

Handwriting Recognition using Neural Network

¹ Shruti Shrikant Kharkar, ² Hoshank Jitendra Mali, ³ Sakshi Satish Gadhari, ⁴ Sarang Sunil Shrikhande, ⁵ Prof. D.K. Chitre

¹Student, ²Student, ³Student, ⁴Student, ⁵Professor

¹Computer Department, Mumbai University

¹Terna Engineering College, Nerul, Navi Mumbai, India

Abstract- Artificial Intelligence can be said to be as the perception of the environment and to act on the particular environment intelligently. Neural networks is one of the tools of Artificial Intelligence. Neural networks has improved the artificial computing and experience of science for optical character recognition. The system can be used to recognize the English characters (A-Z, a-z), numerals (0-9) and special characters (#, \$, %, ^, &, *). We are aiming to implement the system for free handwritten characters, numerals and special characters. Recognition is done by training the neural network enough times using Back Propagation algorithm. We plan to develop offline strategy for detecting the free handwritten characters.

Index Terms - Optical character recognition, Neural network, Back propagation algorithm.

I. INTRODUCTION

Handwriting recognition is undoubtedly one of the most challenging areas of the pattern recognition. The goal of optical character recognition is to classify alpha numeric or other optical samples which are mostly saved as digital images. Several pattern recognition approaches have been applied to both online and off line handwriting recognition on the basis of unique patterns. The process of recognition consists of several steps. Matlab has a special toolbox, called neural network toolbox which makes the implementation less difficult but the knowledge of theory is needed. It is widely used in various applications such as bank check processing, signature verification, document verification and many others. The most extensive use of OCR technology is data entry. The goal of our proposed system is to show the accuracy and speed of character recognition depending on the parameters of the neural network. We can train these networks with preferred parameters. Artificial Neural Network approach for character recognition is now gaining importance because of ANN's high fault tolerance and parallel architecture.

II. LITERATURE SURVEY

Sakshi Mehta et al. [1] presents a theoretical and practical basis for pre processing on handwritten text for character recognition using feed forward neural networks. Approach was made to improve accuracy of recognition of handwritten characters.

Rokus Arnold et al [2] presents the implementation of character recognition using neural networks with the help of matlabs tool. In this paper they tried to recognize the printed and handwritten characters by projecting them on different sized grids. The results showed that the accuracy of the character recognition depends upon the resolution of character projection. Regardless of the orientation, size and the place of characters the network still had a 60% precision.

Shyla afrogee et al [3] describes an artificial neural network approach for the recognition of English characters using feed forward neural network. In this paper, noise has been considered as the major issue that might degrade the performance for character recognition and hence to reduce the noise median filtering technique has been used which can make the recognition bit efficient.

Ankit Sharma et al [4] gives offline strategies to recognize the characters. Image preprocessing is used along with the binarization, thresholding and segmentation method. Back propagation is used to classify the characters in order to recognize them. The method used here gives 85% accuracy for recognition.

III. PROPOSED FRAMEWORK

A. Back Propagation Neural Network-

Back propagation method is used for training a multi-layer artificial neural network with mathematical formulation. Training the network to balance between the input patterns that are used in training and their responses to the input patterns is the main objective of this network.

Phases of back propagation algorithm:

1. Propagate the output results back to the neural network.
2. Update the weight after each propagation.

B. Stages of the proposed system-

The proposed OCR system is divided into two sections. The first is the training section and the second is the recognition section. The stages of the proposed system are shown in the Figure below. Both training and recognition system includes image acquisition, preprocessing and feature extraction. The diagram is referred from Shyla afrogee et al [3].

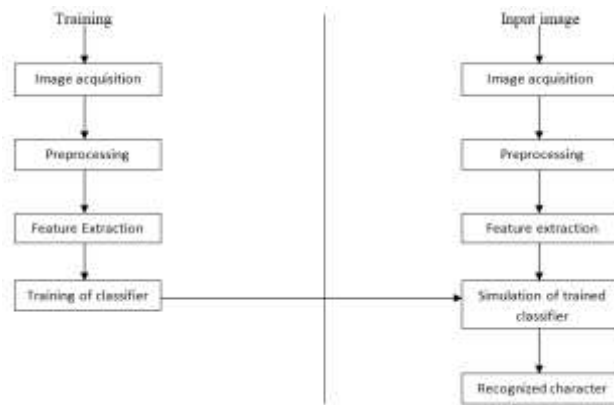


Fig1. Stages of OCR

1) Image Acquisition

The proposed OCR system starts with image acquisition process that takes an input of a digital image by using a digital camera or scanner. Specific format such as JPEG, PNG are taken as the input image. This image is used for testing the network.

