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# Handwritten Character Recognition Using Neural Network

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**Abstract:** *Neural networks are most used for processing any kind of the information, this efficient capability of neural network paved the way for its uses in recognition of patterns. The term "Recognition" plays an important role in our practical lives. It is the basic and most important property of every human. When we see an object for the first time we gather all information about that and compare its behaviors with the existing knowledge stored in our mind. This amazing feature of human brain can be built in systems and machines through the "neural network". Pattern recognition involves recognizing various patterns by finding its association with past experience or knowledge.*

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## I. Introduction:

A "Pattern" can be termed as an arrangement or ordering in which some organization of underlying structure will said to exist. Recognition of such patterns by comparing it with previous knowledge can be done by neural networks. Neural Network is capable of performing any kind of recognition whether concrete or abstract. Concrete Recognition involves recognizing spatial and temporal items (eg: fingerprints, weather maps etc..)Abstract Recognition involves recognizing items that does not have a physical existence.(eg: finding solution to a problem etc..)pattern recognition falls in the category of recognizing abstract objects.

## II. Various Recognition Techniques:

With the advancement of the technology many new types of pattern recognition techniques have been automated. They include all the tasks which can be performed by humans such as speech recognition, voice recognition, handwritten character recognition etc.. As the computers are becoming capable to perform automated pattern recognition many fantastical applications are becoming discovered in the field of finance, manufacturing and medicine."Pattern Class" refers to the collection of all the patterns that share the same properties. It involves the collection of all the significant information from the irrelevant data for example:

- 1.Speech recognition maps waveform to words and handwritten characters
- 2.Character recognition maps a matrix of pixels to words

To obtain the solution of pattern recognition we need to undergo many stages that includes making the measurements, pre-technique, modulation, finding numerical expression for objects in which we are interested and finally classification of it.

## III. Recognition Of Handwrittrern Characters:

The constant development of computer systems demands the development of such technologies to have a better interface between the human and the computer. There are many substantial approaches but the recognition of hand written characters cannot yet approach the human performance because the various difficulties lacking in it. These difficulties include:

- 1.Different writers may have different styles.
- 2.A person's calligraphy can be changed over a period of time
- 3.Indefinite number of shapes of a character
- 4.Similarities among the characters

The process of Pattern recognition involves a series of steps: The first involves segmentation that scans the device localize the limit of each character and distinguish them from each other. This process is not in existence. The second step involves gathering discriminate information from the image of a character and reducing its dimensions. This reduction is thus performed to ease the task of the classification systems thereby competently presenting a character to the classifier.

## IV. Gathering Data:

Gathering the relevant data tends to be the first step in every pattern recognition systems. Depending upon the type of the recognition, algorithm and method for gathering the data may differ. This method involves collection of only the relevant data thereby removing the background data. Before creating a pattern from a

sequence of measurement we need to first execute it by some technical equipment and convert it to numerical form. In character recognition process equipments include cameras and scanners.

The data which acts an input can be sampled at a fixed interval and is digitalized to present it. Any kind of Additional noise will be proved disadvantageous in the process so this gathering of data should be performed by having the system that is robust to variations of individual signal measurement devices.

#### **Registering Data:**

Registration of Data involves a rudimentary model fitting. The internal coordinates of registration system are fixed to the actual data that is required. Designing of this stage involves some a priori knowledge about the data.

The external information provides answers to questions such as when the data was produced? and when does the input begin and end? This process of Registration provides a complete framework based on which the system performs its operation, this proves helpful to decide which will be the valid output.

#### **Preprocessing:**

Preprocessing is the next step of this process. The main aim of preprocessing is to provide better solution to pattern recognition problem without throwing away any important data or information. Real world data is filled with noisy and inconsistent data, this is one of the major for having data preprocessing in existence. Noisy data can cause obscure of signal and cause a lots of confusion especially when the key input variable is noisy. Preprocessing is used enhance the signal by removing the noise. The Term "Noise" refers to anything that hinders the pattern recognition system. Before the data is fed into the system it must undergo preprocessing to obtain the better result and efficient processing methods. Preprocessing involves filtration of data to get the desired, reliable and significant data.

#### **Segmentation:**

Segmentation of characters can be done efficiently by two kinds of approaches: bottom up approach and top down approach. The bottom up approach is systematically the quickest, very fast approach and it is sufficient to perform the segmentation of characters. The top down approach is used to recognize the attributes present in the words, they operate on higher level of abstraction by obtaining features from words rather than splitting the words. The second algorithm appears to be sufficient for the overall recognition process. Since this method tends to be more complex and expensive than the first one it can be controlled by classification process which limits its frequency and obtains the average segmentation time.

#### **Feature Extraction:**

Thus, the offline Vectorization of Handwritten characters has always been a challenging task that is impossible to be completed. There is also no special writing process in existence. For this purpose we have two methods that can be used efficiently.

