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Recognition of Handwritten Characters Using Neural Networks

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ABSTRACT : Recognizing handwritten character are still a problematic. So that is the reason neural networks has ended up as a essential technique for recognizing character nowadays. The purpose behind this paper is to take handwritten English characters as information and after that procedure the character after that train the neural network algorithm and afterward recognize the pattern so that changed character to an improved adaption. HCR technique changes over pictures into editable format. This technique changes over pictures in the form of documents such as edit, modify and store date for long period. This method includes pre-processing, segmentation, Feature Extraction, Classification and Recognition etc.

KEYWORDS*:* Character extraction algorithm; Edge detection algorithm; Character geometry; Gradient features; ANN

I. INTRODUCTION

Handwritten character recognition(HWCR) defined as conversion of a handwritten text into a machine processable format. HWCR is also have the capacity of a computer to get and decipher intelligible handwritten input from sources such as paper reports, photographs, touch screens and other devices. The image of the written text might be detected "offline" from a piece of paper by optical examining. It basically involves optical character recognition. A complete handwriting recognition system additionally handles formatting, performs correct segmentation into characters and finds the most conceivable words. The classification of handwriting recognition should be done in the following two major classifications:

Offline Handwriting Recognition(OFHWR): Under such handwriting recognition, the writing is accessible as an image. It should be possible with the help of a scanner which catches the writing optically.

Online Handwriting Recognition(ONHWR): Under such handwriting recognition, the 2D coordinates of progressive points are represented as a function of time and the order of strokes made by the writer are likewise accessible[4].

Neural networks are organized in layers. Layers are comprised of number of interconnected 'nodes'. Patterns are presented to the network through 'input layer', which impart to one or more 'hidden layers' the place real handling is done through 'connections'. The hidden layers then connection to an 'output layer 'where the output shown[1].

Neural networks are particularly useful for taking care of issues that cannot be communicated as arrangement of step such as recognizing patterns , arranging them into groups, series prediction and data mining. Pattern recognition is the most well known use of neural networks. The neural networks is presented with a target vector furthermore vector which took the pattern details could be an image and handwritten data. The neural network then endeavors to figure out whether the input samples matches with a pattern that the neural network has remembered. A neural network trained for classification is intended to take input tests and arrange them into groups. These groups may be fuzzy, without clearly defined boundaries.

II. RELATED WORK

In [1] authors used to is recognize the characters in a given scanned documents and study the impacts of changing the Models of Artificial Neural Network(ANN). In Pre-processing basic algorithms are applied for segmentation of characters, normalizing of characters and De-skewing. Usage of different Models of Neural Network and applied the

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test set on each to find the accuracy of the particular Neural Network. In [2] authors describe the pattern by method of minimum number of features that are successful in separating pattern classes. An effort is made towards recognition of English Characters and obtained recognition accuracy rate of 94%. Because of its logical simplicity, usability and high recognition rate, Gradient Features ought to be utilized for recognition purposes. In [3] authors concentrate on recognition of English alphabet in order in a given scanned text document because of Neutral Networks. Using Matlab Neutral Network toolbox, we tries to recognize handwritten characters by anticipating them on different sized grids. The fist step is image acquisition which acquire the scanned image took after by noise removing, smoothing and normalization of scanned image, rendering image reasonable for segmentation where image is disintegrated into sub-images. In [4] authors describes a geometry based technique for feature extraction appropriate to segmentation based word recognition systems. The proposed system extracts the geometric features depend on the essential line sort that shape the character skeleton. The system gives a feature vectors its output.

III. PROPOSED METHOD AND ALGORITHM

Proposed Method :

Pre-processing: It is to segment the interesting pattern from the background i.e noise filtering. Smoothing and normalization should done in this step. The pre-processing also defines a compact representation of the pattern.
Segmentation : In the segmentation stage, an image of succession of characters is decomposed into sub-images of individual character. The pre-processed input image is segmented into detached characters by assigning a number to each character using a labeling process.
Feature Extraction : Features of individual character are extracted. The execution of an each character recognition system that depends on the features that are extracted. Two strategies obtained :

1. Based on Character geometry : It extracts the geometric features of the character. This features taking into account basic line types that form character skeleton. It likewise focuses on positional features of the same. This strategy was tested using neural network which was trained with the feature vectors obtained[5].
2. Based on Gradient features : The gradient measures the magnitude and direction of the best change in intensity in a small neighborhood of each pixel. Gradients are computed by method of the Sobel operator[2-7].

