

# Survey on the existing practices in Pattern Recognition.

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**Abstract-** The word PATTERN represent by a set of measurements describing a physical object. Secondly the word RECOGNITION means recognise or identify something from the environment. Both words constitute the term PATTERN RECOGNITION. It gives us an opportunity to create our own scientific world, where we learn how machine can observe environment, how machine can learn to distinguish the pattern of interest. Living being have developed extremely cultivated skills for observing their environment and taking action according to what they observe like recognising a face, understanding the spoken words, reading handwriting, differentiate the fresh food by its smell etc. But how the machines perform the same task by using various algorithms that is the challenge.

Very few people actually know what's that PR is? How's it work? How do machine appear in it? In this paper the introduction of pattern recognition presents. How can a machine learn the rule from data? In actual how the PR is classify? What are the approaches define in PR along with its some applications. Some findings of researchers in the sphere of pattern recognition are also summarizes. And at last conclusion and some of the challenges and concern with its future scope also define.

**Keywords:** Pattern Recognition, Supervised, Unsupervised, Semi-supervised machine learning, Statistical, Structural and Syntactical, and Neural Network methods.

## I. INTRODUCTION

It is generally not difficult for a person to distinguish the \sound of a human voice, from that of a guitar; a handwritten numeral "8," from an alphabet "S"; and the fragrance of a rose, from that of an onion. However, it is difficult for a programmable computer to solve these kinds of perceptual problems. These problems are quite difficult as each pattern usually contains a large amount of statistics, and the recognition problems normally have an unremarkable, high-dimensional, structure.

Apart from entertainment or fun, it's very helpful or useful in the application like disease categorization,

prediction of survival rates for patients of specific disease, fingerprint verification, face recognition, Iris discrimination, chromosome shape discrimination, optical character recognition, texture discrimination, speech recognition, and etc.

Recognition is the identification of a thing or person from previous encounter of knowledge. It is regarded as a basic attribute of living organism. We recognize the object around us and move and act in relation to them. PR is not a new concept. Pattern recognition has its origins in engineering, and the term is popular in the context of computer vision: a leading computer vision conference is named Conference on Computer Vision and Pattern Recognition.

Recognition approaches can be basically classified into three major groups: statistical, structural and syntactical, and neural network methods. Sometimes non-identical methods are merged for example simple methods are used for pre-classification and final decision is made with more cultivated methods the procedure of recognition is basically very simple: after pre-processing some features are withdraw from the unknown character, which is then divided to the class whose members have the most same features[27].

This technology has been proved to be active tool for analysis in various field and application.

## II. THE DEFINITION OF PATTERN RECOGNITION

Many definition of PR have been proposed, PR can be defined as a process, which leads to a decision.

- 1973(Duda and Hart) defined the pattern recognition is a field concerned with machine recognition of meaning

regularities in noisy of complex environments.[1]

- 1977(Pavlidis) defined pattern recognition in his book: “the word pattern is derived from the same root as the word patron and, in his original use, means something which is set up as a perfect example to be imitated. Thus pattern recognition means the identification of the ideal which a given object was made after.”[2]
- 1978(Gonzalez, Thomas) defined pattern recognition as a classification of input data via extraction important features from a lot of noisy data.[3]
- 1985(Watanabe) said that pattern recognition can be looked as categorization problem, as inductive process, as structure analysis, as discrimination method and so on.[4]
- 1990(Fukunaga) defined pattern recognition as” A problem of estimating density functions in a high- dimensional space and dividing the space into the regions of categories of classes.”[5]
- 1992(Schalkoff) defined PR as“*The science that* \*Corresponding author: dvinu1@gmail.com (Vinita Dutt) Published online at <http://journal.sapub.org/ajis> Copyright © 2012 Scientific & Academic Publishing. All Rights Reserved concerns the description or classification (recognition) of measurements”[6]
- 1993(Srihari, Govindaraju) defined pattern recognition as a discipline which learn some theories and methods to design machines that can recognize patterns in noisy data or complex environment.[7]
- 1996(Ripley) outlined pattern recognition in his book: “Given some examples of complex signals and the correct decisions for them, make decisions automatically for a stream of future examples”[8]
- 2002(Robert P.W. Duin) described the nature of pattern recognition is

engineering; the final aim of Pattern recognition is to design machines to solve the gap between application and theory.[9]

