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A REVIEW ON OFF-LINE HANDWRITTEN DEVNAGRI SPECIAL CHARACTER RECOGNITION USING NEURAL NETWORK

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Abstract*:* This paper is about the recognition for handwritten Characters (uppercase and letter) recognition using multilayer perceptron method. Handwritten character recognition is an important research and application area on pattern recognition theory. Firstly, we use some conventional methods like feature Extraction and boundary tracing to pre-process the images. Character is identified by analyzing its shape and comparing its feature that distinguishes each character. Secondly, we use the data to train the samples of handwriting given by different persons. The proposed method will provide good recognition accuracy for handwritten English characters with less training time.

Keywords: Feture Extraction; Boundary Tracing, Training Time, Multilayer Perceptron

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INTRODUCTION

Handwritten character recognition (HCR) is a element of offline character recognition. Handwritten characters have unlimited variety of style from one person to another person. Due to this ample range of variability, it is Difficult to recognize by a machine [1].Handwritten character recognition is a very important and active field of study in pattern recognition and image processing. It uses images scanned from handwritten document to recognize the matching character and let the computer deal with the input data and information directly. It has a large range of useful applications in the postal service, financial assistance, taxes, banking, etc. However, since there are features of random written factors and character-mode's instability, recognition of handwritten characters has been a Challenging matter.Although the research in Optical Character Recognition has been going on for previous few decades, the aim of this area is still out of reach. Most of the researchers have tried to resolve the problems based on the image processing and pattern recognition techniques. The outcome of this research is the gathering of lots of algorithms for classification using the rough representation-in pixels-of the character or feature vector demonstration.

In general, handwriting recognition is classified into two types as off-line and on-line handwriting recognition methods. In the off-line recognition, the characters are usually captured optically by a scanner and the complete characters are existing as an image. But, in the on-line system, the two dimensional coordinates of consecutive points are represented as a function of time and the order of strokes made by the writer are also available.[2] Neural Networks in recent times being used in a variety of pattern recognition. Neural network is playing a key role in handwritten character recognition. Numerous reports of character recognition in English have been published but still high recognition precision and minimum training time of handwritten English characters using neural network is a main problem. Therefore, it is a great important to extend an automatic handwritten character recognition system for English language. In this paper, efforts have been prepared to develop automatic handwritten character recognition system for English language with high recognition accuracy and minimum training and classification time.

II. CHARACTER MODELING

Normally, HCR can be divided into three parts namely pre-processing, feature extraction, and classification.

A. *English Characters*

The English language consists of 26 characters written from left to Right. A set of character is shown in Fig-1.

Fig. 1: A Set of Handwritten English Characters

B. *Pre-Processing*

Pre-Processing stage is to produce a clean character image. As shown in Fig-2.

Fig-2 Pre-Processing

C. *Image Resizing-*

There are lots of variations in the handwriting of different persons. Therefore, after pre-processing and cropping of the image, image resizing is performed so that all character become in equal dimensions of matrix. As shown in Fig-3.

Fig-3 Image Resizing

D. *Image inversion & Edge Detection –*

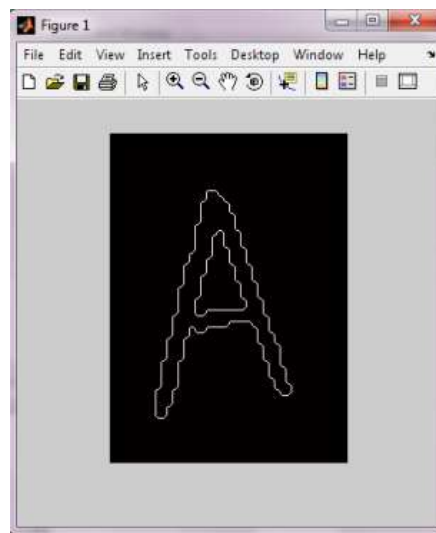Image inversion is the process of inverting the image for more Clear Edge Detection. As shown in Fig-4.

