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RESEARCH ARTICLE

Mobile Application with Optical Character Recognition Using Neural Network

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Abstract—

The Optical character Recognition is a mobile application. The OCR takes image as the input and get text from that image. The character recognition method is presented by using OCR technology and higher quality camera of android phone.OCR technology is used for pattern recognition of characters. Neural network will recognize the complete character with the help of Kohonen algorithm.

At first, text region are scanned properly then it segments the characters. After that pre-processing is done and then it extracted the image. And finally it is recognized in the recognition process. Then it will convert the English text into Marathi in translation process Neural networks have been applied to various pattern classification and recognition. The input to a Kohonen algorithm is given to the neural network using the input neurons. And that input neurons get easily trained and having properties like topological ordering and good generalization. Neural network training process generally fall into the categories of supervised training is accomplished by giving the neural network to set of sample data. Supervised training is the most common form of neural network training. It is mainly designed for people who are unable to read any type of text documents. It uses smart mobile phones of android platform.

Keywords— ***Character recognition module, segmentation, pre-processing, scanning, feature extraction output***

I. INTRODUCTION

With recent widespread application of computers and multimedia technologies, there is an demand increasing to create a paperless environment. English language is frequently used in India. Character recognition is complex task. Many researchers have done lots of work in this field but, 100% accuracy is not achieved. Most of the work is done using OCR technique which takes scanned images as input and further recognize the characters.OCR with Neural Network is used for recognizing and then converting the character in the language that user want.

Neural networks are particularly useful for solving problems that cannot be expressed as a series of steps, such as recognition patterns, classifying into groups, series prediction and data mining.. The neural network is presented a pattern. This could be an any type of image, a sound, or any other sort of data. The neural network then attempts to determine if the input data matches a pattern that the neural network has memorized. Neural network is an information processing unit that is much inspired by the way the human brain works. The human brain consists of an intricate web of billions of interconnected cells called neurons. In Neural Network the information is processed in parallel all neurons work simultaneously. The goal of pattern recognition is to provide reasonable answer of the input.

There are numerous methods for using neural networks depending on the type of application to be developed. Kohonen Neural Network algorithm can be used. It contains two layer of processing the input layer, and the output layer. The system is mainly working on OCR system which is mainly depending on recognition of English character. In this system we are present a technique to recognize an English Typed Character in the form of an Image using Kohonen neural network. The recognition process will be done with the help of neural networks. Using Neural Network we improve the performance in terms of time and to get closer result.

II. PROPOSED SYSTEM

OCR technology is allows the conversion of image which is scanned of printed character into text or any other information that user want using android mobile. OCR technology uses three phases first is Scanning of documents as optical images. Next is Recognition which involves converting those images to character streams representing letters of recognized words and the final element used to accessing or storing the text which are already converted. Converted text is nothing but the extracted text. When, the user begins by capturing an image using mobile camera containing text .To convert extracted text into the Marathi text synthesizer is used. In very first step analyses text is done, pronounceable form is done using transforms text. Speech synthesizer are use to performs conversion of English text into Marathi text. Most of the character recognition systems will be recognized through the input image with computer software. There is a large amount space require for computer software and scanner. In order to overcome this problem of computer and scanner occupying a large space, optical character recognition (OCR) system based on android phone is proposed. To overcome this problem with large spacing scanner and computer software, Optical Character Recognition OCR based on android phone camera is used. Because the performances of smart phone is high than computer.

III. ARCHITECTURE OF CHARACTERS RECOGNITION

Optical Character Recognition is creative process the designer may view the characters. Recognition in different structures, concepts and relations. Character recognition Process involves various phases and procedures. There is no standard approach for constructing the same. The new approach is to discuss about the construction of OCR using Neural Network in a efficient way. Our approach to construct OCR adapts the different phases. The figure1- depicts the OCR development life cycle.

IV. PHASES INVOLVES IN OCR CONSTRUCTION USING NEURAL NETWORK

Construction of OCR adapts one life cycle which requires following set of phases. Each phase which has its own purpose and it is discuss below:

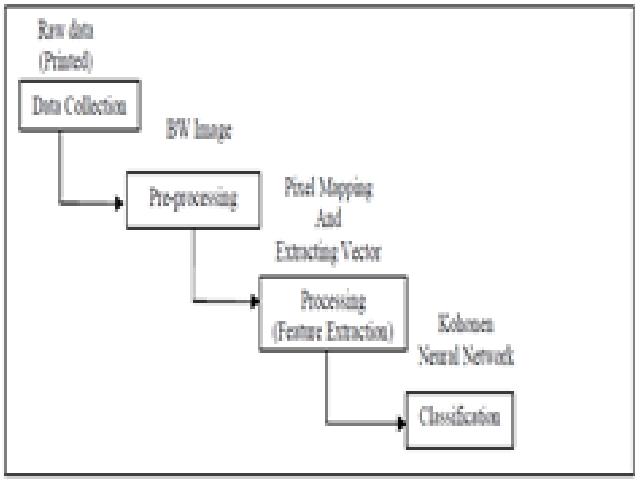

Fig.1 Life Cycle of OCR Construction

1. Scanning:

This application i.e. OCR system uses Android mobile camera. Camera captures image of document. This is nothing but the process of scanning. In short we can say that scanning makes original document as digital image. Generally, original documents are made up of the black coloured text print on the white coloured background. Scanning comes with thresholding which makes the digital image as gray scale image. Thresholding is the process which converts multi level image into bi-level image i.e. black and white image. Fixed threshold level is defined in thresholding. If the Gray levels are below the threshold level, identified as black. Where as if Gray level is above the threshold level, identified as white. This results in saving memory space and computational efforts.

2. Segmentation:

The process of locating regions of printed or handwritten text is segmentation. Segmentation splits text from figures and graphics. When the text is segmented, it isolates characters or words. The mostly occurred problem in segmentation is it causes confusion between text and graphics in case of joined and split characters. Usually, splits and joints in the characters causes due to scanning. If document is dark photocopy or if it scanned at low threshold, joints in characters will occur. And splits in characters will occur if document is light photocopy or scanned at high threshold. OCR system also gets confused during segmentation when characters are connected to graphics.

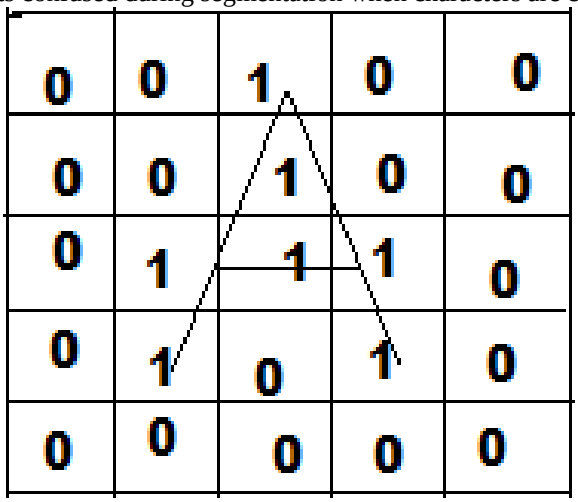

Fig.2 Segmentation using Matrix

3. Pre-processing:

As we seen above, some blur image may occur during scanning process. This results in poor recognition of characters. This usually occurred problem is overcomes by pre-processing. It consists of smoothing and normalization. In smoothing, certain rules are applied to the contents of image with the help of filling and thinning techniques. Normalization is responsible to handle uniform size, slant of characters.

4. Feature Extraction:

In pattern recognition feature extraction is a special form of dimensionality reduction. When the input data is too large to be processed and it takes more space input data will be transformed into a reduced representation of features. Feature extraction is transforming the input data into the set of features. If the features extracted are properly chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. It extracts the features of text image. Features are nothing but the characteristics. The feature extraction technique does not match different character patterns, but rather makes note of abstract features present in a character such as intersections, open spaces, lines, etc. Feature extraction is concerned with the representation of the symbols. The character image is higher level by extracting of special characteristics of the image in this phase.

5. Recognition:

OCR system works with kohonen algorithm which recognizes characters. Word by word recognition of characters is done of the lines. Recognition involves converting these images to character streams representing letters of recognized words In short, recognition extracts text from images of documents.

6. Output:-

The output of the system will be clear binarized image by using image segmentation and kohonen algorithm. And the output of that system is the conversion of English text into Marathi language.

V. ROLE OF KOHONEN ALGORITHM IN NEURAL NETWORK

Kohonen neural network differs both in how it is trained and how it recalls a pattern. Output from the Kohonen neural network does not consist of the output of several neurons. One of the output neurons is selected as a "winner". This "winning" neuron is the output when a pattern is presented to a Kohonen network. Often these "winning" neurons represent groups in the data that is presented to the Kohonen network[6]-[7].

