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Handwritten character Recognition and detection using histogram technique

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ABSTRACT : Cursive handwriting recognition is a challenging task for many real-world applications such as document authentication, form processing, postal address recognition, reading machines for the blind, bank check recognition, and interpretation of historical documents. Therefore, in the last few decades, researchers have put an enormous effort into developing various techniques for handwriting recognition. This chapter reviews existing handwriting recognition techniques and presents the current state of the art in cursive handwriting recognition. The chapter also presents segmentation strategies and a segmentation-based approach for automated recognition of unconstrained cursive handwriting. The chapter provides a comprehensive literature review with basic and advanced techniques and research results in handwriting recognition for graduate students as well as for advanced researchers.

Index terms **- Cursive Script, Detection, Extraction, Histogram.**

I. INTRODUCTION

In Current Scenario, Handwritten Character Detection is a hectic work. To recognize the historical documents and notes, current approach is quite not evaluative and considerable. Most of the Current Recognition Techniques does not work on Raw Images and Line Extraction. Segmentation is the most crucial part of the cursive handwritten recognition problem, which is used for the recognition. Here we are proposing the new System for Handwritten Character Detection. In our Project; we are using Histogram Technique for Scanned Hand written Images. This project in many Levels. For this; we need to create the database which includes the set of different styles of handwritten characters i.e. alphabets. Handwritten character detection, partition and Recognition implemented by using the Histogram technique. This Technique is User Friendly to Use and Effective in Manner.[1][2]

II. WORKING OF PROJECT

First we will take the Scanned Image of the Document. By using the Gray Scale Technique; we will reverse the Input Format of Image.

For Ex: if it is a Colourful Image, then we
will convert it into Black and White Image.
Then we will reverse the Mode of Image
i.e. if Background White and Fore Colour Black
then after reversing ;
Background = Black
Fore Colour = White

Now this is our Proper Input of Image for Further Line and Word Extraction.[3][4][6][7]
Working of proposed system can be divided into 6 sections-

1. Reversal of Image Mode
2. Creating A Data- Base
3. Line Extraction and Separation
4. Word Extraction and Separation
5. Character Extraction
6. Word Detection and Output

1. Reversal of Image Mode

In this Module; we will change the Mode of scanned image as completely explain Earlier. This will enhance the Visibility of the Image. By doing this, back ground and Fore Colour of Image White and Black will be Interchanged Respectively.[4]

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2. Creating a Data-Base

In this Module; we will create a set of Data base. Data base of hand written characters i.e. alphabets a-z in various different Styles and manners like the handwriting of different persons. Every Alphabets which is in database will have a ASCII value.

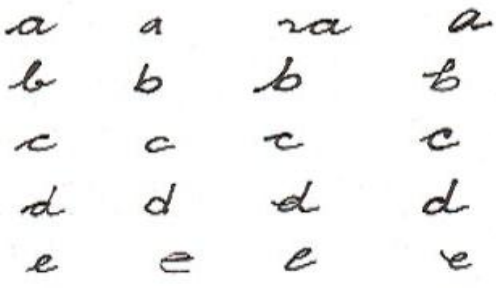
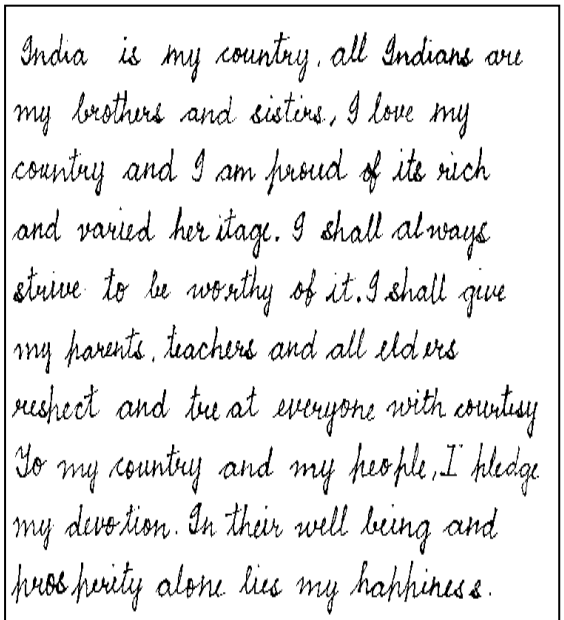


