

A Review of Optical Character Recognition Using Artificial Neural Network



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ABSTRACT

Character recognition is considered as one of the important technology in today's world. It is the electronic translation of scanned images of written or printed text into machine-encoded text. Recognition of text from image is started from recognizing the English alphabets and characters after that, it is done in many foreign languages like Japanese, Chinese, Thai and also some regional languages like Tamil and Telugu.

Keywords— Index Artificial neural networks, Pattern matching, Image recognition, Text recognition, Handwriting recognition, text detection, genetic algorithms, , digits selection, digits recognition, character classification, character selection, character recognition.

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I. INTRODUCTION

Digital image consists of points, lines and curves and in some images it may contains some text along with strokes and some handwritten text contains pressure. Recognition of the text is the technique we use to detect text from the image. There are many types of character recognition techniques like optimal character recognition which used to offline character recognition. Also their is intelligent character recognition which is used to online character recognition. This recognition is done by using touch pads, touch screen, smartphones, pc, etc. In previous systems only recognition of text is done and their were no feature for saving that recognised text, but this system provides this additional feature. Also translation of recognised English to Devanagari text is done in the system and vice-versa.

Feature Extraction is OCR without strict matching to prescribed templates. Also known as Intelligent Character Recognition (ICR), or Topological Feature Analysis, this method varies by how much "computer intelligence" is applied by the manufacturer. The computer looks for general features such as open areas, closed shapes, diagonal lines, line intersections, etc. This method is much more versatile than matrix matching. Matrix matching works best when the OCR encounters a limited repertoire of type styles,

with little or no variation within each style. Where the characters are less predictable, feature, or topographical analysis is superior.

II. STRUCTURE OF OCR SYSTEM STRUCTURE OF OCR SYSTEM

OCR is the acronym for Optical Character Recognition. This technology allows a machine to automatically recognize characters through an optical mechanism. Human beings recognize many objects in this manner our eyes are the "optical mechanism." But while the brain "sees" the input, the ability to comprehend these signals varies in each person according to many factors.

By reviewing these variables, we can understand the challenges faced by the technologist developing an OCR system. The ultimate objective of any OCR system is to simulate the human reading capabilities so the computer can read, understand, edit and do similar activities it does with the text.

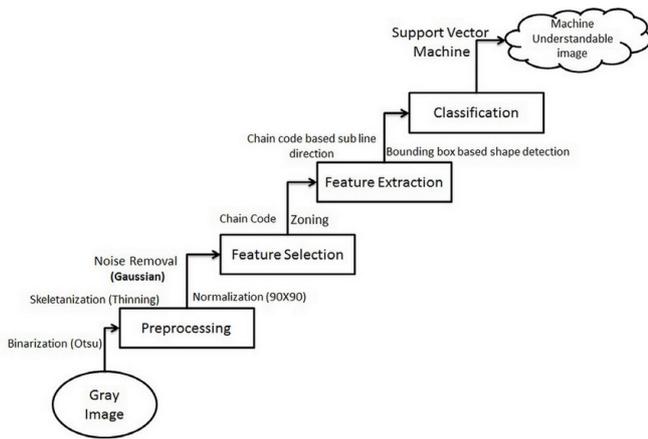


Fig1. Structure of OCR System

Block diagram of the typical OCR system. Each stage has its own problems and effects on the overall system's efficiency. Thus, to tackle the problems, either by solving each particular problem.OCR system by integrating all stages to one main stage, and this is what our research proposes. This paper presents new structure of OCR system which relies on the powerful proprieties. The algorithm is designed and tested in the related sections.

III. COMPONENTS OF OCR SYSTEM

A. Components of OCR system:-

Optical scanning:-

Through the scanning process a digital image of the original document is captured. In OCR optical scanners are used, which generally consist of a transport mechanism plus a sensing device that converts light intensity into gray-levels. Printed documents usually consist of black print on a white background. Hence, when performing OCR, it is common practice to convert the multilevel image into a bi-level image of black and white. Often this process, known as thresholding, is performed on the scanner to save memory space and computational effort.