- 2003(Sergios Theodoridis) Pattern recognition is a scientific discipline whose aim is the classification of the objects into a lot of categories or classes. Pattern recognition is also a integral part in most machine intelligence system built for decision making.[10]

### III. THE STUDY OF PR PROBLEM MAY BE LOGICALLY DIVIDE INTO TWO MAJOR CATEGORY:

- The study of the pattern recognition capability of human being and other living organism. For example: Psychology, physiology, biology.
- The development of the theory and techniques for the design of devices capable of performing a given recognition task for a specific application. For example: Engineering, computer, information science.

### IV. HOW CAN A MACHINE LEARN A RULE FROM DATA?

In PR, data analysis is done with predictive modelling which means some training data is given and user is able to predict the behaviour of the unseen test data. This task is referred to as learning.

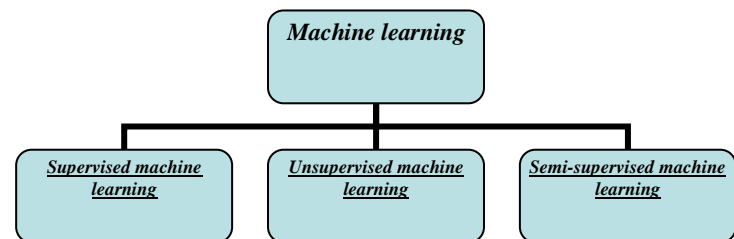


Fig 1. Classification of machine learning

1) *Supervised machine learning*: Most of the practical machine learning uses supervised learning.

It is used when you have input variables ( $x$ ) and an output variable ( $Y$ ) and you use an algorithm to learn the mapping function from the input to the output.

$$Y = f(X)$$

The purpose is to approximate the mapping function so well that when you have new input data ( $x$ ) that you can predict the output variables ( $Y$ ) for that data.

It is called supervised learning because the process of an algorithm learning from the training dataset can be thought of as a teacher supervising the learning process. We know the correct answers, the algorithm iteratively makes predictions on the training data and is corrected by the teacher. Learning stops when the algorithm achieves an acceptable level of performance.

2) *Unsupervised machine learning*: Unsupervised learning is where you only have input data (X) and no corresponding output variables.

The goal for unsupervised learning is to model the underlying structure or distribution in the data in order to learn more about the data.

These are called unsupervised learning because unlike supervised learning above there is no correct answers and there is no teacher. Algorithms are left to their own devices to discover and present the interesting structure in the data.

3) *Semi-supervised machine learning*: Problems where you have a large amount of input data (X) and only some of the data is labelled (Y) are called semi-supervised learning problems.

These problems sit in between both supervised and unsupervised learning..

Many real world machine learning problems fall into this area. This is because it can be expensive or time-consuming to label data as it may require access to domain experts. Whereas unlabelled data is cheap and easy to collect and store.

You can use unsupervised learning techniques to discover and learn the structure in the input variables.

## V PR APPROCHES

There are many ways to categories the PR approaches. The main aim of a PR system is to perform a mapping between the interpretation and representation space. Such mapping, be it a classification, a regression or a description solution and it is called a hypothesis.

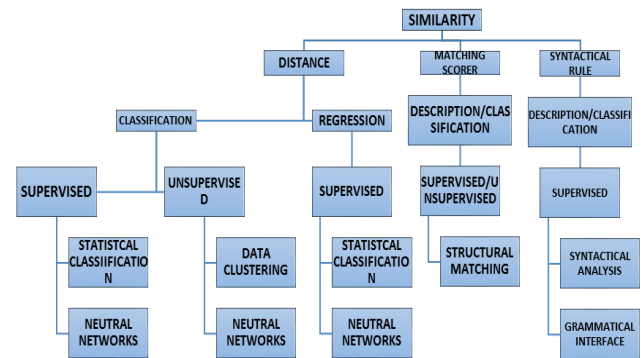


Fig. 2 PR approaches:

We proceeded to briefly describe the main characteristic of these approaches in details:

- 1) *Data clustering*: The purpose of data clustering is to represent data or pattern into meaningful or useful groups using some type of similarity measure. It does not use any prior class information. The solution arrived at are data driven as they do not rely on any superior or teacher and therefore it is an unsupervised classification method. It is useful when anyone want to find some meaning from a pile of unclassified information or in an exploratory phase of PR research of accessing internal data similarities.
- 2) *Statistical classification*: It is classic and long establish approach of PR whose mathematic dwell on the solid body of methods and formulas.it is mainly based on the use of probabilistic model for the feature vector distribution in the classes in order to drive classifying function. Estimation of these distribution is based on a training set of patterns whose classification is known beforehand (e.g. Assigned by human expert). The classifiers concept driven taught from labelled pattern how to perform the classification therefore it consider as supervised method of PR. There are variant of statistical classification approach, which depend on whether a known, parametrized, distribution model is being used or not. There are also most important by product of Statistical classification such as decision tree and table. The approach is adequate when the pattern are distributed I the features space, among the several classes according to simple topologies and preferably with known probabilistic distribution.
- 3) *Neural networks*: We can say that neural nets are inspired by physiological knowledge of the organisation of the brain. They are formed as a set of interconnected identical units knows as neurons.

These interconnections are used to send signal from one neuron to the other. This enhancement is obtained by adjusting connection right. It is different from statistical classification as neural nets have the benefit of being model free machine, behaving as universal approximation, capable of adjusting to any desired output or topology of class in the features space. But there is a drawback that its mathematics is more complex as well as see later on important decision the designer has often little theoretical base guidance. And has to rely on trial and error method. Another disadvantage which can be important for some circumstances is that practically no semantic information is available from a neural net. Neural nets preferable to classic statistical model free approaches, especially when the training set size is small compared with the dimensionality of the problem to be solved.

- 4) *Structural PR*: It is the approach followed whenever one needs to take into consideration the set of relations applying to the parts of the object to be recognized. Sometimes recognition predict the form of structural matching when one needs to access how well an unknown object or part of it relates to some prototype. A matching scorer then computed for this purpose, which does not necessarily have the usual properties of a distance measure. A particular type of structural PR is known as syntactic PR. The goal of recognizing machine is then to verify whether a sequence of pattern primitives obeys a certain set of rules, known as syntactic rules or grammar. For that purpose a syntactic analyser or parser is built and the sequence of primitive inputs to it. It is quite different from other as it operates with symbolic info, often in the form of strings, therefore using appropriate non numeric operators. It is sometimes used at higher level than the other methods like in image interpretation.

#### VI APPLICATION OF PATTERN RECOGNITION

No technology is useful if its applications do not exist. Technology like pattern recognition is widely used in various field. The applications of Pattern Recognition can be found everywhere. It is used in the field of medical Diagnosis, weather forecasting, biometric recognition, Stock Market Prediction, manufacturing industry, military, artificial intelligence, computer engineering, nerve biology, medicine image analysis, archaeology, geologic reconnoitring, space navigation, and armament

technology and so on. Some of applications are detailed below:

- OCR commonly known as optical character recognition is particularly used for document scan. It became the core part of industrial area now a days. It is frequently used in banking, colleges and postal applications. It is widely used as a form of information entry from printed paper data records, whether passport documents, invoices, bank statements, computerised receipts, business cards, mail, printouts of static-data, or any suitable documentation. It is the electronic conversion of images of typed, handwritten or printed text into machine-encoded text.
- Biometric: Bharadwaj et al. have described a review of fingerprint, iris and face using Image Processing techniques [17]. Personal identification systems that use biometrics are very important for security applications in airports, ATMs, shops, hotels, and secure computer access. Recognition can be based on face, fingerprint, iris, or voice, and can be combined with the automatic verification of signatures and PIN codes. Biometrics, as an integral component in identification science, is being utilized in large-scale biometrics deployments such as the US Visitor and Immigration Status Indicator Technology (VISIT), UK Iris Recognition Immigration System (IRIS) project, UAE iris-based airport security system, and India's Aadhaar project. Biometric systems, like other applications of pattern recognition and machine learning, are affected by the quality of input data [18].
- Computer vision deals with the recognition of objects as well as the identification and localization of their three-dimensional environments. This capability is required, for example, by robots to operate in dynamic or unknown environments. This can be useful for applications ranging from manufacturing to household cleaning,

and even for rescue missions. It can be used as a helper for drivers, people with disabilities, load carrier in plants and mines by road and the persons who cannot drive can use voice commands to navigate the vehicle.

