Image Processing and Neural Network Based Handwritten Character Recognition

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Abstract - *This system is very helpful for recognising all characters in an input picture (in English). When a character input image is given to the proposed system, it will recognise the character in the image. Neural networks are used to recognise and classify characters. The main goal of this project is to use a Neural Network approach to effectively recognise a specific character of type format. We created a Handwritten character recognition system based on image segmentation. We used OpenCV for image processing and Tensorflow for neural network training in our framework. This system was created using Python programming.*

KeyWords— **Neural network, Handwritten, Segmentation, OpenCV, Tensorflow**

1. INTRODUCTION

Neural networks are being used in handwriting recognition, which is one of the most active fields of study. Handwriting recognition is a simple task for humans but a difficult task for computers. There are two types of handwriting recognition systems: Online and Offline. The user's handwriting is recognized when the user writes in an online handwriting recognition system. Also available

is details such as the order in which the user made the strokes. However, in an offline handwriting recognition system, the user's handwriting is stored as an image. For a variety of purposes, handwriting recognition is a difficult job. The main explanation for this is that different people have different writing styles. The secondary explanation is that there are several different types of characters, such as capital letters, small letters, digits, and special symbols. To train a near-accurate neural network model, a large dataset is needed. The main explanation for this is that different people have different writing styles. The secondary explanation is that there are several different types of characters, such as capital letters, small letters, digits, and special symbols.

1.1 Related Work

Title	[1]Handwritten Digits Recognition with Neural Networks and Fuzzy Logic
Year of Publication	1995

Author	Wei Lu, Zhijian Li, Bingxue Shi
Description	The author proposes a handwriting recognition scheme based on neural networks and fuzzy logic. To extract local features from a pattern, a neural network is used. A fuzzy logic recognizer is used to perform the recognition based on the function maps. Experiments show that the device is capable of dealing with handwriting character distortion and change variations.
Title	[2].Handwritten Tamil Character Recognition using Artificial Neural Networks"
Year of Publication	2011
Author	P. Banumathi , Dr. G. M. Nasira
Description	This paper presents a method for recognising handwritten Tamil characters. The method of converting a handwritten Tamil character into a printed Tamil character is known as handwritten Tamil character recognition. Handwritten characters are difficult to process because of the wide range of writing styles, as well as the varying sizes and orientation angles of the characters. The scanned image is segmented into paragraphs, paragraphs into lines, lines into words, and words into character image glyphs in the proposed scheme. The features such as character height, width, number of horizontal and vertical lines, horizontally and vertically oriented curves, number of circles, number of slope lines, image centroid, and special dots are extracted from each character image glyph.

Title	[3]. "Handwriting Recognition Using Supervised Neural Networks"
Year of Publication	1999
Author	B. V. S. Murthy
Description	The creation of a framework that is versatile enough to recognize numerical handwritings with the least amount of error is presented in this paper. The first test was performed with a neural network that was only trained using the Character Vector Module as a feature extraction tool. A mere average of 64.67 percent accuracy was achieved, which is well below the set point of recognition accuracy. The modules each have their own distinct characteristics that are trained using the Back-Propagation algorithm to cluster the pattern recognition capabilities of various handwriting samples. To test the software, several untrained samples of numerical handwritten data were collected at random from different people.