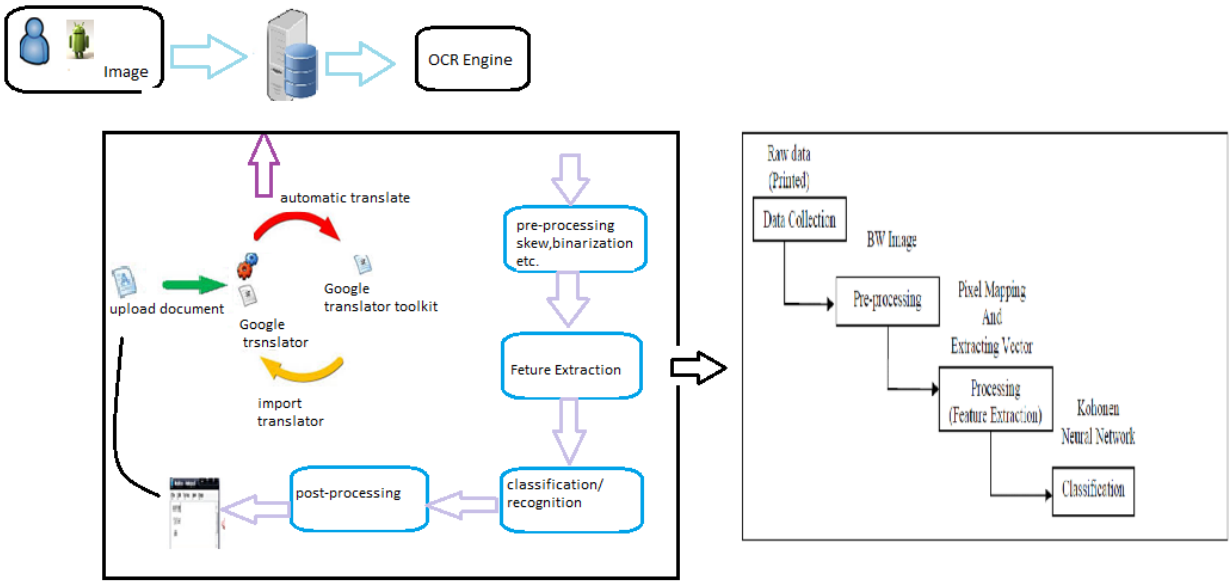

Fig.3 System Architecture

VI. HOW KOHNEN WORK WITHIN NEURAL NETWORK

The Kohonen neural network contains only an input and output layer of neurons. The input to a Kohonen neural network is given to the neural network using the input neurons. These input neurons which are giving the floating point numbers that make the input pattern to a Kohonen network requires that these inputs be normalized to the range between -1 and 1. Presenting an input pattern to the network will cause a reaction from the output neuron. In a Kohonen neural network only one of the output neurons actually produces a value. Additionally, this single value is either true or false. One single output neuron is chosen as the output neuron When the pattern is presented to the Kohonen neural network.

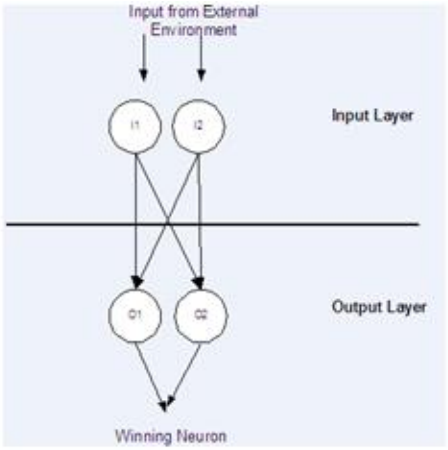

Fig.4Kohonen Neural Network

VII. STEPS FOR NEURAL NETWORK WITH KOHONEN ALGORITHM

I) Normalizing the Input

The Kohonen neural network requires that its input be normalized. To normalize the input we must first calculate the "vector length" of the input data, or vector. This is done by summing the squares of the input vector. In this case it would be.

(0.5 * 0.5) + (0.75 * 0.75)

This would result in a "vector length" of 0.8125. If the length becomes too small, say less than the length is set to that same arbitrarily small value. In this case the "vector length" is a sufficiently large number. Using this length we can now determine the normalization factor. The normalization factor is the reciprocal of the square root of the length. For our value the normalization factor is calculated as follows [6].

$$\frac{1}{\sqrt{0.8125}}$$

This results in a normalization factor of 1.1094. This normalization process will be used in the next step where the output layer is calculated [6].