Fig.1 Alphabets in different forms

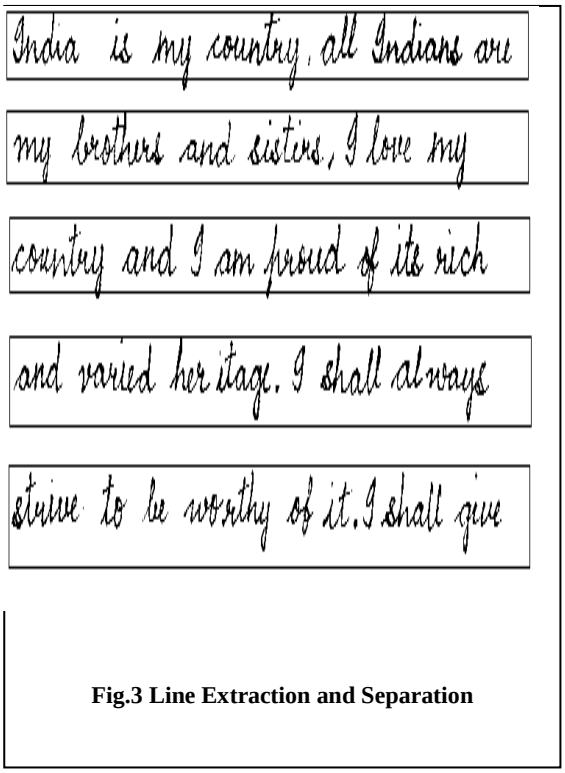
3. Line Extraction and Separation

For This Module; we will be using histogram Graph Technique. This technique will be applied as a whole of the Image. This will form Peak valley type Graph of each and every line of Scanned Image. The peak Valleys will indicate number of Lines in Scanned Image.[4]



India is my country, all Indians are my brothers and sisters, I love my country and I am proud of its rich and varied her itage. I shall always strive to be worthy of it. I shall give my parents, teachers and all elders respect and treat everyone with courtesy To my country and my people, I pledge my devotion. In their well being and prosperity alone lies my happiness.

Fig.2 Original scanned document



India is my country, all Indians are

my brothers and sisters, I love my

country and I am proud of its rich

and varied her itage. I shall always

strive to be worthy of it. I shall give

Fig.3 Line Extraction and Separation

4. Word Extraction and Separation

After Line Extraction, we will perform the Word Extraction. Here also we will use histogram Graph Technique. It will be having 1's and 0's values. The peak Valleys will indicate number of Words in Scanned Image.

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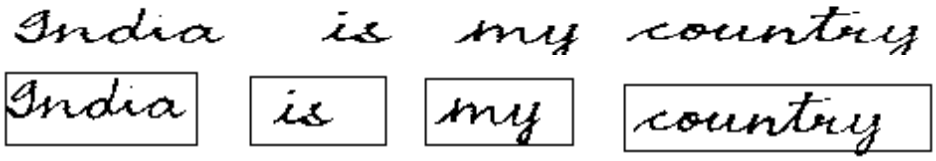

Fig.4. Word Extraction and Separation

5. Character Extraction

After Word Extraction; we will perform the Character Extraction. By comparing the Characters of the Word with the own constructed Hand written Data base. It will give us the recognized Extracted Character of the Input Word.

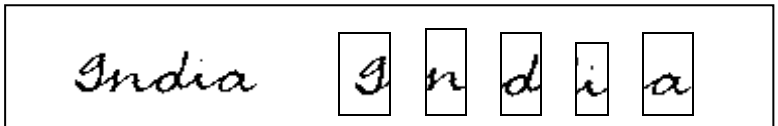

Fig.5 Character Extraction

6. Word Detection and Output

After performing Character Extraction and Detection; we will perform this. In this module; we will get the corrected proper format or our output as a complete Word. Proper Format Input will give us Proper Output.[7]