Fig-4 Edge Detection

E. *Hole Filling-*

Hole filling of the image gives the proper boundary of the selected character. As shown in Fig.5.
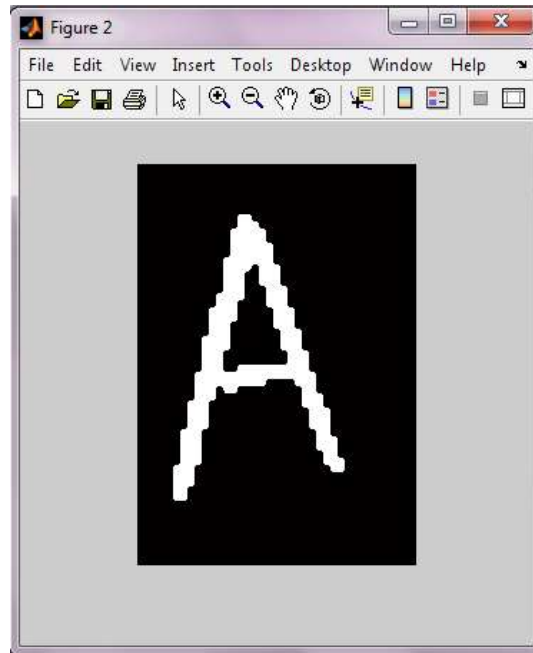

Fig-5 Hole Filling

III. BLOCK DIAGRAM OF SYSTEM

The Block diagram of whole system is shown in the following Fig- 6

Fig-6 Block Diagram Of The system

The procedure of handwritten English character recognition is as follows:

Acquire the sample by scanning.

Edge detection and resizing operations

are performed.

1168

⏹⏹Apply Boundary Detection Feature Extraction technique.

⏹⏹Neural network Classification.

⏹⏹Recognized Character.

IV FEATURE EXTRACTION

In this paper, to extract the information of the boundary of a handwritten character, the eight-neighbour adjacent method has been adopted. This scans the binary image until it finds the boundary. The searching follows according to the clockwise direction. For any foreground pixel A, the set of all foreground pixels connected to it is called connected component containing A. The pixel A and its 8-neighbors are shown in Figure 7. Once a white pixel is detected, it checks another new white pixel and so on. The tracing follows the boundary automatically. When the first pixel is found, the program will be assigned the coordinates of that position to indicate that this is an origin of the boundary. The new found pixel will be assigned as a new reference point and starts the eight-neighbour searching. In this way, the coordinates of the initial point are varied according to the position. As the tracer moves along the boundary of the image, the corresponding coordinates will be stored in an array for the computation of Fourier Descriptors. During the boundary tracing process, the program will always check the condition whether the first coordinates of the boundary are equal to the last coordinates. Once it is obtained; means the whole boundary has been traced and boundary tracing process completes [3].
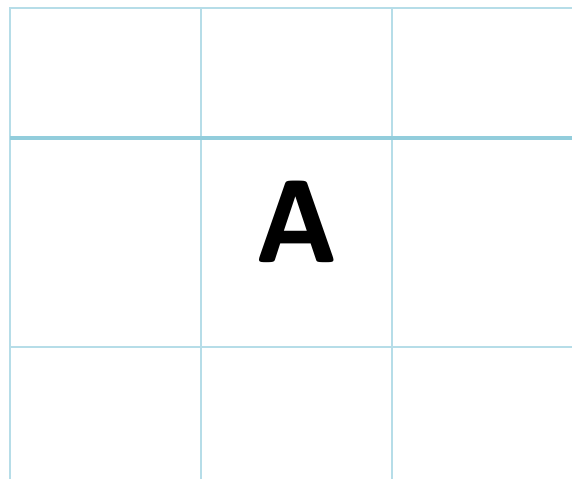

Fig- 7 Pixel A and its 8-neigbour

V NEURAL NETWORK

A. Recognition –

Recognition of handwritten characters is a very complex problem. A feed forward back propagation neural network is used in this work for classifying and recognizing the handwritten characters. The characters could be written in different size, orientation, thickness, format and dimension.

