

# Handwritten Recognition using Deep Convolution Neural Network

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**Abstract:** Optical character recognition (OCR) is actually a software established for the interpretation of images that are captured with the assistance of a scanner and converted into text that is machine-editable, or to transform pictures of characters or symbols into a ASCII or Unicode standard format. We will be building a personality recognition system by employing JAVA during this particular project. In these times, there is an excellent requirement of this type of a recognition system. Computers are now used as a more well ordered and well regulated alternative for taking and managing notes and for eradicating potential issues regarding clarity of handwriting or misplacing sheets of papers. Additional advantages of preferring technology involve the comfort of creating such notes better at a later time. Neural computer are operated in way which is totally different from the operation of normal computers. Neural computer are trained (not Programmed) so that given a certain starting state (data input); they either classify the input data into one of the number of classes or cause the first data to evolve in such how that a particular desirable property is optimized.

**KEYWORDS:** character recognition, neural network



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## INTRODUCTION

Handwriting recognition is the ability of a machine to receive and interpret handwritten input from multiple sources like paper documents, photographs, touch screen devices etc. Recognition of handwritten and machine characters is an emerging area of research and finds extensive applications in banks, offices and industries. The main aim of this project is to design expert system for , "HCR using Neural Network" that can effectively recognize a particular character of type format using the Artificial Neural Network approach. Neural computing is comparatively new field, and design components are therefore less well specified than those of other architectures. Neural computers implement data parallelism. Neural computers are operated in way which is completely different from the operation of normal computers. Neural computers are trained (not programmed) so that given a certain starting state (data input); they either classify the input data into one of the number of classes or cause the original data to evolve in such a way that a certain desirable property is optimized. An Artificial Neural Network (ANN) is an information-processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of large no. of highly interconnected processing elements (neurons) working in union to solve specific problems. ANNs like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process

. Learning in a Biological system involves adjustments to the synaptic connections that exist between the neuron.

## EASE OF USE

### A. Implementation of HCR

HCR works in stages as preprocessing, segmentation, feature extraction and recognition using neural network. Preprocessing includes series of operations to be carried out on document image to make it ready for segmentation. During segmentation the document image is segmented into individual character or numeric image then feature extraction technique is applied on character image.

Finally feature vector is presented to the selected algorithm for recognition. Here these extracted features are provided to Neural Network for recognition of character. Neural network with their remarkable ability to derive meaning from complicated or imprecise data can be used to extract patterns and detect trends that are too complex to be noticed by either human or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyze. This expert can then be used to provide projections given new situations of interest and answer "what if" questions. Other Advantages Include:

- Adaptive Learning: An ability to learn how to do tasks based on the data given for training or initial experience.
- Self-Organization: An ANN can create its own organization or representation of the information it receives during learning time.
- Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
- Fault Tolerance Via Redundant Information coding: partial destruction of network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with

## PROCESS MODEL

Process Models are processes of the same nature that are classified together into a model. Thus, a process model is a description of a process at the type level. Since the process model is at the type level, a process is an instantiation of it. The same process model is used repeatedly for the development of many applications and thus, has many instantiations. One possible use of a process model is to prescribe how things must/should/could be done in contrast to the process itself which is really what happens. A process model is roughly an anticipation of what the process will look like. What the process shall be determined during actual system development.

### A. Incremental Model

Incremental model is used as the process model in our system. shows the process model of the system. To save actual problems in an industry setting, Software Engineering must incorporate a development strategy that encompasses the process, method and the tool layers; this strategy is often referred as process model. A process model for Software Engineering is chosen base on the nature of the Project and its application. For our project, we have selected Incremental Model.

- 1) Using these models, a limited set of customer requirements are implemented quickly and are delivered to customer.
- 2) Modified and expanded requirements are implemented step by step.
- 3) It combines elements of linear Sequential Model with the iterative Philosophy of prototyping.
- 4) Each linear sequence produces a deliverable Increment of the Software.
- 5) Each linear Sequence is divide into 4 parts:-
  - Analysis
  - Design
  - Code
  - Testing

### B. Breakdown Structure

- Gray Scale :

An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. In an (8 bit) gray scale image each picture element has an assigned intensity that ranges from 0 to 255. A gray scale image is what people normally call a black and white image, but the name emphasizes that such an image will also include many shades of gray. A normal gray scale image has 8 bit color depth-256 gray scales. A " true color images 24 bit color depth  $8 * 8$