III. METHODOLOGY

A scanner is used to scan the handwritten English alphabets written on a piece of A4 size paper. Each character is enclosed in a box of size 80 x 80 in jpeg format. The image is converted into a binary matrix of size 80 x 80. Each matrix contains a large number of elements which conveys no information about the pattern. In order to eliminate such elements 80 x 80 matrix is compressed into a matrix of size 10 x 10. The 10 x 10 matrix is segmented column-wise into 10 segments of size 10 each. All the columns of a particular character are mapped into identical patterns used to recognize that particular character. In this way standard weight matrix is obtained for each character. Test characters are presented to the trained net. A counter is used to find out the number of identical patterns produced by the test character. Majority of the identical pattern present in a test character decides the existence of a particular character.[5]

A. Compression of 80 x 80 matrix into 10 x 10 matrix

A matrix can be compressed into a matrix of lower dimension in order to reduce the non significant elements of the matrix. Matrix A can be compressed into matrix A_COM by using the function Φ. Matrix A can be split into n uniform blocks. The dimension of each block A_BLOCKi is m x m.

B. Column-wise Segmentation of 10 x 10 Matrix

The 10 x 10 matrix is segmented column-wise into 10 columns of size 10 each. Each column is mapped into 10 identical patterns used to recognize a character. Weight matrix is initialized to zero. Perceptron learning rule is used to train the net.

1. Perceptron Learning Rule

In a simple perceptron one or more than one neurons are connected to a single neuron with the help of weights, (Fig.7). Weights may be initialized to 0 or very small values. An iterative procedure is used to find out the standard weights. At standard weights the net generates correct outputs.

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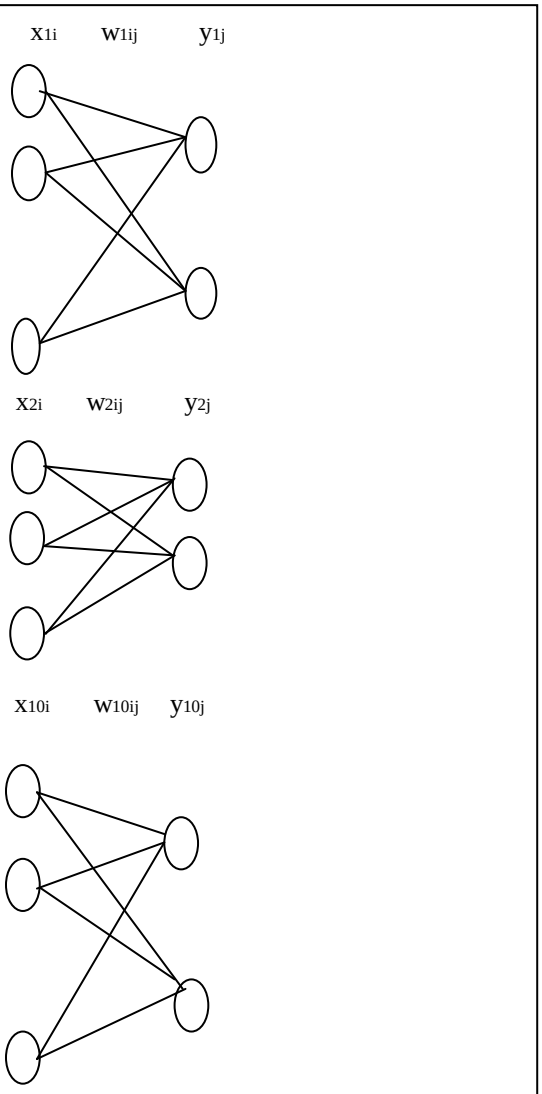

