International Journal of Enhanced Research in Management & Computer Applications
ISSN: 2319-7471, Vol. 5 Issue 5, May-2016, Impact Factor: 1.544

A Comprehensive Review on Handwritten Digit Recognition using various Neural Network Approaches

Pinki[1], Ms Pooja[2]

[1] M. Tech. Student, CSE dept., R N College Of Engineering and Technology, Rohtak
[2] Asst. Professor, CSE dept., R N College Of Engineering and Technology, Rohtak

ABSTRACT

Handwritten digit recognition has capability of the computer to receive information from sources such as paper documentation, camera, tablets and other devices. Handwritten digits are used in different types of data like cheque, post-mail, address on home's name plate and exam form which also filled by hand etc. In recent years, handwritten digit recognition plays a main role for user authentication applications. In the proposed work, we will be developed gradient descent back propagation using neural network based on digit recognition system. Here introducing four phase: preprocessing, segmentation, feature extraction, classification. MNIST dataset contains CSV file from which image can be obtained by reading it. And this image acts as an input to the procedure. After that this image is preprocessed using RGB converter into binary form and contains some noise ,this noise will be remove using median filter and then convert into filtered image and also various techniques such as skeletonization, centering, and thresholding, are used for the preprocessing the image numerals If the characteristics for one class are distinct and remain constant with variations in this class, then we can term the features as good and desired. Neural Network Technique is used for classification and recognition of handwritten digits through training and testing.

Keywords: Feature Extraction, Segmentation, Artificial Neural Network, Neural Network Toolbox, MATLAB

INTRODUCTION

The way of writing anything is changing from person to person and because of this, the human also face difficulty in the recognition of different writing styles and variations, may be the patterns shifted, scaled, distorted, with some skewed and even overwritten and therefore it is hard for computers to recognize the writing of a person, if use computer in place of human.

1.) Pattern Recognition: Since the domain of this proposed system is Pattern Recognition which is a section of machine learning which aims to systematize the patterns and precisions in pattern (data). And the grouping of patterns situated on the former observation of the patterns.

2.) Number recognition streams: Number recognition has two streams.

a.) Online recognition: Online process is converting automatically of text as written on a paper or on an electronic surface using a special device, where a sensor chooses digital pen activities as well as pen direction or angle substitution which is having (x, y) coordinates, is captured during the writing process. This process is called dynamic representation of handwriting. These types of received points are converted from sign to knowledgeable characters which are used in HCI (human computer interface). Online handwritten interface includes: a pen for use it for writing, a surface which is touch sensitive, which would finally be helping in displaying the output and a software which would analyze the applications of stylus while the user performs writing, which would in turn convert the it resulting in output giving a text which is in digitized form.

b.) Offline recognition: Online recognition does not have stoked information so it is extensively different from offline recognition. Offline handwritten text recognition is the static representation of handwriting as with recognizing a scanned

image and it is one of the most energetic areas of research in computer science. Offline documents are scanned images of pre-written text, generally on sheet or on paper. It is the process of converting offline handwritten text into a format that is understood by machine.

In this proposed work, we work with offline digits. We have techniques from pattern recognition since the regeneration of neural networks, acquired a wide-ranging deploy in digital image processing. Some may be handled by many problems, when used to achieve a recognition problem which is fundamental to relevant computation pattern recognition: ignoring the imprecation of aspects, choosing the good characters and obtaining a better transferability or exchangeability. So for we need to provide good training to our computers in order to receive significant accuracy in recognition or recollection and by which we have to use preprocessing, segmentation, feature extraction, classification methods.

LITERATURE REVIEW

Liu, Cheng-Lin, et al. [1] has compared the performances of ten normalization functions and eight feature vectors in handwritten digit recognition on large databases of different sources. The normalization functions implement dimension-based linear/nonlinear normalization and moment-based normalization with varying aspect ratio mapping. This paper proposed some enhanced normalization and feature extraction strategies and estimates their performance with contrast to existing techniques.

Subhashini, P. P. S., and V. V. K. D. V. Prasad et al. [2] has proposed, a method based on Radial basis function (RBF). Neural network plays an important role in pattern classification problems. Training neural network was a challenging nonlinear optimization problem. Multiple algorithms have been premeditated for choosing the RBF neural network prototypes and used to train the network. The efficiency of the proposed methodology was tested on the handwritten digits of different fonts and found to be successful in recognizing the digits. This method is tested on handwritten digits of 0 to 9 of 25 different fonts. The success rate of this method for recognizing handwritten digit is viable.