The first method is Averaged Pixel method (AP Method). This is very simple method that involves reduction of each character to a limited dimension. A grid area is superimposed on the character's image and the average pixel value for each area is then computed. In order to keep track of the actual information the ratio between the initial width and height can be included in the feature vector.

The Second method is Normalized Contour Analysis method this method performs the contour analysis on normalized characters which are obtained from first method. It consists of sending probes to the character the length of each probe is ordinate. In order to get the scale invariance and normalized value between 0 and 1 the probe need to be divided with highest possible values. The intersections between the character horizontal and vertical lines are also needed to be taken into account. Finally the Discriminate analysis method is performed to obtain a efficient features by removing noisy and inconsistent data and sending it to the classifier.

#### **Classification:**

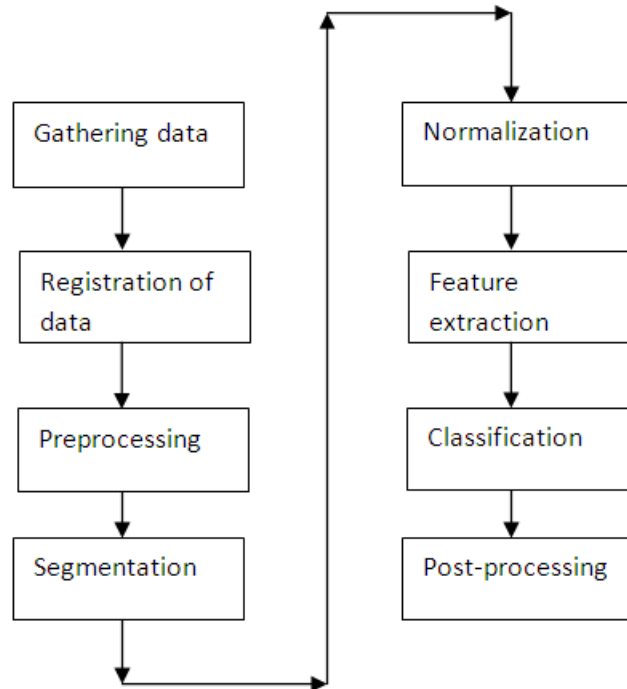
Artificial Neural Network and Multilayer perceptrons forms the basis for classification process. They identify a set of discriminant features that that associate a score to the possible class. The scores are the representation of the probability of each class to be one of the values or characters. There are two kinds of multilayer perceptrons; each one is associated with the different features associated with the previous step. The Normalized contour Analysis has proved to be the efficient method that can be applied with the higher priority. In order to have a better performance and efficient result NCA method and the Average Pixel method can be combined together. In order to minimize the recognition time used in the process AP Method needs to be restricted and involves first applying the NCA method. To have an optimization of entire process several combinations of MLP's are being investigated. The various MLP's are combined depending upon the practical application (digits, uppercase letters, symbol recognition etc)

**Registration Accuracy:**

Interdependencies between the individual classifications can be achieved in post processing phase. This can be achieved by;

- Operating only the post processing phase or
- Operating the post processing along with segmentation and classification

In the block diagram we can enhance the functioning of the systems by making the blocks to interact successfully with each other thereby increasing the overall performance.



**Fig:** Pattern Recognition Process

The motivations behind the configuration of block diagram are:

- I. Information is fed into the classification from the post processing, when the preprocessor receives the impossible or highly portable output it indicates it to the classifier. However this condition has occurred either because there is a fault in the classifier or pre processor. In either of two cases the pre processor is supposed change its behavior and not produce such an error.
- II. Then the classifier revises the phase of segmentation if it finds some of the patterns that are difficult to classify, this is due to malformed segmentation. Then the segmentation process itself should undergo some of the combinations of probes and the classifier will detect the better combination of it.
- III. To detect the correctness of the classification we should revise the feature extractor. This kind of processes are possible only during the training phase where if there occurs any error re-correction can be done. This can be termed as "error\_corrective" feature extraction.

**V. Demonstration:**

The demonstration proposed by us can distinguish 10 handwritten characters. The user can write its own operation in this using the characters that are previously defined. The scanner undertakes the process of presenting the digitalized image of operation that is requested. Demonstration process can be used to decode, and display the furnished image from the scanner. The results that are obtained from the segmentation process and classification are displayed on the screen and finally the computer performs requested operation and the result is displayed on the screen.

**VI. Conclusion:**

Pattern Recognition can be performed by both normal computers as well as neural networks. Normal computers recognize pattern by the normal conventional algorithms and they do not tolerate any kind of noisy data. On the other hand neural networks can tolerate noise and it can even respond for unknown patterns by giving absolute results. Neural networks are proved as the miracles that can be modeled in real world. They are

being frequently used not only in pattern recognition but also in every other fields that are being developed.

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