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Neural Network Based Handwritten Digit Recognition for Managing Examination Score in Paper Based Test

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ABSTRACT: Recognition of handwritten character is a difficult task in the field of image processing, artificial intelligence since the handwriting varies from person to person. In proposed paper, we are training the neural network to recognize the off-line strategies for the isolated handwritten character (0 to 9). This work improves the character recognition and pre- processing of the Character is done by image rendering, character extraction and training and testing steps. The proposed method is based on the use of linear regression algorithm to classify the characters and is used to train the given dataset. After training a network performance curve is generated along with the individual required characters. In given system, numerical character is represented by binary numbers that are used as input then they are fed to an ANN. Neural network followed by the linear regression Algorithm which compromises Training.

KEYWORDS: Neural network, linear regression, Image Acquisition, Character Extraction, Image Rendering.

I.INTRODUCTION

Recognition of handwritten characters is one of the most challenging areas of pattern recognition. It is useful while dealing with practical problems, signature verification, mailing bank check processing, interpretation of address, the documentation analysis, also document verification and many others. Neural networks consist of elements working in parallel and are inspired by biological nervous systems. The regarding network function is determined by the connections between elements. We can train a neural net to perform a specific function by adjusting the values of the connections i.e. weights between elements. Neural networks are trained such that a particular input leads to a desired target output. For many of the document input tasks, character recognition supposed to be the cost effective and fast method available. In this paper, to identify handwritten characters we have constructed a suitable neural network which is able to extract the characters one by one and able to map the target output for training purpose.

II.LITERATURE SURVEY

Hand writing recognition of characters has been around since the 1980s.The task of handwritten digit recognition, using a classifier, has great importance and use such as – online handwriting recognition on computer tablets, recognize zip codes on mail for postal mail sorting, processing bank check amounts, numeric entries in forms filled up by hand (for example tax forms) and so on. There are different challenges faced while attempting to solve this problem. The handwritten digits are not always of the same size, thickness, or orientation and position relative to the margins. Our goal was to implement a pattern classification method to recognize the handwritten digits provided in the MINIST data set of images of hand written digits (0 to 9). The data set used for our application is composed of 300 training images and 300 testing images, and is a subset of the MNIST data set (originally composed of 60,000 training images and 10,000 testing images). Each image is a 28 x 28 grayscale (0 to 255) labelled representation of an individual digit. The general problem we predicted we would face in this digit classification problem was the similarity between the digits like 1 and 7, 5 and 6, 3 and 8, 9 and 8 etc. Also people write the same digit in many different ways the digit ‘1’ is written as ‘1’, ‘1’, ‘1’ or ‘1’. Similarly 7 may be written as 7, 7, or 7. Finally the uniqueness and variety in the handwriting of different individuals also influences the formation and appearance of the digits.

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Velappa Ganapathy, and Kok Leong Liew they proposed a method in which first multi-scale neural training with modifications in the input training vectors is adopted to acquire its advantage in training higher resolution character images and then selective thresholding using minimum distance technique is proposed to increase the level of accuracy of character recognition. A simulator program (a GUI) is designed in such a way that the characters can be located on any spot on the blank paper in which the characters are written. The results show that such methods with moderate level of training epochs can produce accuracies of at least 85% and more for handwritten upper case English characters and numerals [3].

Mathias M.Adankon, Mohamed Cheriet the LS-SVM classifier, like other kernel machines, gives a poor generalization when the hyper parameters are not tuned efficiently. The authors proposed a model selection strategy for the LS-SVM which is a variant of the popular SVM classifier. They formed model selection using the empirical error criterion through the LOO procedure. They applied an algorithm on a handwriting recognition problem, which gave promising results. Compared with the SVM, the sparse LS-SVM classifier, empowered by model selection based on the empirical error criterion and the LOO procedure, achieved higher performance. They conclude from this that the sparse LS-SVM with model selection would be an interesting alternative classifier for the SVM in pattern recognition systems [4].

SOLUTION APPROACH

There are different phases in character recognition process among which first and the main step is Image processing. Next thing is to extract the characters and later to use neural network to train suitable data set. The different steps for performing this task have been described as follows in which following operations are done.

i. Image Read
ii. Gray scale image
iii. Removal of noise
iv. Detecting edges
v. Character extraction
vi. Training and testing

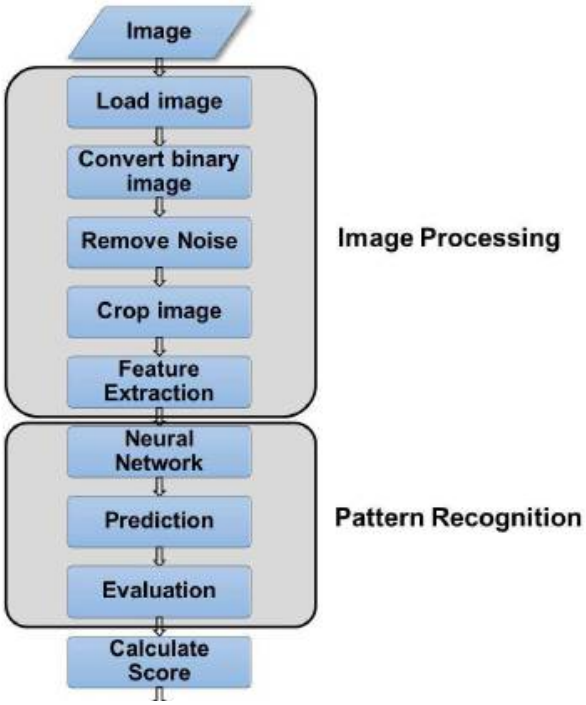

Fig 1 : Solution Approach

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i. Image Read :
We captured the images and converted it into 16x16 pixels. We are considering 100 samples of each image i.e. 1000 samples as a dataset. These images are then converted into gray scale.