Bathani, Ms Rinku, and Ms Honey Patel. [3] has discussed the Container Code Recognition (CCR) can be deployed simply using currently available state of art Optical Character Recognition solution. CCR system consists of four steps: capture the container image from digital camera, pre-processing, character segmentation and character recognition. Container markings follow an International Organization for Standardization standard. There may be additional characters beside eleven ISO characters on the container. Each container ode recognition system use different grouping of algorithms.

Jeong, Cha-Sup, and Dong-Seok Jeong. [4] proposed a method for the recognition of handwritten digits. This method of recognition was based on contour information and Fourier descriptors. First was the preprocessing in which contours of the input digit image was extracted and separate the outer and inner contour from the contour image. Second, the outer contour feature output data was extracted and use them to build standard models. In the last step, digit was recognized by comparing the features of input digits with those of models. 500 data for each digits was used in this paper. So total of 5000 data were used in this paper. The overall recognition rate was 99.04% and to reduce the errors by eliminating the broken contour problems during preprocessing.

Sahlol, Ahmed T., et al.[5] described a proficient approach for the recognition of off-line Arabic handwritten characters. It was based on novel preprocessing operations (including different kinds of noise removal and dilation), structural, statistical and topological features from the main body of the character and also from the secondary components. The popular Feed Forward Neural Network was used for classification of methodology which enhances the performance. The proposed algorithm obtained has promising results in terms of accuracy (success rate of 100% for some letters with an average rate of 88%).In comparisons to others work this technique performs well in terms of performance. We hope also that we will complete a system for recognizing handwritten Arabic texts passing through segmentation techniques for segmenting the words to characters.

Wang, Jeen-Shing, and Fang-Chen Chuang[6] presents an accelerometer-based digital pen for handwritten digit and motion trajectory recognition applications. The digital pen consists of a triaxial accelerometer, a microcontroller, and an RF wireless transmission module for sensing and collecting accelerations of handwriting and gesture trajectories .Pen was used by the user to write digits or make hand gestures, and the accelerations of hand motions measured by the accelerometer were wirelessly transmitted to a computer for online trajectory recognition. The recognition rate for overall handwritten digit was 98%, and for gesture recognition rates it was 98.75%. This result encourages us to further investigate the possibility of using our digital pen as an effective tool for HCI applications.

Bhattacharya, Ujjwal, and Bidyut B. Chaudhuri [23] in this paper described the problem of isolated handwritten numeral recognition of major Indian scripts, shown effort for the development of handwritten numeral database of Indian scripts, and also described a multistage method for high accuracy recognition of these handwritten numerals. So eliminate this problem by these principal offerings presented are pioneering development of two databases for handwritten numerals of the two most popular Indian scripts, a multistage cascaded recognition scheme using wavelet-based multiresolution representations and multilayer perceptron (MLP) classifiers, and application of 2 for the recognition of mixed handwritten numerals of three Indian scripts—Devanagari, Bangla, and English.

The database have 22,556 and 23,392 handwritten isolated numeral samples of Devanagari and Bangla collected from real-life situations, and these can be made available free of cost to researchers of other academic institutions. In this proposed scheme used a numeral which is subjected to three MLP classifiers corresponding to three coarse-to-fine resolution levels in a cascade. This scheme has been extensive to the situation when the script of a document is not known a priori or the numerals written on a document belong to different scripts. Handwritten numerals are used in Indian postal mail and tabular form documents. Also, it has importance in automatic reading of these documents.

Jayadevan, R., et al. **[24]** in this paper proposed to the recognition of printed as well as handwritten Devanagari text because more than 300 million people use Devanagari script for documentation. In this Devanagari script have some unconstraint and overlapped portions of the documents and some characters are broken due to incorrect character segmentation of touching so to need to feature-extraction techniques with training data, classification and matching techniques helpful for the recognition.

There are some applications like postal address reader, huge volumes of historical documents and books remain to be digitized for better access, sharing, indexing, address can be written in any Indian script etc. so it can be helpful for other research communities in India in the areas of social sciences, economics, and linguistics. Some of the leading institutes is gaining much attention because of its large market prospective research in Devanagari OCR are Indian Statistical Institute at Kolkata, International Institute of Information Technology at Hyderabad, Indian Institute of Science at Bangalore, and Indian Institute of Technology at New Delhi.