This will give infinite variations. The neural classifier consists of two hidden layers besides an input layer and an output layer. For training, back-propagation algorithm has been implemented.

B. Multilayer Perceptron Layer –

The perceptron consists of one or more layers of artificial neurons, the inputs are fed directly to the outputs via a series of weight. In this way it can be considered the simplest kind of feed forward network. Multilayer networks overcome many of the limitation of single layer network, but were not used in past because of effective training algorithm was not available. The capabilities of multi-layer networks stem from the non-linearities used with the units. Each neuron in the network receives inputs from other neurons in the network, or receives inputs from the outside world. The output of the neurons are connected to other neurons or to the outside world. Each input is connected to the neurons by a weight.

The neuron calculates the weighted sum of the inputs which is passed through a non-linear transfer function to produce the actual output for the neuron. The most popular non linear transfer function is the sigmoidal type. The typical sigmoid function has the form –
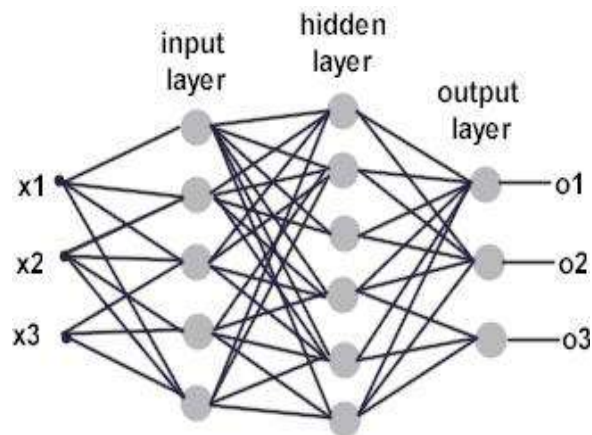
$$f(x) = w \frac{1}{1 + e^{-gx}}$$

Fig-8 Multilayer Perceptron Network

VI FLOWCHART OF THE SYSTEM

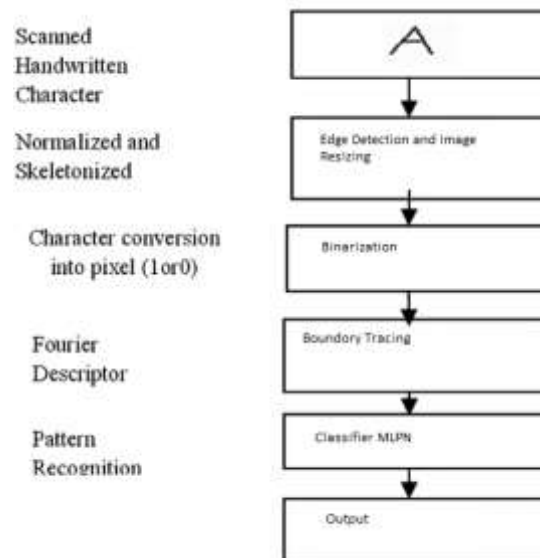A complete flowchart of handwritten English character recognition is given below in Figure-9

Fig-9 Flowchart of the system

Available Online at www.ijpret.com

V PROPOSED RESULT

No. of Hidden Nodes	Learning Rate	Momentum factor	No. of epochs	Recognition
12	0.2	0.8	60	84%
24	0.2	0.8	120	96%
36	0.2	0.8	240	96%

VI CONCLUTION

In this paper, a system for recognizing handwritten English characters has been prepared, although the system is not fully prepared and work is in progress and we have achieved up to boundary tracing of any character still we are hoping to get an adequate and precise result at the end with different sample. Above table shows the proposed result for the system. As shown in the table it is clear that as we increase the number of hidden layer the number of epochs will also increase and our recognition percentage will also increase. As we can see that initially we are taking 12 hidden layers and the recognition percentage is 84% and as the hidden layers increases to 36 recognition percentage increases to 96%.

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