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Optical Character Recognition Implementation using Pattern Matching

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Abstract: This paper represent an algorithm for implementation of Optical Character Recognition (OCR) to translate images of typewritten or handwritten characters into electronically editable format by preserving font properties. OCR can do this by applying pattern matching algorithm. The recognized characters are stored in editable format. Thus OCR make the computer read the printed documents discarding noise.
Keywords: Character recognition, feature extraction, pattern matching, training.

I. INTRODUCTION

Optical character recognition (OCR) is a process of converting a printed document or scanned page into ASCII characters that a computer can recognize. Computer systems equipped with such an OCR system improve the speed of input operation, decrease some possible human errors and enable compact storage, fast retrieval and other file manipulations. The range of applications include postal code recognition, automatic data entry into large administrative systems, banking, automatic cartography and reading devices forblind. Accuracy, flexibility and speed are the main features that characterized a good OCR system. Several algorithms for character recognition have been developed based on feature selection. Some of them have been found commercially viable and have gone into production like Omni Page, Word scan, Type Reader etc. The performance of the systems have been constrained by the dependence on font, size andorientation.

In these algorithms the recognition rate depends on the choice of features. Most of the existing algorithms involve extensive processing on the image before the features are extracted that takes more computational time

In this paper, we discuss a matrix matching based method for character recognition that would not only maintain efficiency and versatility but also effectively reduce the image processing time. The parallel computational capabilities of neural networks [1, 3, 5] ensures a high speed of recognition which is crucial task to a commercial environment. The key factors involved in the implementation are: an optimal selection of features which categorically defines the details of the characters, the number of features and a less image processingtime.

II. OCR SYSTEM DESIGN

The main functional modules in our OCR systems are: image acquisition module, pre-processing module, and feature extraction module and pattern generation. The main task of image acquisition module is to obtain text image from a scanner or a pre-stored image file. It is called 'image' because scanner actually scans pixel of the text and not characters when patterns are scanned and digitized, the data may carry some unwanted noise. For example, a scanner with less resolution may produce touching line segments and blurred images. A pre-processor [3,4] is used to smooth the digitized characters. Moreover, the system must be able to tackle touching characters, proportional spacing, changeable line spacing and change of font style in the scanned text, in addition to the problems of multi-fonts.
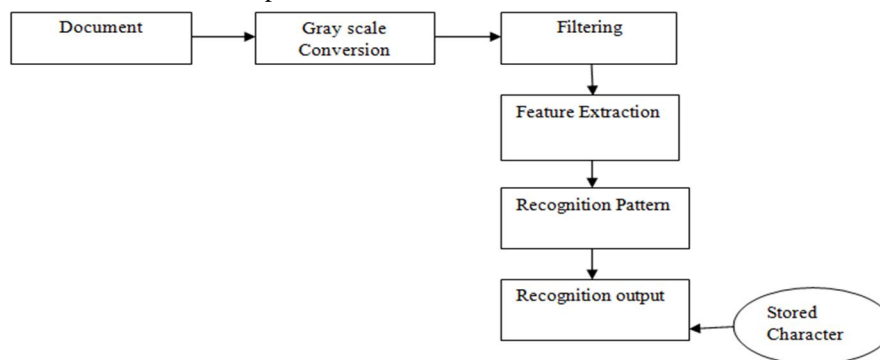

Figure 1. System Block Diagram

A. Grayscale

Grayscale images contains many shades of gray. By measuring intensity of each pixel the grayscale image is obtained. Input document should be gray scaled for achieving accurate output. To convert a color from a color space based on an RGB color model to a grayscale representation following function is used.

$$Y = 0.2126R+0.7152G+0.0722B$$

उपरोक्त विषयान्वये आपणास कळविण्यात येते की, शासकीय तंत्रनिकेतन, आर्वी येथे १६ ते २१ या वयोगटातील ३०० मुली शिक्षण घेत आहेत. सदर किशोर वयोगटातील मुलींसाठी स्वास्थ तपासणी शिबीर आयोजित करण्यास संस्था इच्छुक आहे.

Figure 2 Before Grayscaling

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Figure 3 After Grayscaling

B. Feature Extraction

In our system feature extraction is important part .the process of getting information about any object or group of object is known as feature extraction. A well-defined feature extraction methods makes the classification process more effective and efficient. The major goal of feature extraction is to extract a set of features, which maximizes the recognition rate with the least amount of elements and to generate similar feature set for variety of instances of the same symbol.

The input document may contain several lines of text that needs to be categorized into single character for recognition. For this purpose the following steps are to be applied: For row identification the document is to be scanned horizontally from top to bottom

1) The document is to be scanned for the initial darker pixel to be named as top of therow.