Bottou, Léon, et al [25] this paper proposed the comparison of performance between several classifier algorithms on standard database of handwritten numerals. Here consider accuracy, training time, recognition time, and memory requirements. Here, used the LeNet 4 classifier which eliminates the redundant training examples which also reduce the size requirements of the memory-based classifiers that tested at the cost of increase run time. LeNet 4 is produce the feature vector which is significant variation in the training time and it is performs recognition at 1000 characters. The recognizer is designed to train for find out the correct digit and also correct segmentation. Neural Network is used for recognition and it has advantage over memory-based technique.

Hull, Jonathan J [26] this paper is overcomes the limitations of unconstrained for the writer, style, and method of preparation and also which contained isolated character. Each image was scanned from digital camera and other device at 300 pixels in 8-bit grayscale on a high-quality but flat bed digitizer. Here allowed for experiment with preprocessing and grayscale recognition techniques and also ZIP Code recognition to provide constraints for the recognition of city and state names. A segmentation algorithm is applied to these images and saved to a separate file. These digits are providing truth value by segmentation at that position in the zip code. The main aim of this test set is to provide simulation of the data that would be encountered by an isolated digit recognition algorithm. The database is dividing into explicit training and testing sets to facilitate the result.

OBJECTIVE

The purpose of this proposed work is to categorize handwritten digits using neural networks. We have to create appropriate neural network which is used for training and testing accurately. Extraction of the digits should be prepared one by one and map the extracted digit to the target output for training purpose.

I. An efficient technique to be developed for feature extraction.

II. Classification of techniques is necessary so that results must be improved

III. Development of a computationally easy and intrinsically algorithm for feature selection.

Our objective is to be writing the program code in MATLAB and support an interface which is Graphical User Interface (GUI).

Problem Statement

This proposed work seeks to determine how a system for recognition of handwritten symbols would be implemented on a modern system. We will focus on the single symbol off-line case of handwriting i.e. the input is a static image containing one symbol. This report will discuss the different stages of a complete recognition system to give an overview of the challenges faced, but mainly focus on the recognition phase.

- Only one symbol will be recognized at a time.
- The classifier will only handle with binary data and suppose the images have been pre-processed.
- Handwriting is subject to high conflict in writing style between different authors. Factors contain size, rotation, lengthening and tilt or the equivalence of dissimilar fonts. Even a single person writing the same symbols twice is matter to variation in size and position.
- The handwritten digits are having some variation so not always of the same size, direction, thickness and angle.
- Isolation of tokens by dividing digits into part of digit. Determining where a digit starts and ends.

CONCLUSION AND FUTURE SCOPE

In this work we implemented a neural network for offline recognition of handwritten isolated digits. The network. An experimental result shows that conventional features with back propagation network yields good classification accuracy of 100% and recognition accuracy of 91.2%.The work can be extended to increase the results by using or adding some more relevant features. A lot of efforts have been made to get higher accuracy and there is tremendous scope of improving recognition accuracy by developing new feature extraction techniques or modifying the existing feature extraction techniques. Further the system can be implemented to recognize
the continuous handwritten digits with multistrokes

REFERENCES

[1]. Tuan Trung Nguyen, “Adaptive Classifier Construction: An Approach to Handwritten Digit Recognition”, J.J. Alpigini et al. (Eds.): RSCTC, LNAI 2475, Springer-Verlag Berlin Heidelberg, pp. 578–585, 2002.
[2]. T. Vasudev, G Hemanth kumar, P. Nagabhushan, “Transformation of Arc-Form-Text to Linear Form Text Suitable for OCR”, Pattern Recognition Letters, vol. 28, issue 16, pp.2343-2351, 2007.
[3]. Sonka M., Hlavac V., Boyle R., “Image Processing Analysis and Machine Vision”, 2nd Edition, 1999.
[4]. Chen M. Y., Kundu A., Zhou J., “Offline Handwritten Word Recognition Using HMM Type Stochastic Network”, IEEE Transaction of Pattern Analysis and Machine Intelligence, 16, 481-496, 1994.
[5]. Saula J., Pietikainen M., “Adaptive Document Image Binarization”, Pattern Recognition, vol. 33, issue 2, 2000.
[6]. Dayashankar Singh, Sanjay Kr. Singh, Dr. (Mrs.) Maitreyee Dutta, “Handwritten Character Recognition Using Twelve Directional Feature Input and Neural Network”, International Journal of Computer Applications, Volume 1 – No. 3, 2010.
[7]. Anita Pal, Dayashankar Singh “Handwritten English Character Recognition Using Neural Network” International Journal of Computer Science and Communication vol.1 No. 2, pp 141-144, 2010.
[8]. M. K. Mohammed Altahaf, M. B. Begum “Handwritten Characters Pattern Recognition Using Neural Networks” International Conference on Computing and Control Engineering, 2012.