Fig.6 CSIM Neural Net, each block contains 10 inputs and 2 outputs

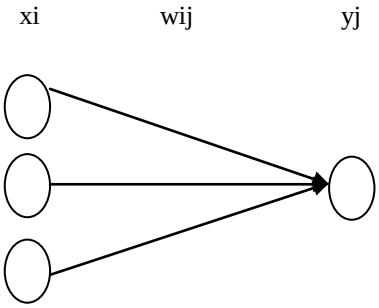

Fig.7 A simple perceptron having 3 inputs and one output

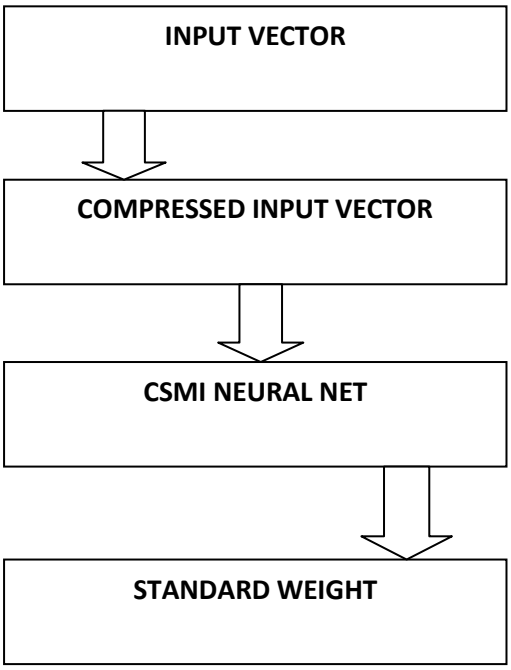

Fig.8 Conceptual Diagram of CSIM training

C. Training of the net to obtain the weight matrix

The training started with an input vector of size [80x 80 = 6400] , compressed into a vector of size [10x 10 = 100] , (Fig.8)

First four characters of the English alphabets are considered for training, (Fig.8). The weights are initially set to zero. The net, (Fig.6) is trained using Perceptron Learning Rule. After training the net for few epochs, the final weight that generates the correct output is obtained. The final weight obtained remains the same for the next few epochs and is considered as the standard weight for testing.

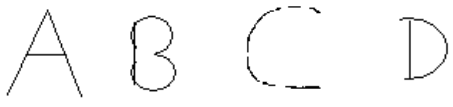

Fig.9 Alphabets considered for CSIM training

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D. Testing of the net

The net is tested with first four characters of English alphabets, deviated to the extent, at which the deviated character can be identified, (Figure 10). The testing starts with a [80 x 80 = 6400] vector compressed into a [10 x 10 =100] vector on the net as shown in Fig.1.

