IJDACR
ISSN: 2319-4863

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary research
Website: www.ijdacr.com (Volume 1, Issue 6, January 2013)

Alpha-Numeric Character Recognition using Back Propagation Neural Network

Mrs. Roopali Gupta
roopali2009@yahoo.in

Prof. Neeraj Shukla

Abstract— **In this paper we present a novel approach for hand written character recognition for both alphabet and numeric characters using feed forward neural network using gradient decent back propagation algorithm. Inputs to the system are scanned images of handwritten alpha-numeric data in jpeg format picture which is then processed and extracted features are then applied to a neural network recognizer to produce recognized output.**

Keywords - **hand written input, image processing, neural network, back propagation algorithm.**

I. INTRODUCTION

The character recognition is a way to solve out problem faced with hand printed characters. With ever increasing requirement for office automation, it is imperative to provide practical and effective solutions. It has been noticed that all sorts of structural, topological and statistical information about the characters does not provide a helping hand in the recognition process due to different writing styles and moods of persons at the time of writing. Hand written character Recognition can be widely used for post offices, banks, airports and airline offices. Character Recognition software is also used in scanners and faxes that allow the user to turn graphic images of text into editable documents.

Optical Character Recognition (OCR) is a very well-studied problem in the vast area of pattern recognition. Its origins can be found as early as 1870 when an image transmission system was invented which used an array of photocells to recognize patterns. Until the middle of the 20th century OCR was primarily developed as an aid to the visually handicapped. With the advent of digital computers in the 1940s, OCR was realized as a data processing approach for the first time. The first commercial OCR systems began to appear in the early 1950s and soon they were being used by the US postal service to sort mail. According to Wikipedia "The accurate recognition of Latin-script, typewritten text is now considered largely a solved problem on applications where clear imaging is available such as scanning of printed documents. Typical accuracy rates on these exceed 99%; total accuracy can only be achieved by human review. Other areas including recognition of hand printing, cursive handwriting, and printed text in other scripts (especially those with a very large number of characters) are still the subject of active research."[1]

In this paper an amend approach for recognition of alpha-numeric characters is presented. Input to the system can be scanned image of characters or it can be an image captured from camera. Our system supports all image formats like .jpeg, .bmp, .gif, .png etc.

II. METHODOLOGY

Flow diagram of our recognition system is shown below:

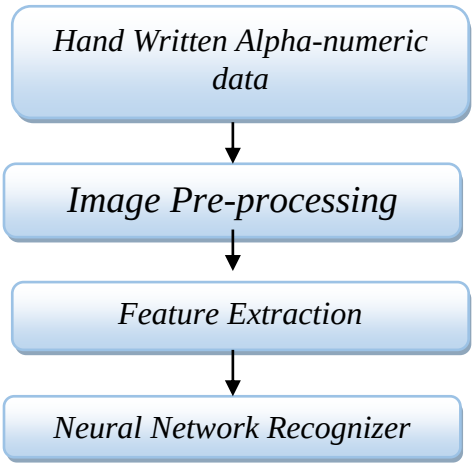

Figure 1: Alpha-Numeric character recognition system Flow-chart

These processes are explained below:

Data collection:

Scanned image of Alphabet and numeric data in .jpeg format is loaded to the system. The system we develop here is capable of identifying single character. So the user has to select the character of its own choice for recognition input. Once the input character is selected, several processes are applied on it.

IJDACR
ISSN: 2319-4863

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary research
Website: www.ijdacr.com (Volume 1, Issue 6, January 2013)

Image Pre-processing:
The variations of image features, usually brightness, give rise to edges. More objectively, the edges are the representations of the discontinuities of image intensity function. Therefore, edge detection algorithm is essentially a process of detection of these discontinuities in an image. Edge detection is an essential tool for estimation of geometrical properties of objects in image analysis, which leads to accurate identification and recognition. Edges form boundary or an outline of an object which segregates 2D planar shapes or objects from the background in a digital image. Boundary between overlapping objects is distinguishable, if edges in an image are identified accurately. The basic shape and topological properties of an object are present in boundary representation.

Feature Extraction
Feature extraction is an important step in achieving best performance with respect to the implementation of a character recognizer, which will have high efficiency, and low error rate for the recognition of characters. Feature extraction means to determine various attributes as well as properties associated with a region or object. The objective of feature extraction is to represent an object in a compact way that facilitate image analysis task in terms of algorithmic simplicity and computational efficiency. Selection of feature extraction methods is probably the most important factor in achieving high recognition performance.

Neural Network

Artificial Neural Network is a collection of very simple and massively interconnected cells. The cells are arranged in such a way that each derives its input from one or more other cells. It is linked through weighted connections to one or more other cells. This way input to the ANN is distributed throughout the network so that an output is in the form of one or more activated cells. The information in an ANN is always stored in a number of parameters. These parameters can be pre-set by the operators or training by presenting the ANN with example of input and also possibly together with the desired output .The following is an example of a simple of ANN.