2. PROPOSED SYSTEM

In our proposed method, we used the Neural Network Based Model to capture handwritten characters from a laptop camera, convert them to frames, and then use them in our system. We used the NIST Dataset, which is open to the public and includes collections of handwritten characters from thousands of authors. Convolutional Neural Network is the neural network model that we used. CNNs are cutting-edge neural networks that have a wide range of uses in the area of computer vision. Tensorflow, an open source library for machine learning applications, was used to train the neural network model. Various image processing operations such as segmentation, thresholding, and Morphological Operations were performed using OpenCV. OpenCV is a free and open source image processing library.
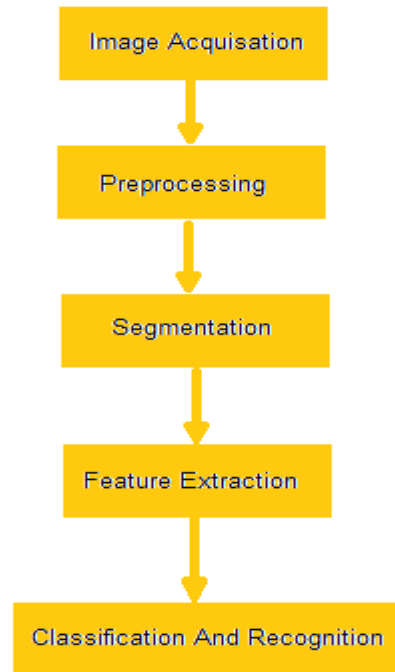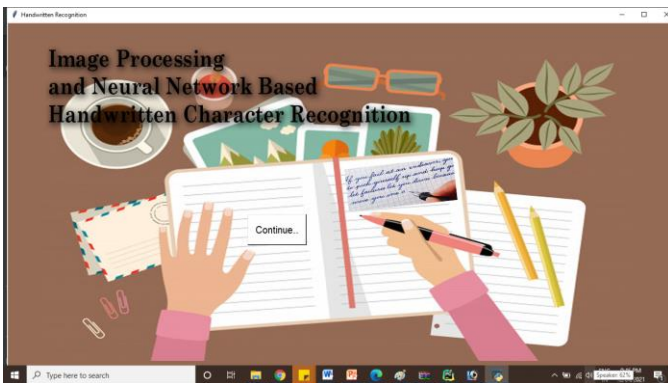
Overview

A. Flow Chart

Figure 1: Flow Diagram of Handwritten Recognition

Implementation

1. **Pre-processing**: This is the first step in the image processing process. The noise in the image is extracted using median filtering in this process. One of the most commonly used noise reduction techniques is median filtering. This is due to the fact that median filtering preserves the image's edges while removing the noise.

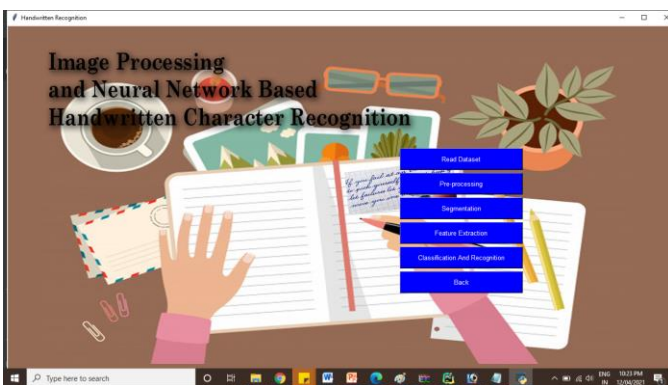Figure 2: Original Dataset of Handwritten

Figure 3: Main

Figure 4: Menu

2. **Conversion-To-GrayScale**: The image is converted to grayscale following the pre-processing stage. Since different writers use pens of various colours and intensities, conversion to grayscale is needed. The system's overall complexity is also reduced by operating with grayscale images.

3. **Thresholding:** When a photograph is transformed to grayscale, the handwritten text becomes darker than the background. We may separate the darker regions of the image from the lighter regions using thresholding. As a result of the thresholding, the handwritten text can be distinguished from its context.

4. **Image Segmentation**: Text may be written in the form of lines by the author. As a result, the threshold picture is segmented into individual lines first. Then each line is broken down into individual phrases. Finally, each word is broken down into its constituent characters.

Conclusions

The project can only identify letters and digits at the moment. Various pre-processing techniques, segmentation approaches, feature extraction processes, and classification techniques are all covered in depth. On parameters such as accuracy and process complexity, this paper defines the most efficient method of handwritten character recognition. Handwriting recognition can be achieved using clustering, feature extraction, and pattern matching, but according to studies, neural networks are more accurate and effective, and they have a higher accuracy rate.

FUTURE SCOPE:

In future we want to implement for:

- Multiple language support

- Additional features can also be added to the software like,
  - Translation
  - Voice reading

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