II) Calculating Each Neuron's Output

To calculate the output the input vector and neuron connection weights must be considered of both. First calculate the dot product of neurons and their weight must be calculated. The Kohonen algorithm specifies that we must take the dot product of the input vector and the weights between the input neurons and the output neurons. The Kohonen algorithm which is specified that we first take the dot product of input vector and weight of input neuron with output neuron.

The result of this is as follows.

$$\begin{vmatrix}0.5 & 0.75\end{vmatrix} \bullet \begin{vmatrix}0.1 & 0.2\end{vmatrix} = (0.5*0.75)+(0.1*0.2)$$

As the above calculation the dot product would be 0.395. This calculation will be performed for the very first output neuron. This calculation will be done for each of the output neurons. Then the output normalize by multiplying it with normalization factor which was determined in previous steps You must now multiply the dot product of 0.395 by the normalization factor of 1.1094. This results in an output of 0.438213. Now that the output has been calculated and normalized it must be mapped to a bipolar number [6].

III) Mapping to Bipolar

Bipolar number is nothing but the another way of representing the binary number. In the bipolar system the binary zero is from -1 and the binary remains a 1.Because of this we must perform similar normalization of the output neurons. To make this mapping we must add one and divide the result in half manner. For the output of 0.438213 this would result in a final output of 0.7191065.The value 0.7191065 is the output of the first neuron. This value will be compared with the outputs of the other neuron. By comparing these values we can determine a "winning" neuron [6].

IV) Choosing the Winner

By comparing all output neurons we choose the output of winning whose bipolar factor is maximum that other output neurons[6].

VIII. IMPLEMENTATION

In this system we first take the image by using android camera. Convert the image into binary matrix. After creating the digitized binary matrix from the input character image, the detection of boundary is very much important to recognize character correctly. After that and it identifies the pattern of character is recognized. The Neural Network is used for boundary detection. The boundary detection procedure is therefore given by

1. For top boundary detection, scan the character matrix starts at the top-left corner and remove all rows from top having only 0's. To detect top boundary there must be at least two consecutive 1's in two consecutive rows. Then the first row of the two consecutive rows from top will be selected as top boundary.
2. For bottom boundary detection, scan the character matrix starts at the bottom-left corner and remove all rows from bottom having only 0's. To detect bottom boundary there must be at least two consecutive 1's in two consecutive rows. Then the first row of the two consecutive rows from bottom will be selected as bottom boundary.
3. For left boundary detection, scan the character matrix starts at the top-left corner and remove all columns from left having only 0's. To detect left boundary there must be at least two consecutive 1's in two consecutive columns. Then the first column of the two consecutive columns from left will be selected as left boundary.
4. For right boundary detection, scan the character matrix starts at the top-right corner and remove all columns from right having only 0's. To detect right boundary there must be at least two consecutive 1's in two consecutive columns. Then the first column of the two consecutive columns from right will be selected as right boundary. In below figure, we show the binary matrix of the sample character 2 and Z after detecting boundary. Then by using kohonen Neural Network normalization perform on the matrix. Normalization is the process of equating the size of all extracted character bitmaps (binary array).For size invariant character recognition, we have converted the boundary detected input character matrix into 12×8 normalized matrix. The normalization procedure is as follows:

Take top row and left column assuming they contain salient features.

Then take alternate row and column until desired 12×8 character matrix is found. For example, the size of input character (after boundary detection) is 15×11.Then during normalization,

a. takes first row
b. delete row 2, 4,6
c. Take the entire remaining row
d. Converted the matrix to 12×11

Similar process for column as in ii (a-d). Finally the matrix is converted to 12×8.

After that train a sample for character. Then create 12 by 8weight matrix for sample (take a positive weight for 1 position and negative weight for 0 position of input character)i.e. normalized the input neurons. Then kohonenNeural Network calculate the weighted sum Oi at each output neuron calculate the normalize factor of input neurons. The calculate the sum of positive weights Pwi of weight of matrix of each characteristics calculate output

for each neuron.Then calculated the bipolar number using formula Yi-Oi/Pwi. This process is just for the first input neuron. Continue above process for remaining input neurons. After that chose winner output neuron whose binary number is maximum than all other output neurons. This winning neuron can give the accurate output which is recognizable character.

IX. CONCLUSION

In this system, we have proposed an artificial neural network-based simple colour and size invariant character recognition system to recognize English alphanumeric characters. Our proposed system gives excellent result for the character letters when they are trained and tested separately but produce satisfactory result when they are processed together. In addition our system is computationally inexpensive and easier to implement. And the is that the system will produce the conversion of English text into Marathi text.

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