

An Overview of Pattern Recognition

Miss. Debalina Nandy

Assistant Professor

Department of Computer Engineering

Atmiya Institute of Technology & Science, Rajkot, Gujarat

Mr. Renish J Padariya

Assistant Professor

Department of Computer Engineering

Om Engineering College, Junagadh

Abstract

Our ability to recognize a face, to understand spoken words, to read handwritten characters... all these abilities belong to the complex processes of “pattern recognition”. The act of taking in raw data and making an action based on the “category” of the pattern. Build a machine that can recognize patterns like Automatic Speech Recognition, Fingerprint Identification, Optical Character Recognition, DNA sequence identification, Face Recognition etc. Reliable pattern recognition machines would be extremely useful. We are often by the knowledge of how patterns are modeled and recognized in nature when we develop pattern recognition algorithms. Research on machine perception also helps us gain deeper understanding and appreciation for pattern recognition systems in nature.

Keywords: Pattern Recognition, Definition, Pattern Recognition System, Application

I. INTRODUCTION

Pattern Recognition is familiar with everyone. In order to apply pattern recognition techniques, the phenomenon to be classified must be represented in some “computer acceptable “form. Furthermore, the representation method used depends critically on the type of phenomenon. A Pattern recognition system (PRS) is an automatic system that aims as classifying the input pattern into a specific class. Pattern Recognition System mostly divided into two categories i.e. Sensing where Use of a transducer (camera or microphone), PR system depends of the bandwidth, the resolution, the sensitivity and the distortion of the transducer and Segmentation and grouping where pattern should be well separated and should not be overlapped. The classification scheme is usually based on the availability on the training set that is a set of patterns already having been classified. Pattern recognition constitutes an important tool in various application domains, but unfortunately, that is not always an easy task to carry out. Pattern recognition is a study how machines can observe the environment, learn to distinguish patterns of interest, make sound and reasonable decisions about the categories of pattern.

A. Human Perception:

Humans have developed highly sophisticated skills for sensing their environment and taking actions according to what they observe, e.g. recognizing a face, understanding spoken words, reading handwriting, distinguishing fresh food from its smell. We can apply many techniques that are purely numerical and do not have any correspondence in natural systems. A pattern is an entity, vaguely defined, that could be given a name, e.g., fingerprint image handwritten word, human face, speech signal, DNA sequence etc. Pattern recognition undergoes an important developing for many years. Pattern recognition include a lot of methods which impelling the development of numerous applications in different filed. Pattern recognition techniques find applications in many areas: machine learning, statistics, mathematics, computer science, biology, etc. There are many sub-problems in the design process.

Many of these problems can indeed be solved. More complex learning, searching and optimization algorithms are developed with advances in computer technology.

II. PATTERN RECOGNITION SYSTEM

A pattern recognition system can be regarded as a process that allows it to cope with real and noisy data. Whether the decision made by the system is right or not mainly depending on the decision made by the human expert. A pattern recognition system based on any PR method mainly includes three mutual-associate and differentiated processes. A very common description of the pattern recognition system that includes five steps to accomplish. The step of classification / regression / description showed in fig is the kernel of the system.

A general composition of a PR system is given below:

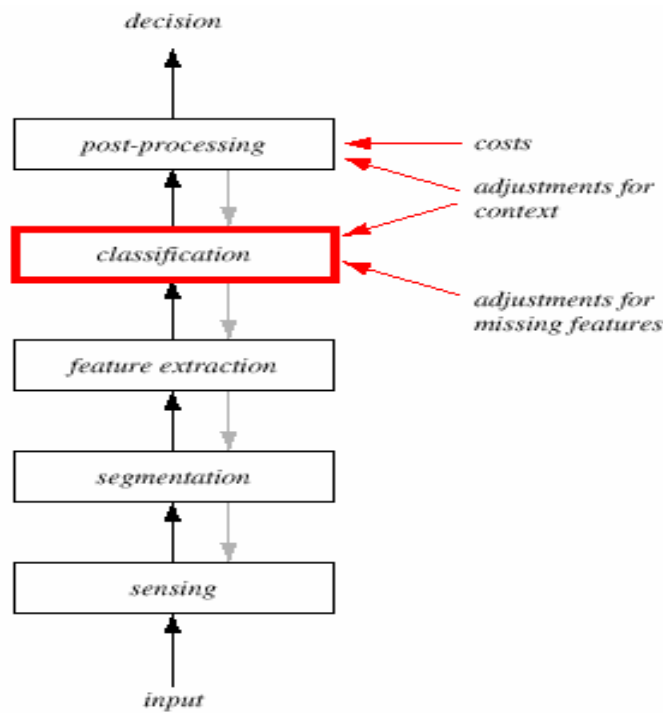


Fig. 1: PR system

Here Feature Extraction means discriminative features Invariant features with respect to translation, rotation and scale, Classification means use a feature vector provided by a feature extractor to assign the object to a category, Post Processing means exploit context input dependent information other than from the target pattern itself to improve performance. Classification is a PR problem of assigning an object to a class, The output of the PR system is an integer label, such as classifying a product as “1” or “0” in a quality control test. Regression is a generalization of a classification task, and the output of the PR system is a real-valued number, such as predicting the share value of a firm based on past performance and stock market indicators. Description is the problem of representing an object in terms of a series of primitives, and the PR system produces a structural or linguistic description. The classification of pattern recognition system Rule based system, Classical fuzzy system, Bayesian system, neural networks system, Fuzzy neural networks systems.

III. PATTERN RECOGNITION APPLICATION

Table - 1
Example pattern recognition applications.

<i>Problem Domain</i>	<i>Application</i>	<i>Input Pattern</i>	<i>Pattern Classes</i>
<i>Document Image Analysis</i>	<i>Machine for Blind</i>	<i>Document Image</i>	<i>Characters, Words</i>
<i>Document Classification</i>	<i>Internet Search</i>	<i>Test Document</i>	<i>Semantic Categories</i>
<i>Biometric Recognition</i>	<i>Personal Identification</i>	<i>Face, Iris, Fingerprint</i>	<i>Access Control</i>
<i>Bioinformatics</i>	<i>Sequence Analysis</i>	<i>DNA Sequence</i>	<i>Known types for genes</i>
<i>Industrial Automation</i>	<i>Fruit sorting</i>	<i>Image taken on belt</i>	<i>Grade of quality</i>
<i>Medical</i>	<i>Computer aided diagnosis</i>	<i>Microscopic image</i>	<i>Healthy cell</i>
<i>Military</i>	<i>Target recognition</i>	<i>Optical image</i>	<i>Target type</i>
<i>Data Mining</i>	<i>Search meaningful pattern</i>	<i>Points in space</i>	<i>Compact clusters</i>

Example of Pattern Recognition Examples

From
Jim Elder
829 Loop Street, Apt 300
Allentown, New York 14707

Nov 10, 1999

To
Dr. Bob Grant
602 Queensberry Parkway
Omar, West Virginia 25638

We were referred to you by Xena Cohen at the University Medical Center. This is regarding my friend, Kate Zack.

It all started around six months ago while attending the "Rubeq" Jazz Concert. Organizing such an event is no picnic, and as President of the Alumni Association, a co-sponsor of the event, Kate was overworked. But she enjoyed her job, and did what was required of her with great zeal and enthusiasm.

However, the extra hours affected her health; halfway through the show she passed out. We rushed her to the hospital, and several questions, x-rays and blood tests later, were told it was just exhaustion.

Kate's been in very bad health since. Could you kindly take a look at the results and give us your opinion?

Thank you!
Jim

From
Jim Elder
829 Loop Street, Apt 300
Allentown, New York 14707

Nov 10, 1999

To
Dr. Bob Grant
602 Queensberry Parkway
Omar, West Virginia 25638

We were referred to you by Xena Cohen at the University Medical Center. This is regarding my friend, Kate Zack.

It all started around six months ago while attending the "Rubeq" Jazz Concert. Organizing such an event is no picnic, and as President of the Alumni Association, a co-sponsor of the event, Kate was overworked. But she enjoyed her job, and did what was required of her with great zeal and enthusiasm.

However, the extra hours affected her health; halfway through the show she passed out. We rushed her to the hospital, and several questions, x-rays and blood tests later, were told it was just exhaustion.

Kate's been in very bad health since. Could you kindly take a look at the results and give us your opinion?

