

# Implementation of Handwritten Character Recognition using Neural Network

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## Abstract

The handwritten character recognition problem has become most famous problem in machine learning. This paper will focus on neural network technique to recognize the handwritten characters. The purpose is to develop a Android Application to recognize characters with a higher accuracy rate reducing its space and time complexities. Random datasets of handwritten characters has been used for conducting experiments. The OCR and many other methods were proposed for character recognition. Recognition, accuracy rate, performance and execution time is an important criterion that is to be met by the method being used. Handwriting character recognition has been a challenging area of research, with the implementation of Machine Learning we propose a Neural Network based approach.

**Keywords:** Handwritten Character Recognition, Neural Network

## I. INTRODUCTION

More people use images to represent and transmit information. This is a challenging problem because there is considerable variety of handwriting from person to person. Image recognition is an important research area for its widely applications. Reading of written or printed document is easy for human being, this ability can be induced in machine using OCR (Optical Character Recognition) technique. OCR is identification of both handwritten and printed document using computer. In OCR technique, digital camera or a scanner is used to capture different types of documents like paper documents, PDF files and character images and convert all these documents into machine editable format like ASCII code. OCR can be classified into two categories based on text type and acquisition of documents. On basis of text type OCR is of two types HCR (Handwritten Character Recognition) recognition of intelligible handwritten input from source such as paper documents and PCR (Printed Character Recognition) recognition of printed documents. Main reason for high recognition complexity in HCR due to the varying writing styles of different peoples. Even in same individual also the writing style and format are different. OCR is divided into Offline and Online recognition systems based on acquisition of documents. In offline systems already written document is scanned and is taken as input for recognition. But in case of online systems character is recognized at the time of writing, where characters are captured by a tablet digitizer. Electronic pen is used to write the character on the digitizer and based on the pen movement character can be recognized.

Handwritten recognition is very useful in real world. There are many practical problems where handwriting recognition system is very useful like documentation analysis, Mailing address interpretation, bank check processing, signature verification, postal addresses. Several approaches have been used in both online and offline handwriting recognition field like statistical methods, structural methods, neural network and syntactic methods. Some recognition system identify strokes, other apply recognition on single character or entire words. So handwriting recognition system is work as a communication medium between human and machines.

## II. LITERATURE SURVEY

### **A. Diagonal Based Feature Extraction System Using Neural Network**

The characters in this paper are recognized using a new technique called the diagonal feature extraction technique. There were two approaches used, firstly with 54 features and secondly with 69 features which constituted the Neural Network character recognition system. The diagonal feature extraction method was compared with the traditional horizontal and vertical feature extraction methods, by training the neural network with both the methods. Six recognition neural networks were built in process. The results experimentally revealed that 69 features gave a better accuracy rate than 54 features. The system presented in the paper seems ideal to convert handwritten text documents into structural format.

### **B. Handwritten English Character Recognition Using Neural Network**

The paper demonstrates the use of Feed Forward Algorithm along with Back Propagation Algorithm. We paper successfully recognizes characters using a multilayer perceptron with 1 hidden layer. Higher performance can be achieved in Back Propagation once the number of hidden nodes to be used is successfully determined. The recognition of characters is proved to be better and gives an accuracy of 70% and above for English handwritten characters.

### **C. Digital Image Processing Techniques in Character Recognition**

The paper explains the various phases of image processing being used in character recognition such as Image Restoration, Image Enhancement, Segmentation, Feature Extraction and Classification with Recognition. These techniques are used along with Neural Network due to its high tolerance to noise. This helps in removing all unwanted signals in images that are distorted over years. Successful character recognition becomes possible for such documents as well and the systems generate perfect results.

### **D. Character Recognition using Neural Network**

In this paper, neural network is used to recognize characters. It improves the recognition rate as the system is developed for isolated English characters – A to Z. The paper makes use of feed forward back propagation and the Neural Network is trained using Back Propagation to classify and recognize characters. The English characters are represented in the binary form as is then fed to the Neural Network for further processing. The paper fails to recognize cursive handwritings.

### **E. Handwritten Digit Recognition**

The paper presents a comparison of the feature vectors, the feature extraction strategies are proven to perform better than their baseline counterparts. The gradient feature extraction technique works best for gray scale images giving the most accuracy rate of characters and also the Normalization-Cooperated Feature Extraction (NCFE) yields a good performance result. The gradient feature extraction technique is applied on the gray scale images and other.

## III. METHODOLOGY

### **A. Preprocessing**

The goal of preprocessing is to discard irrelevant information that can negatively affect the recognition. Generally, the irrelevant information includes duplicated points, wild points, hooks, noise etc. Preprocessing aims to produce data that are easy for the HCR system to operate accurately.

### **B. Segmentation**

After preprocessing a clean document is obtained. In this stage, segmenting the document into its sub components. It separates the logical parts, like text from graphics, line of paragraph, and characters of a word. Segmentation is important phase in HCR system.

### **C. Feature Extraction**

A set of rules stored on HCR engine comparing against characters shape and its features that distinguishes each character identify a character. The main part of recognition system design is the selection of a stable representative set of features. It is most consequential issue in the designing issues involved in building an HCR system.

### **D. Classification**

The main decision making stage of HCR system is classification. Classification uses the features extracted in the feature extraction stage to identify the text segment.

### **E. Post Processing**

It is the final stage, post processing refining the decisions taken by the previous stage, improves the recognition and recognizes words using context. It is ultimately responsible for outputting the best solution and is often implemented as a set of techniques that rely on character frequencies, lexicons, and other context information.

#### IV. ALGORITHM

Algorithm: Classification of Characters

Input: Images with handwritten character.

Output: Recognition of the character and giving it in a printed format.

Method: Structural features and K-nn classifier.

- 1) Step 1: Convert the gray level image into Binary image.
- 2) Step 2: Pre-processing the Binary Image.
- 3) Step 3: Convert binary image into a single Dimensional Array of [1, n].
- 4) Step 4: Keep the label of each Array along with it.
- 5) Step 5: Feed the Classifier with the train\_data set.
- 6) Step 6: Repeat step for all images in sample and test database.
- 7) Step 7: Estimate the minimum distance between feature vector and vector stored in the library by using Euclidian distances.
- 8) Step 8: Classify input images into appropriate class label using minimum distance k-nearest neighbour classifier.

#### V. CONCLUSION

Random and standard datasets of handwritten characters have been used to evaluate the algorithms. Here we use neural network algorithms to determine the best algorithm in terms of many factors such as execution time, accuracy and performance. The comparison between the proposed approach and other existing approaches will be focused in the future. The proposed methodology has produced good results for images containing handwritten text written in different styles, different size and alignment with varying background.

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