2) Pre-processing

Preprocessing is the preliminary step which transforms the data into a format that will be more easily and effectively processed. The main task in preprocessing the captured data is to decrease the variation that causes a reduction in the recognition rate and increases the complexities, as for example, preprocessing of the input raw stroke of characters is crucial for the success of efficient character recognition systems.

2.a) Gray image conversion

A gray image has pixel value from 0 to 255. The lowest value represents the black pixel intensity and highest value represents the white pixel intensity. In this stage a RGB images are converted into gray scale images.

The following equation is used to convert an RGB image into a Gray scale image:

$$g(x,y) = 0.299 \times R(x,y) + 0.587 \times G(x,y) + 0.114 \times B(x,y)$$

Where $R(x,y)$ is Red component, $G(x,y)$ is Green component, $B(x,y)$ is the Blue component of the color image and $g(x,y)$ is the gray scale image.

2.b) Noise removal

The next step in image pre-processing is noise removal. It is necessary to remove the noise from the image because it may produce difference between the actual and captured image. This causes the variation in database feature and measured feature and also affects the accuracy of the system. Edge detection is difficult in noisy image. Noise and the edges contain high- frequency content. So before extracting features from the image, it is very important to remove the noise from the image.

2.c) Thresholding

Thresholding method, which is used in this system, aims to find accurate separation point of foreground and background of the gray level image.

The following equation is used for thresholding:

$$f(x,y) = \begin{cases} 1 & \text{if } f(x,y) > T \\ 0 & \text{Otherwise} \end{cases}$$

Where T is a threshold value

2.d) Binarization

Binarisation of an image converts the image into an image which only has pure black and pure white pixel values in it. Basically during binarization of a grey-scale image, pixels with intensity lower than half of the full intensity value gets a zero value converting them into black ones. The remaining pixels get a full intensity value converting it into white pixels.

2.e) Segmentation

The segmentation is the most important part of the preprocessing method. It makes us possible to extract every little detail of every separate character. Line is extracted followed by character extraction. The binary image is scanned from top to bottom and sum of row pixels is calculated. If sum is 0 then line is extracted. Similarly for character is extracted if sum of column pixels is 0. The image is scanned from left to right for character extraction.

2.f) Normalization

Normalization is the process of equating the size of all extracted binary images. There are lots of variations in the size of characters. In order to make the extracted characters in equal dimension of matrix, normalization is performed. The normalized character matrix is of size 12x8.

3) Feature extraction

Features of a character depicts the morphological and spatial characteristics in the image. Feature extraction is a method of extracting of features of characters from the sample image. The normalized character matrix of size 12x8 that consist only 1 and 0 is converted to a column matrix. This columnized matrix acts as feature vector which is fed to input layer of the back propagation neural network.

4) Training of Classifier

The decision making part of the recognition system is the classification stage. A feed forward back propagation neural network is used for classifying and recognizing the English characters. The pixels derived from the normalized character in the segmentation stage form the input to the classifier. The classes of recognition problem are shown in the following table:

0	1	2	3	4	5	6	7
8	9	A	B	C	D	E	F
G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V
W	X	Y	Z	A	B	C	D
E	F	g	H	I	J	K	L
M	N	o	P	Q	R	S	T
U	V	w	X	Y	Z		

Table1. Character set

5) Simulation of Trained Classifier

The network recognizes the characters with the help of the features extracted from the test images.

➤ Accuracies of different methods for OCR-

<i>Methodology</i>	<i>Clustering</i>	<i>Pattern matching</i>	<i>Feature extraction</i>	<i>Neural network</i>
Accuracy	High	Low	High	Very high

Table2. Comparison on accuracy

IV. CONCLUSION

This paper analyzes the use of Artificial Neural Network in handwriting recognition. This can be carried out using feed forward back propagation algorithm which is applied to the data collected in specific time. This paper determines the effective method of handwritten character recognition on parameters like accuracy, complexity of method. Handwriting recognition can be carried out using clustering, feature extraction, pattern matching, but neural network is more reliable and efficient and it gives a higher accuracy rate according to the research done.

V. REFERENCES

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