2) Now for bottom the next blank line is detected. The area between this is row of characters inimage.

Top

उपरोक्त विषयान्वये आपणास कळविण्यात येते की,शासकीय तंत्रनिकेतन, आर्वी येथे १६ ते २१ या वयोगटातील ३०० मुली शिक्षण घेत आहेत.bottom

Figure 4 Row Detection

3) Now each character is to be identified for the row obtained earlier. This is done by scanning the row vertically from top   to bottom, the first darker pixel detected is the leftmost (left) pixel of character. Now if all pixel are found to be blank then this is right of character
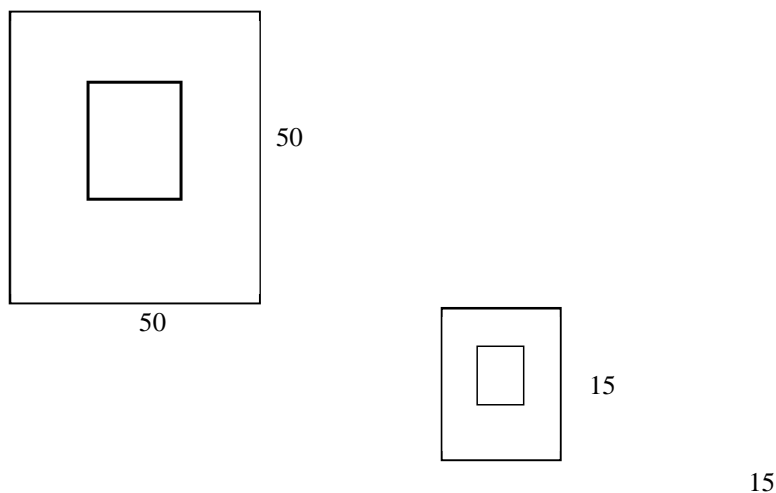
Top   right

उपरोक्त विषयान्वये आपणास कळविण्यात येते की,शासकीय तंत्रनिकेतन, आर्वी येथे १६ ते २१ या वयोगटातील

leftbottom

Figure 5 Boundary

4) The character from the scanned image is normalised from any pixel size to 15 X 15 pixel. It cropped the image by using top, left, right, and bottom boundaries as in figure6.

5) Now the cropped image of 15 X 15 can be binarized into array of 15 X 15, where black representing 1 and white representing 0 as shown in figure7.

Figure 7 Binarization of character

C. Recognition of Pattern

Pattern based recognition require matching of generated binary format with the existing template for this purpose the binary has been divided into 5 tracks and each track subdivided into 8 sectors. A corresponding track-sector matrix is to be generated, identifying number of pixels in eachregion.This procedure is shown in figure 8.
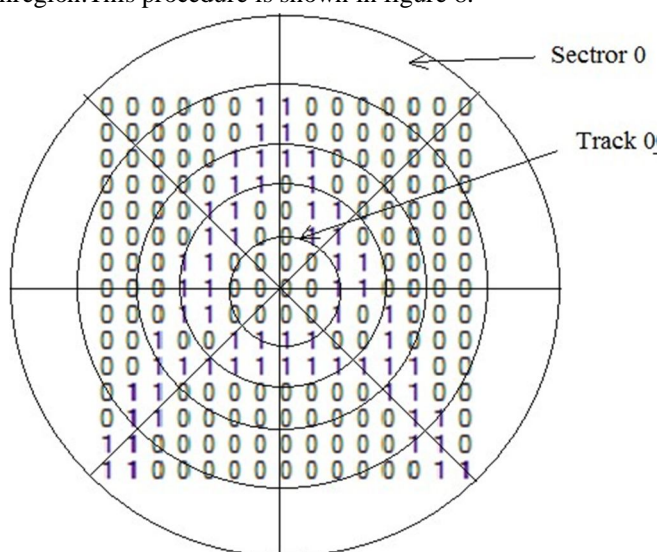

Figure 8 Division into tracks and sectors

III. RESEARCHRESULTS

The recognition rate for character images of same font used of up scaling is almost 100%.However, for down scaling the recognition rate reduces. Algorithm was tasted for handwritten characters where two observation affects the recognition rate.

A. People tend to use different fonts than the algorithm has been trained on.
B. Characters may have been written in bad handwriting.

IV. CONCLUSION

We have shown that Pattern Matching can be implemented successfully in optical character recognition. The system has image pre and post processing modules for text image. The experiment result shows recognition rate is 70% for noisy data to up to 75%. Further work is initiated for multiple font and size characters and hand written character recognition.

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