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Optical Character Recognition Using Artificial Neural Network

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Abstract -This paper examines the use of neural networks to accomplish optical character recognition.Recognition of Handwritten text has been one of the active and challenging areas of research in the field of image processing and pattern recognition [4].The whole process of recognition includes two phases segmentation of characters intoline, word and characters and then recognition through feedforward neural network. Basically an offline handwritten alphabetical character recognition system using multilayer feed forward neural network has been described in our work. a method of feature extraction is introduced for extracting the features of the handwritten alphabets and then we use the data to train the artificial neural network.It contributes immensely to the advancement of an automation process and can improve the interface between man and machine in numerous applications [7].

Keywords - Character Recognition, Training, Feature Extraction, Image Processing, ANN,OCR, classification.

INTRODUCTION

Character recognition, usually abbreviated to optical character recognition or shortened OCR, is the mechanical or electronic translation of images of handwritten, typewritten or printed text (usually captured by a scanner) into machine editable text [1]. It is a field of research in pattern recognition, artificial intelligence and machine vision. Though academic research in the field continues, the focus on character recognition has shifted to implementation of proven techniques. For many document-input tasks, character recognition is the most cost-effective and speedy method available. And each year, the technology frees acres of storage space once given over to file cabinets and boxes full of paper documents [10].

The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a digital image) corresponding to alphanumeric or other characters. The process of OCR involves several steps including segmentation, feature extraction, and classification [12].Theneural network technology can be usedto analyze the stroke edge, the line of discontinuity between the text characters, and the background [3]. Allowing for irregularities of printed ink on paper, each algorithm averages the light and dark along the side of a stroke, matches it to known characters and makes a best guess as to which character it is. The OCR software then averages or polls the results from all the algorithms to obtain a single reading [2]. Neural networks can be used, if we have a suitable dataset for training and learning purposes. Datasets are one of the most important things when constructing new neural network.

METHODOLOGY

To solve the defined handwritten character recognition problem of classification we used MATLAB computation software with Neural Network Toolbox and Image Processing Toolbox add-on.In Classification Processthere are two steps in building a classifiertraining and testing. These steps can be broken down further into substeps.

TRAINING

a. Pre-processing – Processes the data so it is in a suitable form .
b. Feature extraction – Reduce the amount of data by extracting relevant information—Usually results in a vector of scalar values. (We also need to normalize the features for distance measurements)
c. Model Estimation – from the finite set of feature vectors, need to estimate a model (usually statistical) for each class of the training data.

TESTING

a. Pre-processing

b. Feature extraction – (both same as above)
c. Classification – Compare feature vectors to the various models and find the closest match. One can use a distance measure.

