

Handwritten Digit Recognition

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Abstract

Most people effortlessly recognize those digits as 5, 0, 4, 1, 9, 2. That ease is deceptive. We carry in our heads a supercomputer, tuned by evolution over hundreds of millions of years, and superbly adapted to understand the visual world. Recognizing handwritten digits isn't easy. Rather, we humans are stupendously, astoundingly good at making sense of what our eyes show us. But nearly all that work is done unconsciously. And so we don't usually appreciate how tough a problem our visual systems solve.

The difficulty of visual pattern recognition becomes apparent if you attempt to write a computer program to recognize digits like those above. What seems easy when we do it ourselves suddenly becomes extremely difficult. Simple intuitions about how we recognize shapes - "a 9 has a loop at the top, and a vertical stroke in the bottom right" - turn out to be not so simple to express algorithmically. When you try to make such rules precise, you quickly get lost in a morass of exceptions and caveats and special cases. It seems hopeless.

I INTRODUCTION

Handwriting recognition (HWR) is the ability of a computer to receive and interpret intelligible handwritten input from sources such as paper documents, photographs, touch-screens and other devices. The image of the written text may be sensed "off line" from a piece of paper by optical scanning (optical character recognition) or intelligent word recognition. Alternatively, the movements of the pen tip may be sensed "on line", for example by a pen-based computer screen surface, a generally easier task as there are more clues available.

Handwriting recognition principally entails optical character recognition.[dubious – discuss] However, a complete handwriting recognition system also handles formatting, performs correct segmentation into characters and finds the most plausible words.

Off-line handwriting recognition involves the automatic conversion of text in an image into letter codes which are usable within computer and text-processing applications. The data obtained by this form is regarded as a static representation of handwriting. Off-line handwriting recognition is comparatively difficult, as different people have different handwriting styles. And, as of today, OCR engines are primarily focused on machine printed text and ICR for hand "printed" (written in capital letters) text.

In daily life practices the name and address from ID card, by bank clerks and in some institutions where the records are kept and entered from document to digital form. Even after 30 years of research in handwriting recognition, we still have a problem to recognize unconstrained handwriting and it is still an open field of research. Our main motive is to use the offline handwriting recognition method for medical purpose and its possibilities and future scope. Offline text handwriting recognition is the process of recognizing human's handwriting from a scanned paper document which is made available in the form of binary or gray scale image. This available image is then made available to the recognition algorithm.

The main process in offline recognition are distance measure, making prototype, feature extraction, processing, classification and knowledge acquisition from training data. Some classification techniques which are generally used in handwriting recognition are Neural Network, Back

Propagation Algorithm, K-nearest Neighbour. Those classification techniques considered statistical based approach where the features extraction are labelled by using statistical means [1].

This paper proposed the use of neural network for the offline handwriting recognition. We intended to use the very simple nearest neighbour OCR algorithm. For this the training and test images are used to train and test the neural network respectively. For any system to recognize well, it is very important to train it very well. As we all know the difference between the real life input and the training data provided to the system is very large, thus it is very well understood that the system may not behave well. Thus we have to give a diverse training data to the system.

We have to survey from the other author research paper and they have to measure some related work of our research project. They are:

Rahul KALA, et.al: proposed work on Offline Handwriting Recognition method with used Genetic Algorithm. In this research describe to a piece of paper and then convert it into text. They are used genetic algorithm to implement Offline

Handwriting Recognition [4]. Brandon Maharrey COMP 6600 Artificial Intelligence Spring 2009 they survey about A Neural Network Implementation of Optical Character Recognition that measure that neural network is also use in OCR for the handwritten notes or words [7]. Sang Sung Park, Won Gyo Jung, Young et.al: teams they are implemented Optical Character Recognition System Using BP

Algorithm they told her They use OCR (OCR : Optical Character Recognition) technique which is that saving relevant documents to DB after extracting text by using OCR. That is, text should be entered to DB after classifying segments one by one in realized whole document after doing character recognition through OCR. In this paper, in order to solve this problem, we constructed OCR system that saves abstracted characters to DB automatically after extracting only equivalent and necessary characters from a large amount of documents by using BP algorithm [8].