Thank you!
Jim

Fig. 2: English Handwriting Recognition

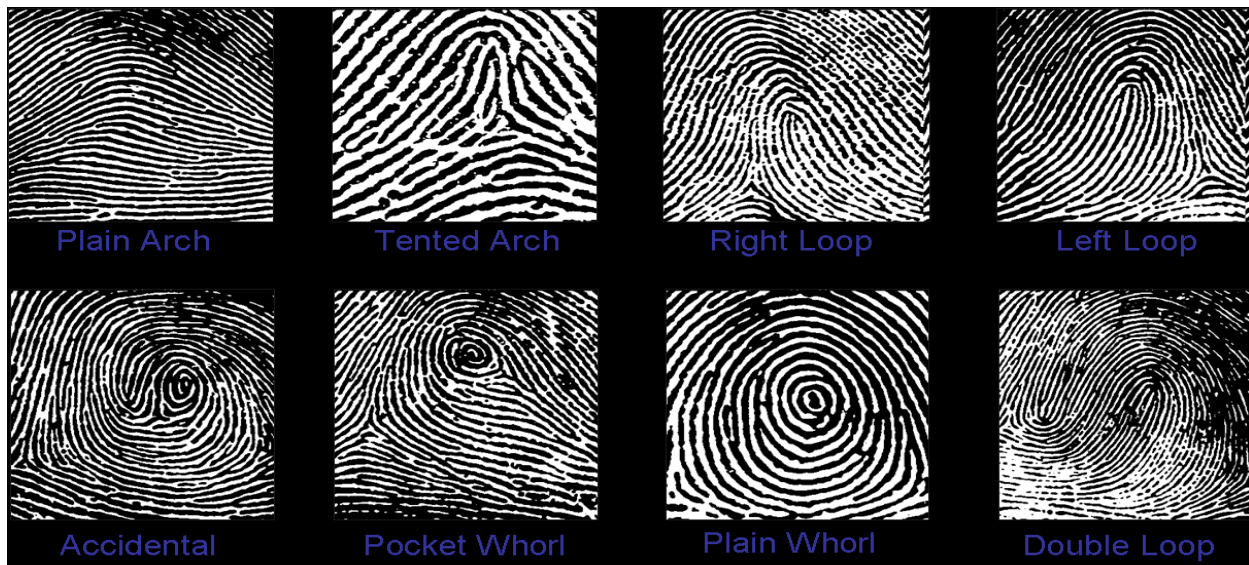


Fig. 3: Fingerprint Recognition

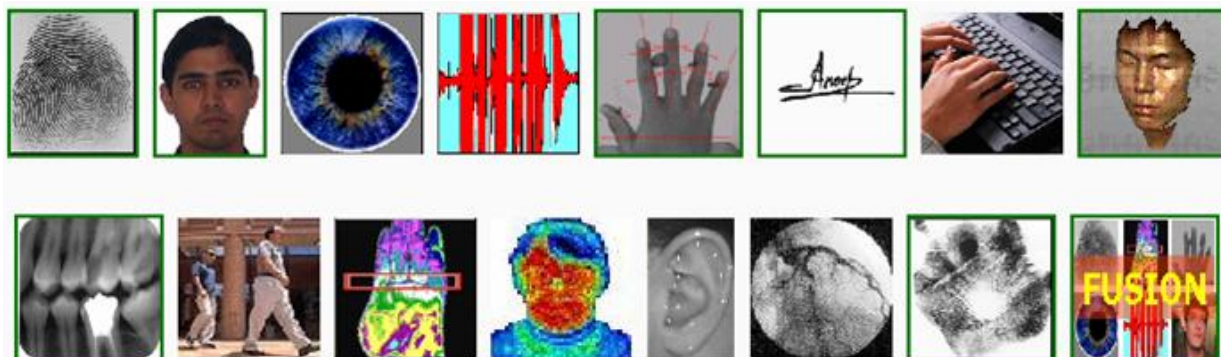


Fig. 4: Biometric Recognition

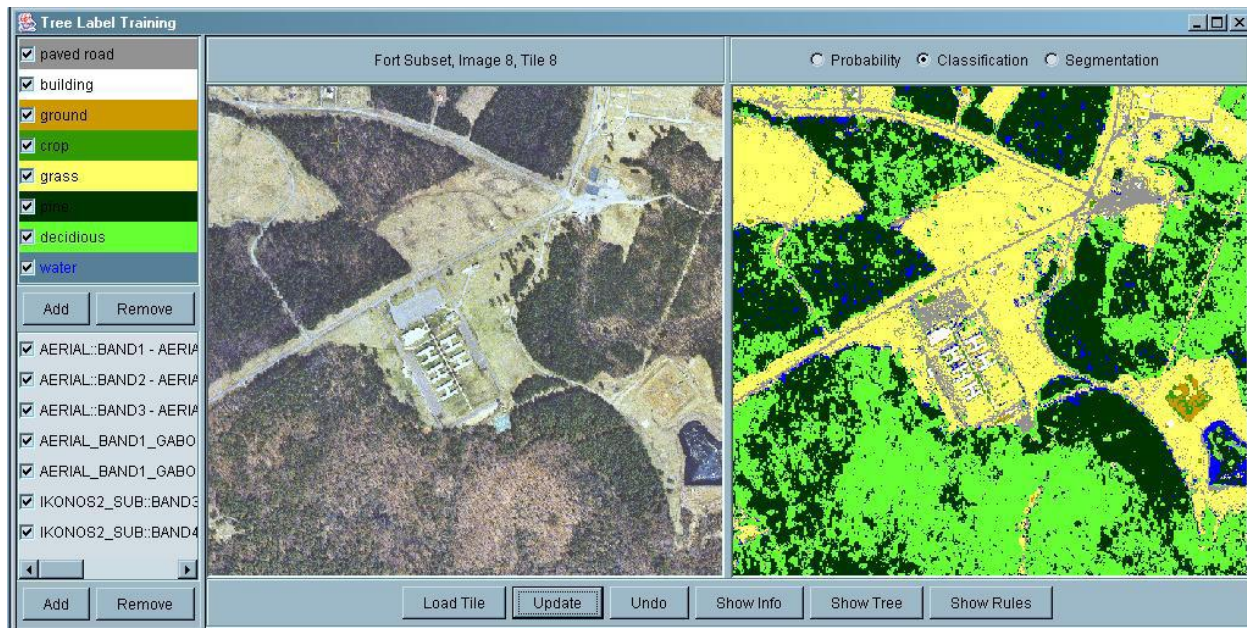


Fig. 5: Land covers classification using satellite data

IV. CONCLUSION

Watanabe wrote in the preface of the 1972 book he edited, entitled *Frontiers of Pattern Recognition*, that Pattern recognition is a fast-moving and proliferating discipline. It is not easy to form a well-balanced and well-informed summary view of the newest developments in this field. It is still harder to have a vision of its future progress. Pattern recognition techniques find applications in many areas: machine learning, statistics, mathematics, computer science, biology, etc. There are many sub-problems in the design process. Many of these problems can indeed be solved more complex learning, searching and optimization algorithms are developed with advances in computer technology. There remain many fascinating unsolved problems. In its broadest sense pattern recognition is the heart of all scientific inquiry, including understanding ourselves and the real-world around us. And the developing of pattern recognition is increasing very fast, the related fields and the application of pattern recognition became wider and wider.

REFERENCES

- [1] Bezdek, J.C and S.K Pal Eds, *Fuzzy Models for pattern recognition*, IEEE presses New York, 1992.