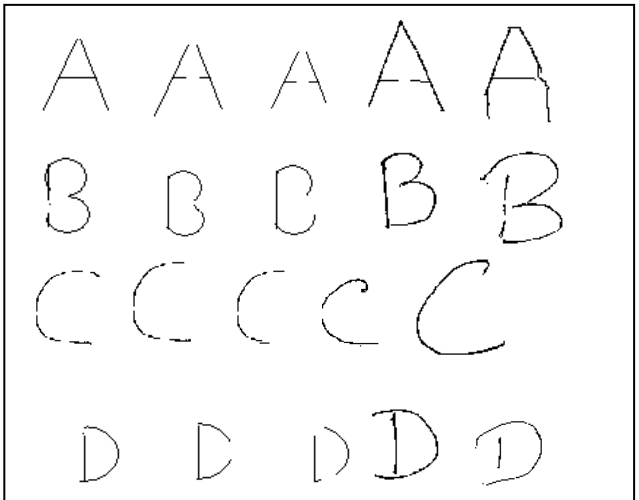

Fig.10 Alphabets considered for CSIM testing

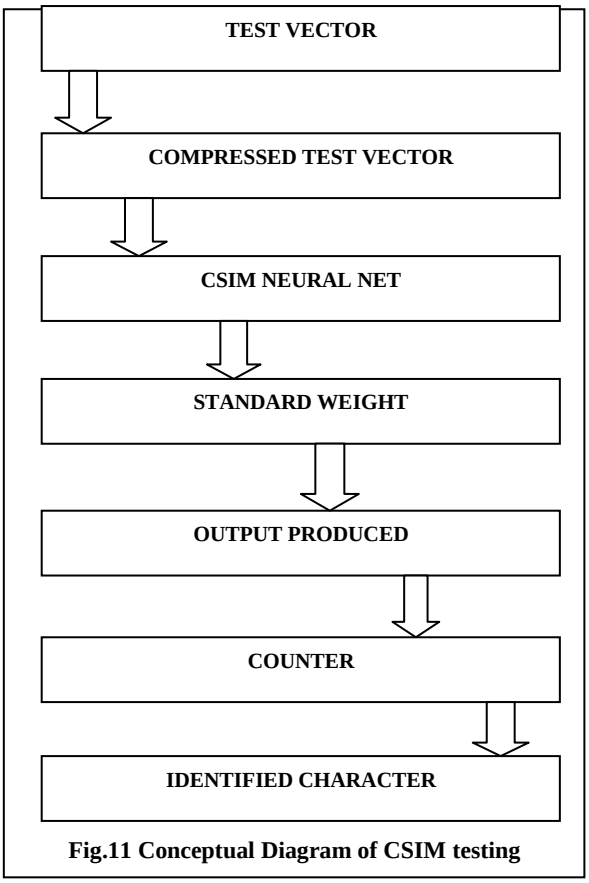

Fig.11 Conceptual Diagram of CSIM testing

The compressed vector is presented to the net having the standard weight matrix. Since, there are two outputs, input patterns are mapped as either [-1,-1], [-1, 1], [1, -1] or [1,1] to identify the characters A, B, C or D respectively. A counter is used to count the number of identical pattern outputs from the ten different segments for confirmation. A value greater than or equal to six is considered for the identification of a particular character, (Fig.11). Example. Let us consider four characters of English alphabet A, B, C and D. A can be represented by a 10 x 10 matrix shown below.

					*				
				*		*			
			*				*		
		*						*	
	*								*
*									*
*	*	*	*	*	*	*	*	*	*
*									*
*									*
*									*

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In the above matrix the blank space can be considered as -1 and * can be considered as 1. So, the vector representation of the matrix A in column major form is represented as:

A={-1,-1,-1,-1,-1,1,1,1,1,1,-1,-1,-1,-1,1,-1,1,-1,-1,-1,-1,-1,-1,1,-1,-1,1,1,1,1,-1,-1,1,-1,-1,-1,1,-1,-1,-1,-1,1,-1,-1,
-1,-1,1,-1,-1,-1,1,1,-1,-1,-1,-1,-1,1,-1,-1,-1,1,-1,-1,-1,-1,-1,1,-1,-1,-1,1,-1,-1,-1,-1,-1,1,1,-1,-1,1,-1,-1,
-1,-1,-1,-1,-1,-1,1,1,1,1,1,1}

A can be compressed to form a matrix of dimension 5 x 5 by applying compression algorithm.

		*	*	
	*		*	*
*	*	*	*	*
*				*
*				*

A_COM={-1,-1,1,1,1,-1,1,1,-1,-1,1,-1,1,-1,-1,1,1,1,-1,-1,-1,1,1,1,1}

Similarly, compression algorithm is applied on B, C and D to form B_COM, C_COM and D_COM.

IV. APPLICATIONS

- This will be applicable where ever there is a need of any kind of Hand written or Cursive character Detection.
- It will be very much useful and convenient for Historical Research and Files.
- It will be used In Doctors Prescriptions or Scientists hand written Thesis, Journals and Research Papers.

V. CONCLUSION

The problem of the cursive handwriting is made complex by the fact that the writing is inherently ambiguous letters in a word are generally linked together, poorly written, and may even be missing. As a consequence, cursive script recognition requires sophisticated techniques, which uses a large amount of shape information and which compensates for the ambiguity by the use of contextual information. The recognition strategies heavily depend on the nature of the data to be recognized. Small modifications and sensitive selection of the parameters in the laboratory environment provide high recognition rates for a given data set. However, a successful system reported in the literature may fail in real-life problems due to unpredicted change in data and violation of the initial assumptions in real life environment. In this study, we try to maximize the amount of information to be retained in the data to a certain extent. The proposed method avoids most of the pre processing operations, which causes loss of important information. However, the information, extracted in the global parameter estimation stage, is used on top of the original image as needed. We used the slant and skew angle information, but we did not make slant or skew angle correction. We used the binary information, but we did not rely only on the binary information. One of the major contributions of this study is the development of a powerful segmentation algorithm. Utilization of the character boundaries, local maxima and minima, slant angle, upper and lower baselines, stroke height and width improves the search algorithm of the optimal segmentation path, applied on a gray-scale image.

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