PATTERN RECOGNITION : A SURVEY

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1. **Abstract :** Pattern recognition is the basic concept of human intelligence. It is the general technology for detection and classification of patterns in data. Patterns are defined by human beings. It is the human ability. Recognition is thereby related to finding concepts and the art of naming. Consequently, pattern recognition is a very basic area of science. Pattern recognition is field of research, which is in existence from the long time. This study presents an extensive literature review of various categories of pattern recognition.

IndexTerms - Pattern, Recognition, Fingerprint, Intelligence, Handwritten.

2. INTRODUCTION

Pattern recognition is a branch of science which deals with recognition of an pattern. A pattern can be defined as an set of predefined rules. These rules are to be followed in order to get a desired output [17]. Many applications of pattern recognition have been applied in the real time. Some of them are described below. Pattern recognition uses training and learning concepts. During this process the machine or the algorithm is made to learn the patterns through some extensive algorithms. After the algorithms are exposed to some pattern which can be identified by the algorithms. The system is trained in such a way that it can give an efficient and desired output. The applications are also implemented based on their usage in the real-time.

(EX:finger print, hand writing recognition, speech and voice, robotics, astronomy etc).

2.1. Hand written pattern recognition :

Character Recognition is one of the most successful applications of neural network technology[1]. Character recognition is classified into two categories as:

1.Offline character recognition

2.Online character recognition

Offline character recognition deals with set which is obtained from scanned handwritten document. Online character recognition deals with automatic conversion of characters that may be written using a special digitizer. There are two main areas in Character Recognition: 1.Printed Character Recognition 2.Handwritten Character Recognition.

Printed Character Recognition includes all printed texts of newspaper, magazines, books and outputs of typewriters, printers or plotters. Handwritten Character Recognition includes handwritten texts.

2.2. Finger print pattern recognition:

Fingerprints are found on the fingers and toes of human beings. They act as unique identities for each person [13]. The fingerprints differ from person to person. The fingerprint images can be used to hide some data [40-47]. Fingerprints are immutable and individual. Minutiae extraction in done in fingerprint recognition. Minutiae means small or minute. The fingerprint of different persons change in a minute manner. Ridge is a narrow hilltop like symbols which are present on the fingers as fingerprints. Ridges differ the fingerprints of one person from another. Arches, loops and whorls are 3 types of fingerprints mainly observed. Security is the main aspect of fingerprint recognition.

2.3. Speech controlled robotics using artificial neural network:

Communication can be visual or aural. Language plays a very important role in the case of human communication[20]. Speech is considered as the best way of interaction with the human being. As we all know speech is one of the most user friendly ways to interact with the human [24].There are two ways of communication

gesture based communication.

speech based communication.

Speaker independent system generally have low accuracy as compared to speaker dependent systems. Factors such as gender, age, emotions, and speed come into consideration. Here we are stick to speaker dependent system. In this paper we used MFCC coefficients as features to train an ANN with BPA. ANN performed reasonably well to identify words from speech. The word so identified was used as a command to control a humanoid robot.

2.4. Voice recognition:

Voice recognition is one of the methodologies in pattern recognition. The voice recognition is easily accessible to everyone [29]. In addition this greatly saves the time. It is an alternative to typing on a keyboard. It is like if we talk to the computer and our words appear on the screen. The software has been developed to provide a fast method of writing on a computer and can help people with a variety of disabilities [33]. It can be used for security purposes in a device or a vehicle. Support Vector Machines method is the best based on the classification system. By this method the authorization of vehicles based on voice recognition system can be made more unique. We mainly use this technique to reduce the false accuracy rate.

3.1. Handwritten pattern recognition:

S.no	Pre-processing	Segmentation	Feature Extraction	Classification
[1]	Binarization Edge detection Dilation.	Using MATLAB's function like region props bwlabel, rectangle imcrop.	Zoning Density Features Diagonal Feature Extraction Projection Histogram Features Distance Profile Features Background Directional Distribution Features.	Neural networks are used for classification.
[2]	Binarization.	No segmentation is done.	MLP is trained to recognize the label of the image slices without feature extraction.	Recurrent Neural network.
[3]	Noise Removal Binarization Edge Detection Dilation and filling.	pre-processed input image is segmented into isolated characters by assigning a number to each character using a labelling process.	No feature extraction is done.	A feed forward back propagation neural network is used.
[4]	Noise reduction Edge detection Binarization Slant removal.	External segmentation Internal segmentation.	Statistical features Structural features Global Transformation and Series expansion.	Template matching Neural network.
[5]	Image cleaning Slope Removal Slant Removal Size Normalisation.	Viterbi alignment is used both for obtaining a new segmentation or labelling of the training of data set.	Features are extracted by applying a grid to the image and computing three values for each cell of the grid.	Hidden Markova model is used.
[6]	Binary image.	No Segmentation.	Averaged HOG features are used for features extraction.	Recurrent neural network is used.
[7]	Greyscale image binarization.	Individual character is recognizsed.	curve feature extraction will be performed.	Neural network training tool in MATLAB.