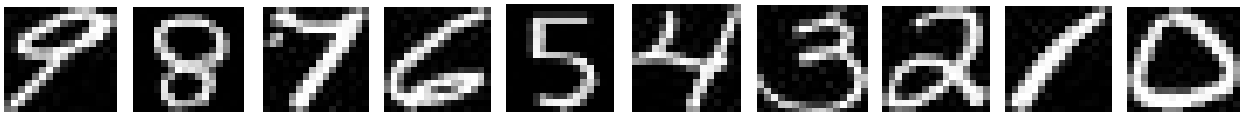

Fig. 2 : 16x16 pixel images

ii. Gray scale image:
Captured images may not be necessarily in a form that can be used by image analysis routines. We may need to reduce noise or may need to simplify, enhanced, and altered, filtered etc. for the improvement. In this the first step is to transfer the coloured image into gray scale image which will result to noisy gray scale image.

iii. Removal of noise:
In this stage, the filtering is done to cancel out the presented noise. It is necessary to remove the noise from the image since it may cause difference between the captured image and actual palm. Edge detection will be difficult in noisy image as noise and the edges contain high frequency content. The noise produced is mainly due to device we use for capturing images, or atmospheric conditions or surroundings etc.

iv. Detecting Edges:
To obtain edge of the noiseless gray scale image, edge detection algorithm is applied. Edge detection operators can't detect every edges like gray level edges, color edges, texture edges etc. Each of different operation has specialty in edges and thus for better edge detection more complex will the operation be.

v. Character extraction:
Here, we check for the maximum connected components with the properties of each component that is in the box form. Then individual characters are cropped into different sub images, which is the raw data for the feature extraction. Once the extraction of the character is done, we pass it to another stage for further classification and training purpose of the neural network.

vi. Training and testing:
For Logistic Regression, We are loading the training data in the work space. Images shown in section Fig 1 have 1000 handwritten digits (100 for each digit). Each digit image is a 16x16 pixel image. So we get 1000 dataset and these dataset are used to train and test the neural network. By using logistic regression algorithm we get the best probability of a scanned image and based on that we classify the image from 0 to 9.

III. RESULT AND DISCUSSION

Images we are using as a data will be coloured one. Before the extraction of features from the image, pre-processing the image for reducing noise or irrelevant information to get the better image properties will be more reliable and beneficial. The results are shown in form of images for different stages.

Following are the results of the input i.e. scanned images given to the neural network.
The scanned images are classified on the basis of probability. The scanned images are given to the neural network and based on the probability it will classify the images from '0' to '9' as shown in figures.

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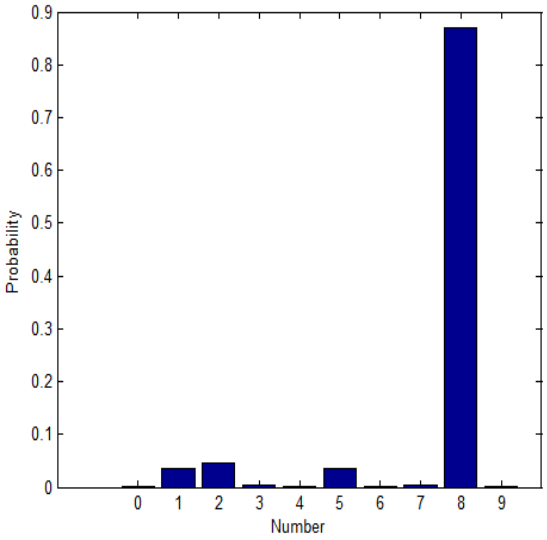

Fig 3: Image classification graph for character '8'

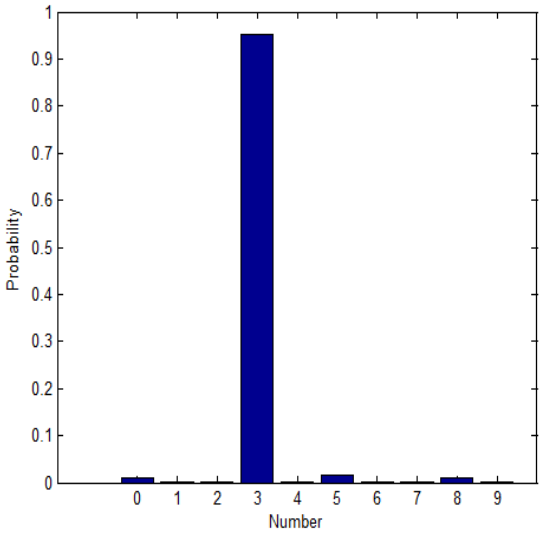

Fig 4: Image classification graph for character '3'

IV.CONCLUSION

This paper gives the brief idea about the handwritten digits or character recognition process using neural network. The proposed neural network based method gives approx 90% accuracy in results. The result of the proposed work is shown as above, which clearly shows the accuracy result of the algorithm. We can have this idea for managing hand written examination scores in paper based test. Similarly we can apply the concept for the recognition of cursive handwriting.

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