Pre-processing:-

The image resulting from the scanning process may contain a certain amount of noise. Depending on the resolution on the scanner and the success of the applied technique for thresholding, the characters may be smeared or broken. Some of these defects, which may later cause poor recognition rates, can be eliminated by using a pre-processor to smooth the digitized characters.

Feature extraction:-

The objective of feature extraction is to capture the essential characteristics of the symbols, and it is generally accepted that this is one of the most difficult problems of pattern recognition. The most straight forward way of describing a character is by the actual raster image. Another approach is to extract certain features that still characterize the symbols, but leaves out the unimportant attributes.

Post processing:-

Post processing are two types-

1. Grouping
2. Error-detection and correction

IV. ARTIFICIAL 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:

1. A neural network acquires knowledge through learning.
2. A neural network's knowledge is stored within inter neuron connection strengths known as synaptic weights.

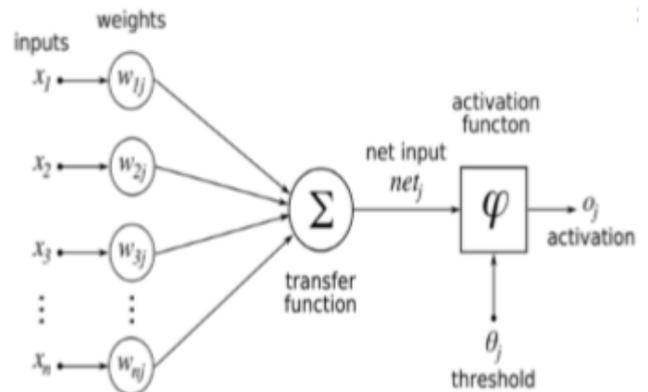


Fig 2 Structure of ANN

The most common neural network model is the multi-layer perception (MLP). This type of neural network is known as a supervised network because it requires a desired output in order to learn. The goal of this type of network is to create a model that correctly maps the input to the output using historical data so that the model can then be used to produce the output when the desired output is unknown. A graphical representation of an MLP is shown below.

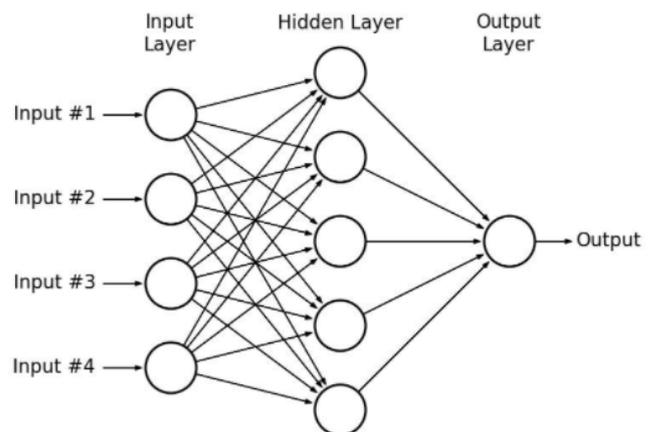


Fig 3 Block diagram of MLP

V. BACKPROPAGATION ALGORITHM

The back-propagation algorithm consists of four steps:

1. Compute how fast the error changes as the activity of an output unit is changed. This error derivative (EA) is the difference between the actual and the desired activity.

$$EA_j = \frac{\partial E}{\partial y_j} = y_j - d_j$$

2. Compute how fast the error changes as the total input received by an output unit is changed. This quantity (EI) is the answer from step 1 multiplied by the rate at which the output of a unit changes as its total input is changed.

$$EI_j = \frac{\partial E}{\partial x_j} = \frac{\partial E}{\partial y_j} \times \frac{dy_j}{dx_j} = EA_j y_j (1 - y_j)$$