- Recognition of objects on earth from the sky (by satellites) or from the air (by aeroplanes and cruise missiles) is called remote sensing. It is important for cartography, agricultural inspection, detection of minerals and pollution, and target recognition. In the paper by Manolakis et al. hyperspectral image processing for automatic target detection applications has been described [19]. A hyper spectral remote sensing system has four basic parts: the radiation (or illuminating) source, the atmospheric path, the imaged surface, and the sensor. Imaging sensors on satellites or aircraft gather this spectral information, which is a combination of sunlight atmospheric attenuation, and object spectral signature.
- Many tests for medical diagnosis utilize pattern recognition systems, from counting blood cells and recognition of cell tissues through microscopes to the detection of tumours in magnetic resonance scans and the inspection of bones and joints in X-ray images.
- As one of the few biometric methods that possess the merits of both high accuracy and low intrusiveness, face recognition technology (FRT) has a variety of potential applications in information security, law enforcement and surveillance, smart cards, access control, among others [20–23]. For this reason, FRT has received significantly increased attention from both the academic and industrial communities during the past 20 years.
- Speech recognition: Some time we need an application who provide user a usability to interact with machine verbally for that we use automatic speech recognition

system. Commercial systems for automatic response to flight queries, telephone directory assistance, and telebanking are available. It is helpful for the disabled person as they can directly contact with the machine without touching it. THE NEED for deciding whether a given segment of a speech waveform should be classified as voiced speech, unvoiced speech, or silence (absence of speech) arises in many speech analysis systems [24].

Application classification	Input Data	Output Response
<b>Character Recognition</b>	Optical signals or strokes	Name of character
<b>Speech Recognition</b>	Acoustic waveforms	Name of word
<b>Speaker Recognition</b>	Voice	Name of speaker
<b>Weather Prediction</b>	Weather maps	Weather forecast
<b>Medical Diagnosis</b>	Symptoms	Disease
<b>Stock Market Prediction</b>	Financial news and charts	Predicted market ups and downs

Fig 3. Application classification

VII. LITERATURE REVIEW OF SOME PAPER:

PAPER TITLE	AUTHOUR	IMPORTANT REVIEWS
Pattern recognition Using Genetic Algorithm	Majida Ali Abed , Ahmad Nasser Ismail and Zubadi Matiz Hazi	<ul style="list-style-type: none"> <li>This paper proposed a method called Genetic algorithms for recognizing Pattern (isolated Arabic characters).</li> <li>The proposed method which is applied for (isolated form of Arabic characters), it also be used for recognizing other three forms (beginning, middle and end form) with a little change in algorithm architecture.</li> </ul>
Mining Classification Rule by using Genetic Algorithms with non-random initial population and uniform operator	Koray Korkut , Bilal Alatas	The recognition of machine-printed characters and handwritten a machine-printed characters and handwritten characters are the first practical application in the field of pattern recognition
Pattern Recognition in Image Processing – A Study	Hemalatha <sup>1</sup> , Jeevan K .A <sup>2</sup>	<ul style="list-style-type: none"> <li>A practical implementation and application of image processing and isolated word recognition has been explained.</li> <li>This paper also covered different classifier which is widely used in this area such as Bayesian and Gaussian classifiers, as well as artificial neural networks</li> </ul>
Robust Face Detection Using the Hausdorff Distance	Oliver Jesorsky, Klaus J. Kirchberg, and Robert W. Frischholz	<ul style="list-style-type: none"> <li>This paper presents a shape comparison approach to achieve fast, accurate face detection that is robust to changes in illumination and background. The proposed method is edge-based and works on grayscale still images.</li> <li>The Hausdorff distance is used as a similarity measure between a general face model and possible instances of the object within the image, suitable for real-time application.</li> </ul>
A Survey of Affect Recognition Methods: Audio, Visual and Spontaneous Expressions	Zhihong Zeng <sup>1</sup> , Maja Pantic <sup>2</sup> , Glenn I. Roisman <sup>1</sup> and Thomas S . Huang <sup>1</sup>	<ul style="list-style-type: none"> <li>This paper focus on the Promising approaches have been reported, including automatic methods for facial and vocal affect recognition.</li> <li>This paper survey the recently efforts to develop algorithms that can process naturally occurring human affective behaviour have emerged.</li> </ul>