Character Extraction :
Step 1 : Create a traverse list : list of all pixels which have been already traversed. This list is initially empty.
Step 2 : Scan row pixel-by-pixel.
Step 3 : Whenever we get a black pixel check whether the pixel is already in the traverse list, if it is simply disregard and overlook and proceed onward else apply Edge-detection algorithm .
Step 4 : Add the list of pixels returned by Edge-detection Algorithm to traverse list.
Step 5 : Continue the steps 2-5 for all rows.

Edge Detection :
The Edge detection algorithm has a list called traverse list. It is the list of pixel already traversed by the algorithm[1-7].
EdgeDetection(x,y,TraverseList);
Step 1 : Add the current pixel to TraverseList. The current position of pixel is (x,y).
Step 2 : NewTraverseList = TraverseList * currentposition(x,y).
If pixel at (x-1,y-1) then
Check if it is not in TraverseList.
EdgeDetection(x-1,y-1,NewTraverseList);
End if
If pixel at (x-1,y-1) then
Check if it is not in TraverseList.
EdgeDetection(x-1,y+1,NewTraverseList);
End if
If pixel at (x,y+1) then
Check if it is not in TraverseList.
EdgeDetection(x,y+1,NewTraverseList);

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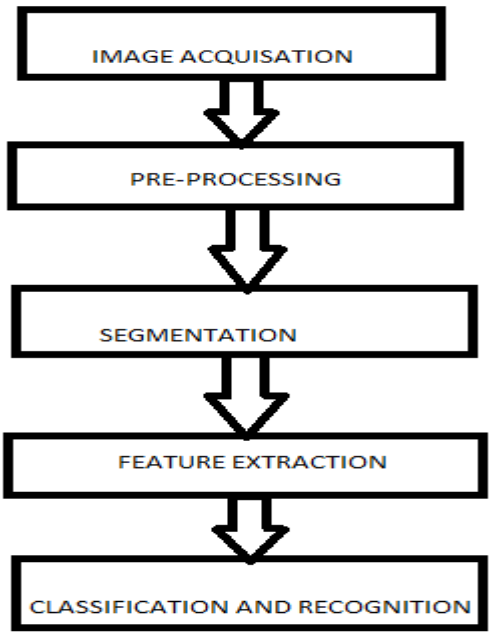
End if
Step 3 : Return



IV. SIMULATION RESULTS

Hand written character recognition(HWCR) system was tested on few different scanned images containing handwritten text written with various styles and the results were highly promising. The proposed strategy performs pre-processing on the image for evacuating the noise and further uses feature extraction using gradient technique or using character geometry which gives moderately good classification compared to OCR. The strategy is advantageous as it uses nine elements to train the neural network utilizing character geometry and twelve elements utilizing gradient technique. The advantage lies in less calculation required in feature extraction, training and classification phases of the technique. The proposed methodology has provided good results for images containing handwritten text written in different styles, different size and arrangement with varying background. It classifies large portion of the handwritten character accurately if the image contains less noise in the characters furthermore in the background. Characters written with neat handwriting are classified more accurately. By using neural networks 93.9% accuracy has been achieved using character geometry and 93.4% accuracy has been achieved using gradient features as shown in both the tables.

Using Character Geometry:

Epochs(iterations)	Hidden layers	Config(input,hidden,output)	Classification(%)
40	10	85,10,26	22
103	20	85,20,26	75.4
142	30	85,30,26	92.7
167	35	85,35,26	93.9
110	39	85,39,26	12.5
54	45	85,45,26	81.2

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Using Gradient Features :

Epochs(iterations)	Hidden layers	Config(input,hidden,output)	Classification(%)
43	10	108,10,26	10
183	20	108,20,26	82.4
142	30	108,30,26	80
132	35	108,35,26	93.9
148	39	108,39,26	76.8
109	45	108,45,26	86.2

V. CONCLUSION AND FUTURE WORK

In conclusion, in this paper the explanation behind choosing artificial neural network to perform character recognition is because of their high noise tolerance. The designed systems can yield accurate results, gave the right dataset is available at the time of training the network. The software performs well both in terms of speed or accuracy. Be that as it may, the character location is not proficient since the size of every block varies. This can be taken care of by introducing the weights during training of dataset. There is an extent of improvement the current system. The performance of the method has been tested for a arranging English text written in capitalized, yet require further investigation.

In future, we will attempt to improve the performance of the neural network by including some more features other than the existing ones. Refinement of the segmented characters should be possible keeping in mind the end goal to achieve higher accuracy rate. As the feature extraction methods such as gradient technique and character geometry used as a part of the strategy does not arrange characters of various language, the technique can be extended for language independent classification from the images of other languages with little changes.

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