



An Intelligent Handwriting Words Identification System Based on Neural Network

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ABSTRACT

The identification of manually typed words is one of the most important problems in computer, which has made many researchers to research on this topic and create intelligent systems to identify them. In this paper handwriting words recognition system was designed using matlab A horizontal and vertical segmentation method is applied to split the characters from the handwritten images. Obtained characters are represented using greyscale values. The greyscale values are fed to the neural network input for classification purpose. Backpropagation algorithm is applied for training of neural networks. The NN operations include two stages-training and testing. Training stage is used for updating the parameters of network. Testing stage is used for recognition of characters which are English alphabet letters (small and capital letters). Database used in the system contains 400 images for 40 alphabets (26 small letters, 14 capitals). 10 images of each letter written by different person are taken. The characters are presented directly to the network and correctly sized in pre-processing.

Keywords: Handwritten word recognition, Neural Networks, Horizontal segmentation, Vertical segmentation, Backpropagation

1. Introduction

A character recognition system has gained a lot of traction since the turn of the century. Among these systems are: online handwritten systems (the direct system) and offline handwritten systems (the indirect system). Due to its acceptable performance and ease of use, the direct system is one of the most widely used. The indirect system is less accurate than the first one, but it can be used in areas that don't require accuracy, and improvements and development have been made to it. The system can be utilized with high precision, such as for bank money counting machines.

Vision system design, software development, and consulting are all provided by Recognition Science. Pattern recognition, research systems for biomedical applications, microscopy-based vision, automated inspection, remote sensing, and target recognition are the specialties of recognition science. Services for product development, training, and consulting are available. Software libraries for image enhancement, information evaluation, feature extraction, classification, and learning have been developed by recognition science.

Over the past four decades, researchers have concentrated on issues pertaining to the machine simulation of reading by humans. The nature of the challenge, which is distinguished by the issues associated with it, attracted a lot of theories when researchers began developing recognition systems. The research is described as being somewhat difficult to fit into the property of Handwritten word recognition. This property's ability to recognize various forms of handwriting adds complexity, depending on the nature of the author's formal handwriting. Analysis of letters related to handwritten text requires the separation of these characters in one word from each other and then identification of a single letter, which Computer Humans are not surprised by.

The design of a neural network-based handwritten word recognition system is the objective of this paper. The system for handwritten word recognition has two main stages. The first stage is called segmentation and is used to extract features from an image of handwriting. The second stage is used to identify characters and words. A crucial step in a handwriting recognition system is segmentation. The algorithms used to segment handwriting images are the subject of this thesis. The system's recognition rate depends on using an effective pattern recognition algorithm and clearly segmenting the word's characters. Grayscale values are preferred for character recognition because each character belongs to its own class.

In an online character recognition system, letters are recognized as they are typed or as forms are drawn. Additional tools used in the system include digital panels that are clearly marked at a high degree of 200 pixels; however, in an offline system, letters are recognized after the writing or printing of the text has been completed. Many researchers have been working on a system to identify letters related to the word "handwritten" for three decades. Despite their long efforts, this area is still difficult, and all of the systems that exist are limited in some applications. While some of the proposed methods in the field of handwriting character recognition may be useful, keep in mind that these methods are still incomplete.

2. Methodology

2.1 Image processing

Given that the English alphabet consists of 28 letters, printed and handwritten letters frequently do not differ significantly. There are two types of letters in the English alphabet: both large and small letters. Only 11 of these 28 written letters differ from capital letters in any way: a, b, d, e, g, h, n, q, r, t, and y), also known as (A, B, D, E, G, H, N, Q, R, T, and Y). The remaining letters, on the other hand, are identical in writing: c, f, i, j, k, l, m, o, p, s, u, v, w, x, z) (C, F, I, J, K, L, M, o, p, s, u, v, w, x, z). More specifically, the 26 letters in capital and small letters, as well as how they are written in printed and handwritten form, are displayed in the table below.



Fig. 1 - English alphabet

2.1.1 Segmentation

There are several stages to handwriting word recognition. Preprocessing, character recognition, and segmentation of handwritten words are all examples of these. In the order of operations for object recognition, image segmentation is an essential step. Finding the elements in the image, such as strings of characters, individual words or characters, figures, tables, and other textual objects, is the function of segmentation.

Because handwriting images may contain distortion and noise, which will be segmented, it is necessary to filter this noise. This program uses a filter for character segmentation. If a column or row has more than 30 pixels, it indicates that the character is real; otherwise, it will delete the character because that indicates that it is not a character or that the character is too small to be useful.

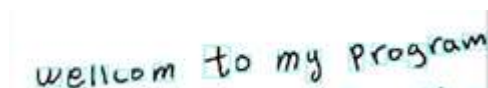


Fig. 2 - character segmentation

Lines in an image can be identified using the transformation. Using transformation, for each pixel in image space (x_0, y_0)

$$T = x \cdot \cos \theta + y \cdot \sin \theta$$

2.2 Neural Networks

a system with a lot of connections built on the parallel architecture of the brain and other biological human nervous systems. Like humans, ANN learn by example. In order to process a large amount of data for a specific task like pattern recognition or data classification, synaptic weight adjustments are made to connections between neurons.

