nodes and output nodes. The network is unsupervised type [9], as the output is not known.
- In Kohonen network one of the output nodes is each time selected as a winning output thus the whole single process of detecting each character is decided with the help of an output node.
- With each character recognized the network is adjusted so that the accuracy of the application increases for next character recognition.



- The image taken is further processed [10] by initially thinning the characters in the image using the Hilditch algorithm.
- The image is processed for noise removal [11] thus eliminating the little distortions present.
- Every pixel of the image is analyzed and if the value of any pixel is greater than a threshold value the pixel is made completely black or else made completely white. Thus the characters are made highly contrasting when compared with the background.
- The image is segmented [12] to separate and distinguish the characters from one another and processed individually to recognize each of them.
- The result is displayed on the result activity along with the vocal output.
- The characters recognized are taken into a textbox where the user can edit the word or give any Kannada word in English of his interest to obtain the meaning.
- Finding the meaning of the words is not done by comparing it in the back end but it is being done by connecting to the internet and using any one of the popular Kannada dictionary sites. Thus the whole application would run on a lot less memory as the meaning for word need not be saved in any file in the back end

VI. TESTING

There were a number of challenges faced while implementing the OCR. Few of them are mentioned below.

Displaying the meaning automatically:

While displaying meaning automatically along with the words recognized would lead to a certain problem where an extra input textbox has to be provided making the whole meaning on net module redundant.

Hence the recognized characters were taken directly into the textbox and also it makes the user to directly edit them if the Kannada words in English are not completely compatible. It reduces the redundancy as finding the meaning of recognized words and some random words in which user is interested need not be done by two separate modules.

Background shadows in the image:

While taking the image the background image may contain some shadows. These irrelevant shadows may cause a large distortion when the image is processed and these shadows become more prominent resulting in the wrong identification of characters.

As processing the image results in removing the little distractions it also causes the shadows to become more prominent, so care should be taken to take image with very less shadow falling on the image. The resulting image also depends on the built in camera of the device, hence the processing and result of shadows may vary depending on the device.

VII. EXPERIMENTAL RESULTS

The picture of the printed/written Kannada text will be taken as shown below. And this image is then processed.

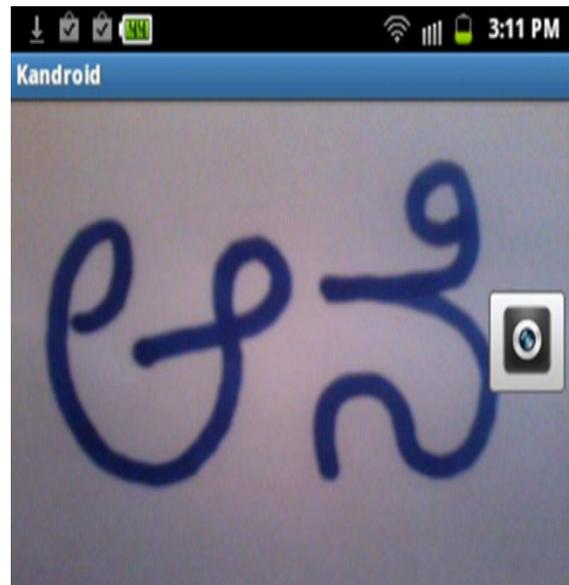


Figure 2. Image Processing

The photo is processed and made into a grey scale image which the application can read.



Figure 3. Conversion to Grey Scale Image

As shown below, the exact English translation of the Kannada word is displayed. It may be modified by the user. The word's English meaning is then found with the help of the internet and is displayed as well.

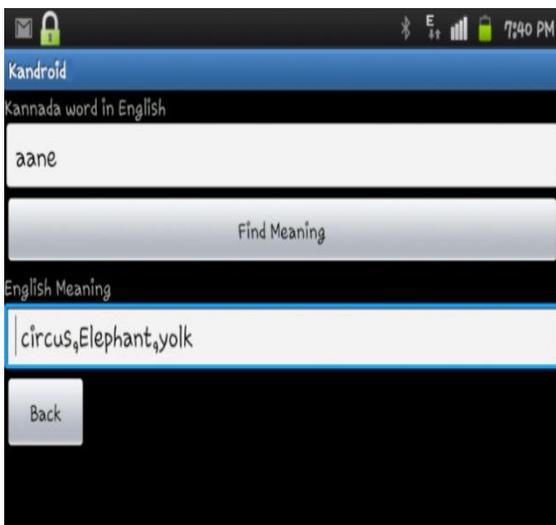


Figure 4. English Conversion of Kannada Word

VIII. USE OF KANNADA OCR

Kannada Optical Character Recognition (Kannada OCR) refers to an application that performs optical character recognition of characters from images in which text is printed in Kannada. It converts Kannada characters into English characters and also provides its English meaning. This application will be useful for those individuals who

have no knowledge about the Kannada language and hence require assistance to read any information presented in this language. It is quite simple as they just have to click a picture of a notice board/poster and they will get to know how to read it along with the meaning of the notice board/poster. It is a very useful application for tourists as well.

IX. CONCLUSION

The paper is based on an Android application based on optical character recognition concept for normal Android device users. The implementation uses the Kohonen neural network for better accuracy and speed. The application uses a set of already predefined characters to train the network after launching it. The user has to make use of built in camera on the device to take a picture containing the Kannada characters or words. The image is processed further to remove the noise, improving the contrast between the characters and the background and scaling the image. The characters are distinguished and separated from each other and individually identified through the network. With every correct identification, the network makes sure that the probability of recognizing the character increases. The characters recognized are displayed in the result along with the voice output. The recognized characters are directly taken as input to the text box and the user can even enter any words of his choice to find the meaning. When the application is not able to detect the characters due to large distortion a suitable error message is displayed and also when not able to find the meaning due to slow internet or a bad input a message is displayed.

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