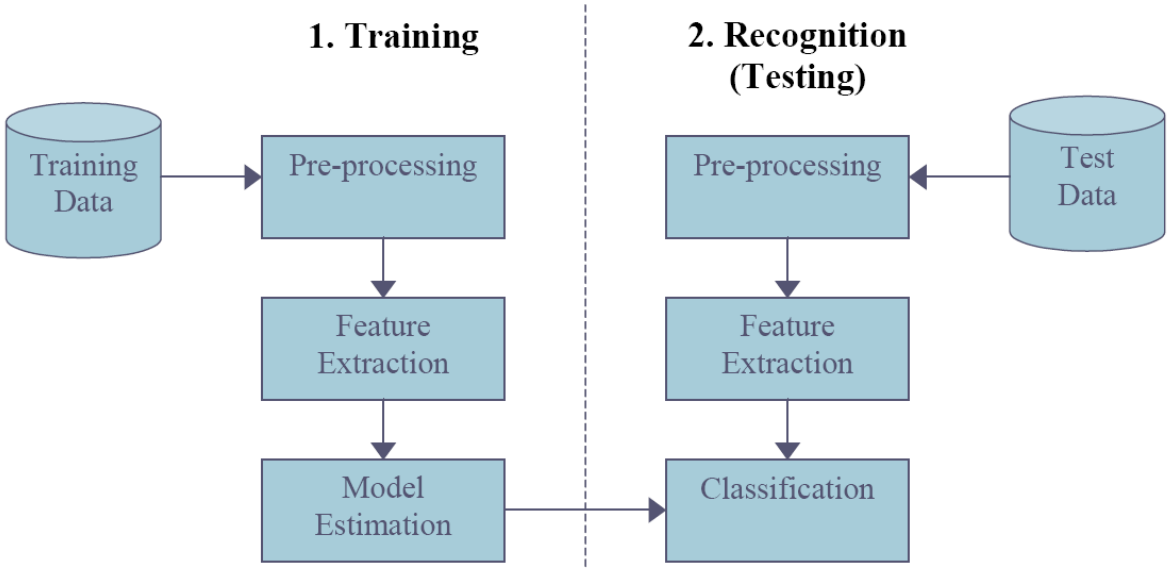

Fig 1. Training And Testing Of Data

AUTOMATIC IMAGE PREPROCESSING

The image is first being converted to grayscale image follow by the threshing technique, which make the image become binary image. The binary image is then sent through connectivity test in order to check for the maximum connected component, which is, the box of the form [6]. After locating the box, the individual characters are then cropped into different sub images that are the raw data for the following feature extraction routine. Binarization is Usually presented with a grayscale image, binarization is then simply amatter of choosing a threshold value.Morphological OperatorsRemove isolated specks and holes in characters, can use theMajorityoperator.Segmentation is by far the most important aspect of the pre-processing stage. It allows the recognizer to extract features from each individual character [12]. In the more complicated case of handwritten text, the segmentation problem becomes much more difficult as letters tend to be connected to each other.It Checks the connectivity of shapes, label, and isolate.

FEATURE EXTRACTION

The sub-images have to be cropped sharp to the border of the character in order to standardize the sub-images. The image standardization is done by finding the maximum row and column with 1s and with the peak point, increase and decrease the counter until meeting the white space, or the line with all 0s. This technique is shown in figure below where a character “S” is being cropped and resized.

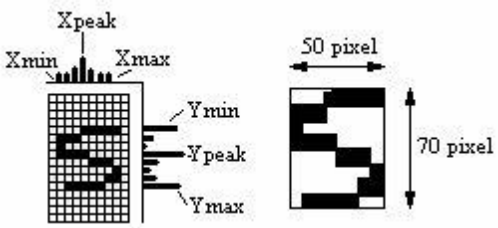

Fig 2. Cropped and resized picture

The image pre-processing is then followed by the image resize again to meet the network input requirement, 5 by 7 matrices, where the value of 1 will be assign to all pixel where all 10 by 10 box are filled with 1s, as shown below:

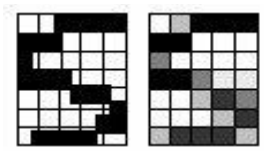

Fig 3. Image resize again to meet the network input requirement

Finally, the 5 by 7 matrices is concatenated into a stream so that it can be feed into network 35 input neurons. The input of the network is actually the negative image of the figure, where the input range is 0 to 1, with 0 equal to black and 1 indicate white, while the value in between show the intensity of the relevant pixel [15]. By this, we are able to extract the character and pass to another stage for future "classification" or "training" purpose of the neural network character.

DESIGN AND IMPLEMENTATION

Initially we are making the Algorithm of Character Extraction. We are using MATLAB as tool for implementing the algorithm. Then we design neural network, we need to have a Neural Network that would give the optimum results . There is no specific way of finding the correct model of Neural Network. It could only be found by trial and error method [11]. Take different models of Neural Network, train it and note the output accuracy. There are basically two main phases in our Paper: Pre-processing and Character Recognition. In first phase we have are preprocessing the given scanned document for separating the Characters from it and normalizing each characters. Initially we specify an input image file, which is opened for reading and preprocessing. The image would be in RGB format (usually) so we convert it into binary format [8]. To do this, it converts the input image to grayscale format (if it is not already an intensity image), and then uses threshold to convert this grayscale image to binary i.e.all the pixels above certain threshold as 1 and below it as 0. we needed a method to extract a given character from the document.

The character recognition application can be used in two different ways. First way is to type every command inside the MATLAB console and workspace on hand. The second way is to use already pre-prepared Graphical User Interface [10]. The GUI consists of two files. First file include all necessary programming code, and the second file include visible interface shapes and forms. The interface works like the workflow of recognition process. First we load the image, than we select the character and after that we click crop, pre-process, feature extraction and finally recognize [7]. On every stage, GUI shows us a new image, which is unique for the each step. The images can be viewed in the Main window, RGB, Binary, Crop to Edges and Features window.

CONCLUSION

This paper carries out a study handwritten character recognition using Artificial Neural Network.Artificial neural networks are commonly used to perform character recognition due to their high noise tolerance. The systems have the ability to yield excellent results. The feature extraction step of optical character recognition is the most important. A poorly chosen set of features will yield poor classification rates by any neural network. At the current stage of development, the software does perform well either in terms of speed or accuracy but not better. It is unlikely to replace existing OCR methods, especially for English text. A simplistic approach for recognition of Optical characters using artificial neural networks has been described.

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