Recognition of Handwritten Devnagari Characters through Segmentation and Artificial neural networks

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Abstract

Handwritten character recognition is the ability of a computer to receive and interpret intelligible handwritten input from sources such as paper documents, photographs, touch-screens and other devices.Handwritten Marathi Characters are more complex for recognition than corresponding English characters due to many possible variations in order, number, direction and shape of the constituent strokes. The main purpose of this paper is to introduce a new method for recognition of offline handwritten devnagari characters using segmentation and Artificial neural networks. The whole process of recognition includes two phases- segmentation of characters into line, word and characters and then recognition through feed-forward neural network.

Keywords—handwritten character recognition, Segmentation, line segmentation, word segmentation, character segmentation, lower modifier, upper modifier, Header line, Baseline, feed-forward neural network.

1. Introduction

Character recognition plays an important role in the modern world. It can solve more complex problems and make human's job easier. An example is handwritten character recognition. Every individual has his own style of writing. Any individual having a very good knowledge of the script of a language can easily read some words written on a paper, though those are written in very bad manner, on the basis of his/her mental dictionary. Such words cannot be easily read by a machine as there may be various irregularities caused in expressing these words which are not easy to handle by a machine. Due to very strange styles of writing, a lot of difficulties are faced in machine recognition process. In recent years, a lot of research has been done in handwritten character recognition, but very little is done on the integration on segmentation and recognition based on neural networks. Optical character recognition (OCR) is the mechanical or electronic translation of scanned images of handwritten, typewritten or printed text into machine-encoded text. It is a process that converts words or characters, on a printed page into a digital image, and creates a digital file so that users can later search for that text and characters within that text. Handwritten character recognition is an important field of Optical Character Recognition. Here, in this paper, we will be considering the integration of segmentation and recognition using artificial neural networks.

The paper is organized as follows- The optical character recognition is introduced in section 2. Applications of OCR are discussed in section 2.1. Section 3 describes the Devnagari script. Section 3.1 gives the properties of the devnagari characters. Section 3.2 discusses structural analysis of touching characters. In section 4, the segmentation process is given. The proposed system is given in section 5. Concluding remarks are given in Section 6.

2. Optical Character Recognition

Optical Character Recognition (OCR) translates the scanned printed or handwritten document images into a text document.

Handwritten Character Recognition is an intelligent OCR capable of handling the complexity of writing, writing environment, materials, etc. Here is the Traditional OCR system structure:
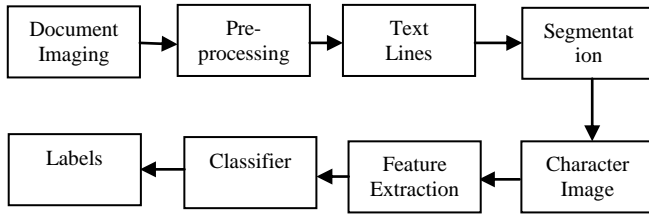

Figure 1: Traditional OCR

2.1. Applications of OCR

An OCR can convert the text from the image into text that can be easily edited on the computer. Following are the applications of OCR.

1. Automatic text entry into the computer for desktop publication, library cataloguing, ledgering, etc.

2. Automatic reading for sorting of postal mail, bank cheques, postal code reading, commercial forms reading government records, manuscripts and their archival and other documents,

3. Document data compression: from document image to ASCII format,

4. Language processing such as indexing, spell checking, grammar checking, etc.,

5. Multi-media system design, etc.

3. Devnagari Script

Devnagari script is different from Roman script in several ways. This script has two-dimensional compositions of symbols: core characters in the middle strip, optional modifiers above and/or below core characters. Two characters may be in shadow of each other. While line segments (strokes) are the predominant features for English, most of the characters in Devnagari script are formed by curves, holes, and also strokes. In Devnagari

language script, the concept of uppercase, the lower-case characters, is absent. But the alphabet itself contains more number of symbols than that of English. Marathi is an Indo-Aryan language spoken by about 71 million people, mainly the Marathi people of western and central India [8]. It is the official language of the state of Maharashtra. Marathi is thought to be a descendent of Maharashtri, one of the Prakrit languages which developed from Sanskrit. We know that the Handwriting style varies from person to person. It has a large character set with curves and lines in the shape formation, which may be over lapping (touch) in a word. Touching characters can touch each other at different position because of individual writing styles vary greatly. Following are the various regions of a devnagari script [11, 15].
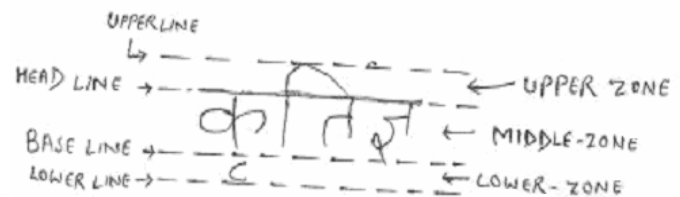