Neural Network for Character Recognition:
For the present work, we have used a multi-layered neural network with two hidden layers each containing ten neurons. In addition, we have an input layer containing twenty six neurons (one for each input for alphabet recognizer) and ten neurons (for numeric recognizer) and a single output neuron which represents the character. The network is fully connected and its weights are updated using the gradient descent method i.e,

$$\omega^{new} = \omega^{old} - \eta\frac{\partial E}{\partial w}$$

Where

$$E = \frac{1}{2}\sum_{i3}(y_{i3}^{d} - y_{i3})^2.$$

The back propagated errors are calculated at each layer and using the generalized delta rule, the following weight update formulae are obtained for the network [1].

$$W_{i3,i2}(t+1) = W_{i3,i2}(t) + \eta\delta_{i3}v_{i2}$$

Where $\delta_{i3} = y_{i3}(1 - y_{i3})(y_{i3}^{d} - y_{i3})$

$$W_{i2,i1}(t+1) = W_{i2,i1}(t) + \eta\delta_{i2}v_{i1}$$

Where

$$\delta_{i2} = v_{i2}(1 - v_{i2})\sum_{i3}\delta_{i3}W_{i3,i2}$$

$$W_{i1,i0}(t+1) = W_{i1,i0}(t) + \eta\delta_{i1}x_{i0}$$

Where

$$\delta_{i1} = v_{i1}(1 - v_{i1})\sum_{i2}\delta_{i2}W_{i2,i1}$$

The output v at each neuron is calculated using the Sigmoidal activation function given by,

$$v = \frac{1}{(1+e^{-h})}$$

Where h is the original output.
For our network, $i_0 = \{1, 2, 3, 4, 5, 6\}$, $i_1 = \{1, 2, \ldots 9, 10\}$, $i_2 = \{1, 2, \ldots, 9, 10\}$ and $i_3 = \{1\}$. The learning rate η is taken as 0.5.

Implementation:

The back propagation algorithm described above requires a numerical representation for the characters. Hence the methods for feature extraction are applied so that the extracted features are appropriate for neural network.
When a particular character is queried, the network returns a value which can then be converted into the corresponding character. However, the learning necessitates that for each training input, the shape of the character being entered be associated with the character (and hence the ASCII value) provided by

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary research
Website: www.ijdacr.com (Volume 1, Issue 6, January 2013)

the user. To this end, we also need to have a numerical representation for the shape of the character. A vector containing certain numerical features of the pattern (or character in our case) is known as the feature vector.

III. Simulation & Results

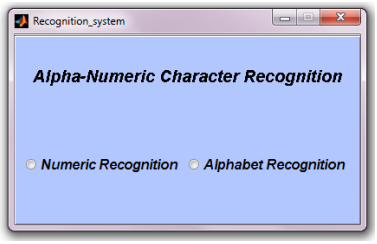

Figure 2: Recognition system

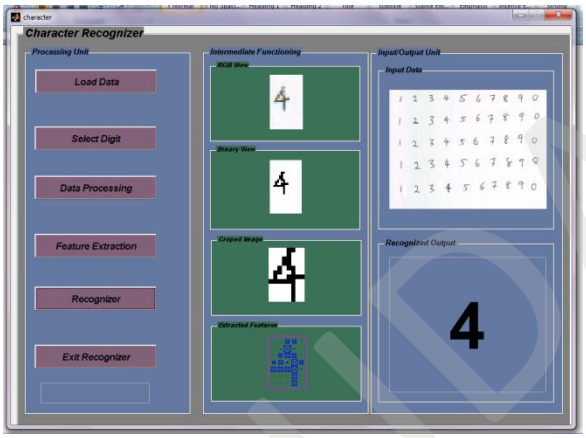

Figure 3: Numeric recognition

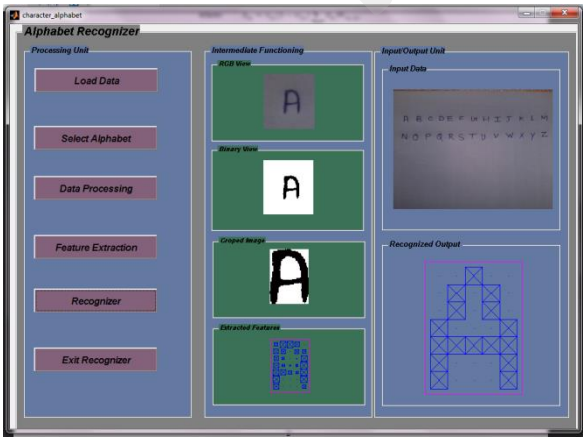

Figure 4: Alphabet recognition

Figure 2, 3, and 4 shows the graphical user interface for alpha-numeric character recognition system.

IV. Conclusions

In this paper a system for handwritten character recognition using image processing and neural network has been developed and the performance has been evaluated for numeric data as well as alphabet. The use of gradient decent back propagation algorithm has improved the performance of neural network. This recognition system is tested successfully over a bunch of characters with 98.06% recognition rate.

References

[1] J. Mantas, \An overview of character recognition methodologies," Pattern Recognition, vol. 19, no. 6, pp. 425 { 430, 1986.

[2] Aha, D. W., Kibler, D. & Albert, M. K. (1991) Instance-based learning algorithms. Machine Learning 6(1), 37–66.

[3] R. Bozinovic and S. Srihari, \O_-line cursive script word recognition," Pattern Analysis and Machine Intelligence, IEEE Transactions on, vol. 11, pp. 68 83, Jan. 1989.

[4] Claus,D.'HandwrittenDigitRecognition',http//:www.robots.ox.ac.uk/~dclaus.

[5] NeuralNetworks.2003,http://documentswolfram/.com/applications/neuralnetworks/index2.html

[6] V. Govindan and A. Shivaprasad, \Character recognition { a review," Pattern Recognition, vol. 23, no. 7, pp. 671 { 683, 1990.

[7] ArtificialNeuralNertwork,1997,http://www.emsl.pnl.gov/proj/neuron/neural/what.html

[8] Q. Tian, P. Zhang, T. Alexander, and Y. Kim,\Survey: omnifont-printed character recognition," in Society of Photo-Optical Instru-mentation Engineers (SPIE) Conference Series (K.-H. Tzou & T. Koga, ed.), vol. 1606 of Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, pp. 260{268, Nov. 1991.