\* 8 bits  $256 * 256 * 256$  colors = 16 million colors. Some gray scale images have more gray scales, for instance 16 bit = 65536 gray scales. There are two general groups of images

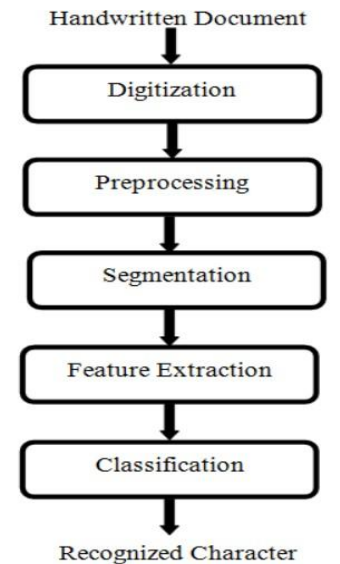


Fig. 1. figure 1.

vector graphics (or line art) and bitmaps (pixel based or images).

- Thinning :

Thinning algorithm is a Morphological operation that is used to remove selected foreground pixels from binary images. It preserves the topology (extent and connectivity) of the original region while throwing away most of the original foreground pixels

### C. Segmentation

In this part the characters will be identified as letters and the image will be converted to text. After the image is cleaned up and becomes a binary image which contains only the text, the binary image is then saved and the memory is cleaned up. This step is very important to increase the speed of the system. After the following steps should be done

- Divide the text into rows
- Divide the rows into words
- Divide the word into letters

### D. Feature Extraction

In pattern recognition in image processing, Feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into reduced representation set of features (also named feature vector). Transforming the input data into the set of features is called features extraction

### E. IR2 tree algorithm time complexity

The processing time  $T$  for the searching nearest hotels/lodges is proportional to the number of hospital register to the particular location  $T = O(NC)$ , where,  $N$  is the number of hotels/lodges and  $C$  is the number of users,  $C$  can be represented by  $S$  as  $C = O(S)$ . Thus, the total processing time  $T$  could be estimated as:  $T = O(NC) = O(S^2)$

### F. Time and Space Computation

The space complexity can be defined as amount of memory required by an algorithm to run. To compute space complexity we used two factors:

- Constant Characteristic
- Instant Characteristic

Space requirement  $S(p)$  can be given as:  $S(p) = C + Sp$  where,  $C$  is constant i.e. fixed part that denotes space of inputs, outputs, instructions used.  $Sp$  is space dependent on instance characteristic i.e. variable part and it include space for recursion stack. The time complexity of an algorithm is the amount of processor time required by an algorithm to run to completion. It is difficult to compute time complexity in terms of physically clocked time. For instance in multi tier system, executing time depends on many factors such as:

- System Load
- Number of other programs running
- Instructions used and speed of underlying hardware

### G. Recognition for Handwritten English Letters: A

Character recognition is one of the most interesting and challenging research areas in the field of Image processing. English character recognition has been extensively studied in the last half century. Nowadays different methodologies are in widespread use for character recognition. Document verification, digital library, reading bank deposit slips, reading postal addresses, extracting information from cheques, data entry, applications for credit cards, health insurance, loans, tax forms etc. are application areas of digital document processing. This paper gives an overview of research work carried out for recognition of hand written English letters. In Hand

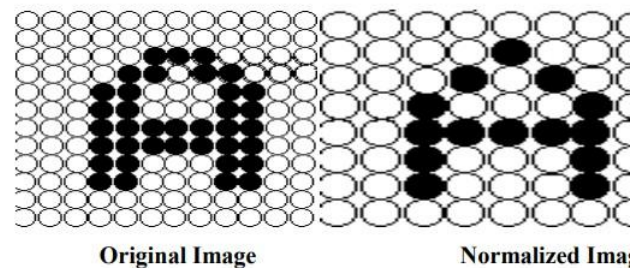


Fig. 2. figure 2

written text there is no constraint on the writing style. Hand written letters are difficult to recognize due to diverse human handwriting style, variation in angle, size and shape of letters. Various approaches of hand written character recognition are discussed here along with their performance

### H. Scope

System will be designed in way to ensure that offline Handwritten Recognition of English characters. Our old and epic HCR literature can be restore in digital form. Use of Neural Network for classification. Large number of training data set will improve the efficiency of the suggested approach.

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