Many problems can be solved by neural networks without the problem's internal structure being described or found. For instance, if we have a collection of examples, we use neural networks, which can first learn the results of a problem that has been solved and then solve many other problems that are similar to it. It is an extremely convenient and effective method of problem solving.

2.2.1 Backpropagation network

The back propagation network's fundamental processing unit. Units that receive the output of the processing unit in the center of the figure are depicted as the entries on the left and right. Call, make an output, and have a value associated to be used in the process of adjusting the weights are the characteristics

of the processing unit. The processing unit performs a weighted sum of the inputs. During the learning process, the weight associated with the connection between units is denoted by and changes.

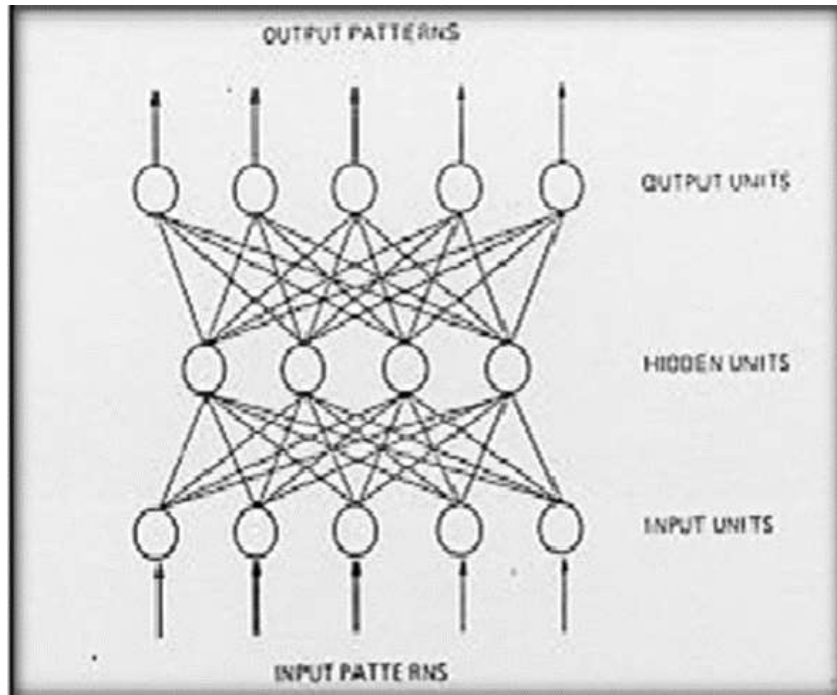


Fig. 3- back propagation network construction

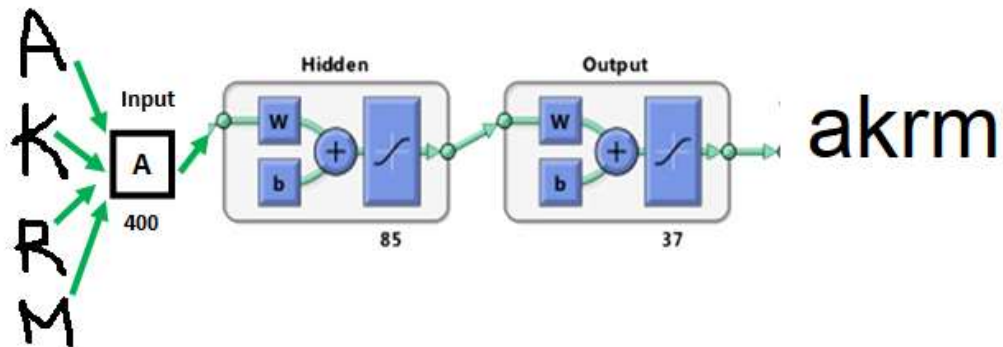


Fig. 4- NN general steps

Algorithms			
Data Division:	Random (dividerand)		
Training:	Gradient Descent with Momentum & Adaptive LR (train		
Performance:	Mean Squared Error (mse)		
Calculations:	MEX		
Progress			
Epoch:	0	358 iterations	2000
Time:	0:00:10		
Performance:	0.408	9.98e-05	0.000100
Gradient:	0.770	0.000607	1.00e-19
Validation Checks:	0	0	6

Fig. 4- NN training stage

Table .1- PBNN parameters

Parameters	Value
Number of neurons in input layer	400
Number of neurons in output layer	37
Number of neurons in hidden layer	85
Maximum Iteration number	5000
Learning rate	0.001
Momentum rate	0.4
Error	0.001
Activation Function	Sigmoid

3. Testing and Result

The network was trained and tested by 400 alphabet images , 70% for training and 30% for testing .

3.1 Result

In this paper an intelligent hand writing words system is developed, this system based on image processing and neural network , the system trained by 280 images and tested by 120 image , in testing phrase the network has 95.5% recognition rate .

4. Conclusion

In the proposed paper, an intelligent hand writing words system is developed, this system based on image processing and neural network. The system was trained by 280 images for every word which they written manually by volunteers. The input training images is reshaped using pattern averaging technique into dimension of 20*20, which was the training input image for BPNN, in the testing stage , the system was tested by 120 images , the recognition rate was 95.5% , which shows that the system has good accuracy .

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