[8]	Size normalization Binarization Edge detection Segmentation.	Line segmentation Word segmentation Character segmentation.	No feature extraction is mentioned here.	Feed forward network.
[9]	Slant and slope Angle are corrected.	Over segmentation and Under segmentation.	No feature extraction.	HMM module is used.

3.2. Finger print pattern recognition:

Ref no	Low quality image	Latent fingerprint	advantage
[10]	Low.	Low.	Useful for finding a image from an large database.
[11]	Low.	Low.	Can be placed as a building block for a fingerprint recognition system.
[12]	Moderate.	Low.	Huge amount of data can be verified in a less amount of time.
[13]	Moderate.	Low.	It requires less memory and can be deployed in smart cards.
[14]	High.	Moderate.	The partial minutiae can be converted to an complete image for further recognition.
[15]	Low.	Moderate.	Detects real and non real image.
[16]	Moderate.	Moderate.	There is an image quality control to increase efficiency of an image.
[17]	High.	Moderate.	Divides the required fingerprint from a group of images.
[18]	Low.	Low.	Works efficiently than a minutiae model.
[19]	Low.	High.	It involves multitask learning and can identify latent fingerprints.

3.3. Speech controlled robotics using artificial neural network:

Author	Year	Recognition Technique	Language	Accuracy
[20] Meysam Mohamad pour, Fardad Farokhi.	2010	Multilayer Perceptron + UTA algorithm.	English	98%

[21] Ghulam Muhammad, Yousef A. Alotaibi, and Mohammad Nurul Huda.	2009	Hidden Markov Model (HMM).	Bangla	more than 95%
[22] Douglas O'shaughnessy.	2003	HMM	English	Good Accuracy.
[23] Vimal Krishnan V.R Athulya Jayakumar Babu Anto.P.	2008	Discrete Wavelet Transform.	Malayalam	89%
[24] Bassam A. Q. AlQatab , Raja N. Ainon.	-	HMM	Arabic	97.99%
[25] N.Uma Maheswari, A.P.Kabilan, R.Venkatesh.	-	Hybrid model of Radial Basis Function and the Pattern Matching method.	English	91%
[26] Raji Sukumar.A Firoz Shah.A Babu Anto.P.	2010	ANN	Malayalam	80%
[27] A.Rathinavelu, G.Anupriya, A.S.Muthanantha murugavel.	2007	Feed forward neural networks.	Tamil	81%
[28] A.P.Henry Charles1 & G.Devaraj.	2004	HMM	Tamil	Offers High Performance.
[29] M. Chandrasekar, and M.Ponnavaikko	2008	HMM	Tamil	80.95%

3.4. Voice recognition:

Ref no.	**Difficulty when voice changes.**	**Complexity when recognizing the voice.**	**Advantages.**
[30]	Moderate.	Moderate.	Software suitable for children studying and which might keep them interested.
[31]	Moderate.	High.	This technology leads to greater financial savings. No extra cables and no extra cost.
[32]	Low.	Low.	Can help with menial computer tasks, such as browsing and scrolling.
[33]	High.	High.	This makes it possible to let the model choose a suitable number of effective components automatically.

[34]	Moderate.	Moderate.	Needed for machine classification research on both acoustic and linguistic features .
[35]	Moderate.	Moderate.	Used for automatic detection and classification using the voice recognition.
[36]	Low.	Moderate.	Speech recognition systems are optimized to an average adult's voice and tend to exhibit a lower accuracy rate .
[37]	Low.	Low.	It is used to assess the relevance of acoustic features specifically designed to characterize creaky voice.
[38]	Moderate.	Moderate.	A silent speech interface that makes use of such PMA data, the MVOCA, was tested on two speech tasks.
[39]	High.	Moderate.	High error rates have been observed in clinical documents generated by this technology.

4. Conclusion:

Usage of pattern recognition can be further implemented in the various applications. The fingerprint recognition, handwritten recognition, voice and speech recognition have their importance in their own fields. The applications can be further expanded to increase the security in the respective fields. In future, we are planned to extend the work using an application development for speech recognition.

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