- [2] Witold pedrycz, *Special issue on fuzzy set technology in pattern recognition*, *Pattern Recognition Letters*, 1996.
- [3] Pavilidis, T., *Structural Pattern Recognition*, Springer-Verlag, New York, 1977.
- [4] M.petrou, *learning in pattern recognition: some thoughts*, *Pattern Recognition Letters* 22, 3-13, 2001.
- [5] B. Ripley, *Pattern Recognition and Neural Networks*, Cambridge University Press, Cambridge, 1996.
- [6] Srihari, S.N., Covindaraju, *Pattern recognition*, Chapman & Hall, London, 1034-1041, 1993.
- [7] B. Ripley, *Pattern Recognition and Neural Networks*, Cambridge University Press, Cambridge, 1996.
- [8] Watanabe, *Pattern Recognition: Human and Mechanical*, Wiley, New York, 1985.
- [9] S.Priyanka and K.Manavjeet, *Classification in Pattern Recognition: A Review*, 2013.
- [10] A.Seema and D.Rajeshwar, *Pattern Recognition Techniques*, August 2012.
- [11] R. C. Gonzalez, "Object Recognition", in *Digital image processing*, 3rd ed. Pearson, August 2008, pp. 861-909.
- [12] L.Abbishek, *Basic pattern Recognition and digital image processing using SAS/AF frame*.
- [13] P.A. Devijver and J. Kittler, *Pattern Recognition: A Statistical Approach*. London: Prentice Hall, 1982.
- [14] J.Anil, F., I., D.Robert, M.Jainchang, *Statistical pattern Recognition: A review*, January 2000.
- [15] Kandel,A., *Fuzzy Techniques in Pattern Recognition*", John Wiley and Sons, New York,1982.