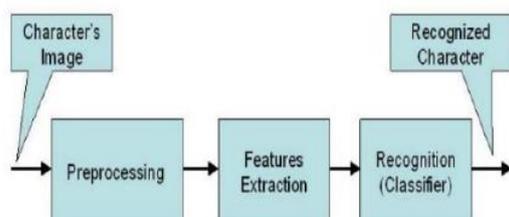
Made Edwin Wira Putra, IpingSuprianaSuwardi both has implement the Structural off-line handwriting character recognition using the purpose of those model is to give the ability in improving recognition accuracy without relying in normalization technique. They are use in graph technique. The graph consists of several edges that indicate the connected vertices. The vertices

are joining and to form a curve that make the character. The curve is extracted by analyzing the character's chain code, and its string feature is created using some principle [1].

Krupadholakia has to define about the handwritten character recognition technique are divided into some subparts such as preprocessing, segmentation, feature extraction, classification and post processing[11].

III WORKING METHODOLOGY

1) . OCR- Optical Character Recognition (OCR) is the mechanism of translation of images of handwritten, typed or printed texts by the means of scanner into a machine editable text. It is generally used for converting the paper books and documents into electronic files. When we scan any paper, the scanner only produces the image file or a photo of the page. This image is not readable for texts by computer that is the computer cannot understand the letters written or typed on the page. So, we cannot edit the texts of that image as we can do in any word processor. For that specific function we use OCR software to convert it into a word processor file or text to enable us to do editing on those printed or written texts. For our Offline Handwriting Recognition system we propose the use of Neural Network. We intended to use the nearest neighbour OCR algorithm.



OCR Aanalysis

2)Neural Network- A neural network is a powerful data modeling tool that is able to capture and represent complex input/output relationships. The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks similar to those performed by the human brain. Neural networks resemble the human brain in the following two ways: they acquire knowledge through learning, and the knowledge is stored within inter-neuron connection strengths known as synaptic weights [12], [5].

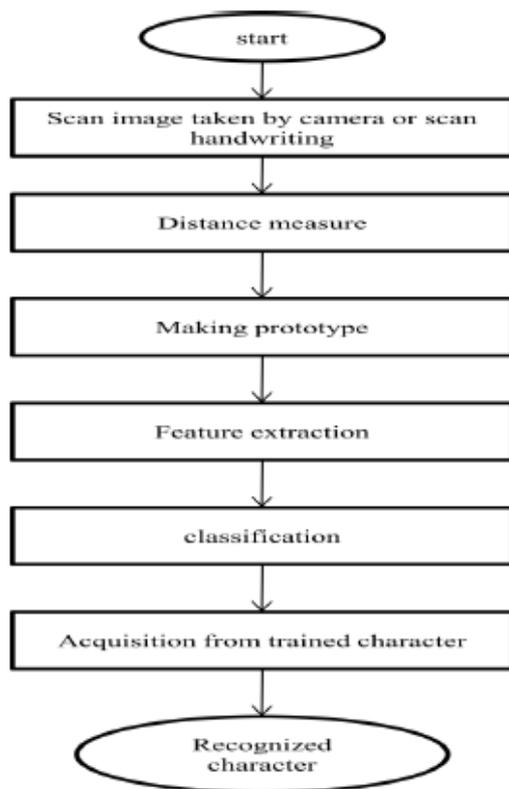
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IV IMPLEMENTATION

The neural network algorithm first acquires the characters by ungrouping them. Each individual recognized character will be treated as the test images. Each test image is now compared to each trained neural network character. In the whole process the

OCR algorithm will try to guess the test image. When any of the test images is guessed by the OCR, it is stored in the different test image as actual character to which it resembles. By performing these steps in a single line we will get a set of recognized characters arranged in an order with their respective places. Since we cannot recognize all of the handwritten words, we here try to guess the possible string with those recognized characters in given pattern

by our saved offline dictionary. Those character patterns are matched to every possible string and the best match is given as the answer. It is quite difficult to have a dictionary of all possible strings, thus we have given an option for online search for the possible answers for that recognized character pattern.



Workflow Logic Implementation.



The implementation is made with the different numbers and found to be the algorithm have been working very fine with good and efficient accuracy.

VI CONCLUSION

Neural Networks have really created a new vision in the computer and industrial applications. Previously mat lab was used for such simulations but in such implementations one does not have full control, nor the ability to understand that what is happening behind the application. However with more understanding of neural networks, now we have more control over its applications and now we can easily implement such intelligence to identify objects into machines and computers in order to cater our needs in the industrial applications.

V EXPERIMENT AND RESULTS

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