## V. ADVANTAGES

Pattern recognition has also been used extensively in various fields. This field become the most advantageous and widely used even by a common man. Earlier the observation and recognition which WAS DONE BY A MAN IS NOW DONE BY THE MACHINE very effectively. It also provide a good interface by interacting the user with the machine world. It is extensible used both for security and learning purpose now a days. Advantages of this technology is shown by its applications itself.

## VIII. DISADVANTAGES

The technology called pattern recognition is so wide. Various approaches we notify in pattern recognition .Each approach has its own significance as well as disadvantages. Like Reference (Jain et al., 2004a) gives a brief overview of the field of biometrics and summarizes some of its advantages, disadvantages, strengths, limitations, and related privacy concerns. In (Jain et al., 2004b), the authors also address the problem of the accuracy of the authentication and that of the individual's right to the security, to the privacy and to the anonymity. Neural nets approaches also not use everywhere due to some of its complexities and limitations.

## IX. PR CHALLENGES AND CONCERN

A lot of research effort is needed before the two novel and far-reaching paradigms are ready for practical applications [11]. So, this section points on several challenges that usually come in the current context and will be summarized for the design of automatic pattern recognition procedures. Various approaches are discus here in brief and various application of pattern recognition have already been identified in the previous sections and some will return here on a more technical level. Many of the points raised in this section have been more extensively discussed in [13]. We will emphasize these which have only been touched or are not treated in the standard books [12, 14,

15] or in the review by Jain et al. [16]. The issues to be described are just a selection of the many which are not yet entirely understood. Some of them may be solved in the future by the development of novel procedures [11] or by gaining an additional understanding. Others may remain an issue of concern to be dealt with in each application separately. Another concern is that it is difficult to understand pattern recognition and its algorithm in all the fields as it is too wide as beyond ones imagination.

## X. FUTURE WORK

A lot of advancements using Pattern recognition yet to come.... Robotics is one of the leading area where you can start your work. Where you can train the Humanoids etc. [25]. Pattern recognition technologies are of central importance to this. Just as a biological entity acts not on the raw data received from eyes, but on the analyses and hypotheses derived from it, the data from telescopes, microscopes, endoscopes, and every other sort of artificial eye, will be mediated through pattern recognition algorithms designed to make it machine usable. A method for pattern recognition based on Singular Value Decomposition (Feature Extraction) with Error Back Propagation of Neural Network (Recognition) was successfully implemented for iris recognition. This suggests a future scope on researching a better computationally efficient and robust classifier which can handle more number of classes for pattern recognition. Human Computing paradigm suggests that user interfaces of the future need to be proactive and human entered, based on naturally occurring multimodal human communication [26]. More specifically, human-centred interfaces must have the ability to detect subtleties of and changes in the user's behaviour, especially his or her affective behaviour, and to initiate interactions based on this information, rather than simply responding to the user's commands.



## XI. CONCLUSIONS

Pattern recognition is now involved everywhere. You can't imagine your life without the use of PR Technology. In this paper we define the Pattern Recognition and its definitions and lot of application and scope where the PR gain its popularity. We also define some important approaches which gives the birth of this new technology. Recognition of patterns and inference skills lie at the core of human learning. It is a human activity that we try to imitate by mechanical means. The human process of learning patterns from examples may follow along the lines of trial and error. By freeing our minds of fixed beliefs and petty details we may not only understand single observations but also induce principles and formulate concepts that lie behind the observed facts. New ideas can be born then. This technology gives enormous scope to explore your own observation and convert it into machine perception. It has many applications from product development to entertainment. It is still very much in the development stage with many users creating their own customized applications and setups to suit their needs. It opens up unparalleled avenues of accessibility, interaction and collaboration for learners

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