Figure 2: Devnagari script structure

Devanagari Script has 13 vowels ('svar) and 36 consonants ('Vyanjan') [2] and 10 numerals along with modifier symbols. All the individual characters are joined by a header line called "*Shiro Rekha*" which makes it difficult to isolate individual characters from the words. There are various vowel modifiers which add up to the confusion [3]. Minor variations in similar characters can be there in the handwriting.
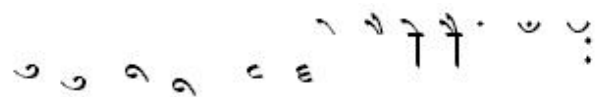

Figure 3: Modifiers

Figure 4: vowels and consonants

3.1 Properties Of The Devnagari Characters

Basically, there are three classes of basic characters based on presence and position of vertical bar.

- End bar characters

- Non bar characters

- Middle bar characters

3.2 Structural Analysis of Touching Characters

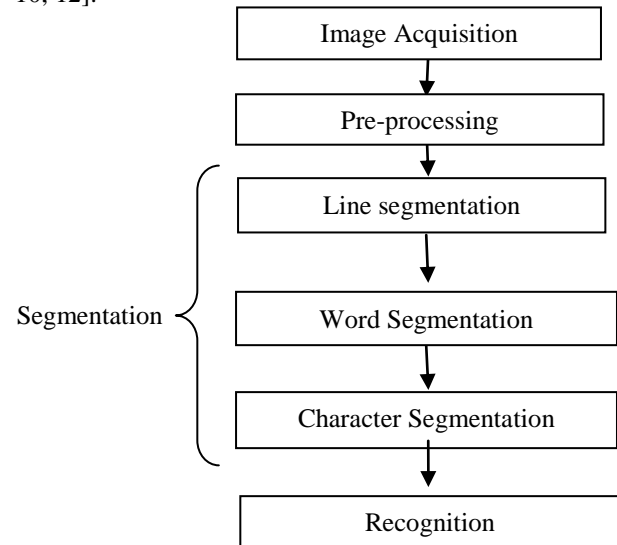Based on the above discussion, we can categorize the devnagari characters as follows [1]:

Category 1: Touching characters containing sidebars or no bar at right end

Category 2: Half character touching to full characters containing sidebars at right end.

Category 3: Pattern between two vertical bar of touching characters that may have middle bar character.

4. The Proposed System

So, the proposed system can be summarized as [6, 7, 9, 10, 12].

5. The Segmentation Process

In the proposed system, the recognition process of scanned text document image to the digitized image consists of the following steps [5, 17] - Preprocessing, Segmentation of lines, Segmentation of words, Segmentation of Characters, Recognition using neural network

- Preprocessing

The total process of preprocessing of the image can be summarized as follows [4, 13, 16] – Scanning the Image, Skew detection and correction, noise removal, Binarization, Normalization

- Line segmentation

It includes segmentation of lines based on the Bounding box formation. Before that, thinning of characters will be

done. We will make the following assumptions while performing the segmentation.

1. The height of the character (including the modifiers) should be 100 pixels.

2. The skew should be less.

Original image-

Image after line segmentation-

…………………………….

- Word segmentation

- Character segmentation

- Neural Networks

Neural Networks are definitely the preferred approach for recognizers, in cases of small variability of patterns. A neural network is a powerful data modelling tool that is relationships. Neural networks are ideal for specific types of problems, such as processing stock markets or finding trends in graphical patterns.

Here, the Feed forward neural network will be used to recognize the segmented characters of devnagari script [14]. In this paper, we proposed a system capable of recognizing handwritten characters or symbols with the help of neural networks.

6.   Conclusion

We can conclude that, most of the work in character recognition area is done on either segmentation or on only recognition of segmented characters. Development of handwritten Devnagari OCR is still a challenging task in Pattern recognition area. Here, we propose a method which does the segmentation of handwritten characters into line segmentation, word segmentation and character segmentation. And further recognition process will be done with the help of neural networks. The attempt is to improve the performance in terms of time and to get closer results.

7.   References

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