3. Compute how fast the error changes as a weight on the connection into an output unit is changed. This quantity (EW) is the answer from step 2 multiplied by the activity level of the unit from which the connection emanates.

$$EW_{ij} = \frac{\partial E}{\partial W_{ij}} = \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial W_{ij}} = EI_j y_i$$

4. Compute how fast the error changes as the activity of a unit in the previous layer is changed. This crucial step allows back propagation to be applied to multilayer networks. When the activity of a unit in the previous layer changes, it affects the activities of all the output units to which it is connected. So to compute the overall effect on the error, we add together all these separate effects on the output units. But each effect is simple to calculate. It is the answer in step 2 multiplied by the weight on the connection to that output unit.

$$EA_i = \frac{\partial E}{\partial x_i} = \sum_j \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial x_i} = \sum_j EI_j W_{ij}$$

By using steps 2 and 4, we can convert the EAs of one layer of units into EAs for the previous layer. This procedure can be repeated to get the EAs for as many previous layers as desired. Once we know the EA of a unit, we can use steps 2 and 3 to compute the EWs on its incoming connections.

VI. LITERATURE SURVEY

Text Recognition from the capturing image is research area which attempts to develop a system with ability to automatically read text from the image. Many peoples in India use the Devagari font or style for the documentation. Many book publisher uses Devnagari font in their book. Denagari is most accepted script in India. Handwriting Devnagari recognition generally involves Segmentation, Pre-processing of the characters and digits, Recognition [3]. For the image to text reading image classification, character recognition, and digits recognition are various task performed by using various techniques. Different advanced techniques in image classification like Artificial Neural Network, Optimal character hyper plane are used [1]. For handwritten text there are difficulties

occurs to recognize the text. For this problem the genetic algorithm is best solution. The basic idea for the Genetic algorithm comes from the fact that algorithm can be used as an excellent means of combing various style of writing a character and generating new style[2]. Genetic algorithm search unknown character for read from file and much operation will perform on it to manipulate it and extract it. For this, Algorithm goes to some flow- Read unknown character-process character-recognition-generation initiation-evaluation-selection-best solution [4]. The whole process of recognition include two phase segmentation of character into line word and character and then recognition feed forward neural network. Basically an offline handwritten Alphabets character recognition system using multiplayer feed forward neural network [5]. Artificial Neural Network (ANN) also use for the text recognition. Artificial Neural Network acts as the human brain. Before doing something it think on it and take action so best result occur. Artificial Neural Network is parallel distributed process use for the image classification. ANN, Support Vector Machine, Fuzzy measurement, Genetic Algorithm and their combination for digital image these are various techniques to classify the image [7].

ANN is used to recognition ten different handwritten digits this from 0-9 and characters are A-Z. In ANN the great amount of data are present so the preprocessing of the data is carried out using conventional Artificial Intelligence technique [8]. The approach taken to solve the OCR problem was based on psychology of the characters as perceive by human. Thus the geometric feature of character and variant were considered for recognition [6]. The optimal character Recognition using 40 point feature extraction. For English text recognition the 40 point extraction technique is used [9].

VII. GENETIC ALGORITHM

A GAs is an optimization and search method utilized in computer science to find fairly accurate solutions to problems. It is inspired by processes in biological evolution such as natural selection, inheritance, recombination, and mutation. GAs is generally realized in a computer model, in which a population of runner solutions to an optimization problem progress to better solutions. The evolution starts from a population of completely random. Individuals and occurs in generations. In each generation, the fitness of the entire population is evaluated, and multiple individuals are selected from the present population based on their fitness. These are modified, mutated, or recombined to make a new population, which becomes present in the next iteration of the algorithm. Usually, the solutions are represented in strings of 0s and 1s, though different encodings are also possible. So, evolutionary algorithms play on populations, in its place of coming to one solution. [3]

VIII. CONCLUSION

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. Despite the computational complexity involved, artificial neural networks offer several advantages in back-propagation network and classification in the sense of emulating adaptive human intelligence to a small extent.

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