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A Survey on the Use of Pattern Recognition Techniques

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Abstract-Pattern recognition is an innate cognitive process of matching information from the environment with the information stored in memory. Core methods are successful in many areas of numerical analysis, pattern recognition and machine learning. These are methods which generate an abstracting model from given observations (objects, measurements) in a training step, which subsequently allows generalizing statements for new observations. Various approaches are used to implement a pattern recognition system. In this paper we will discuss Statistical, Structural, hybrid and Neural Network based approach.

Keywords– *Pattern Recognition, Statistical Pattern Recognition, Structural Pattern Recognition, Neural Networks.*

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I. Introduction

Pattern Recognition techniques provide a variety of techniques, in mathematics and computer science, that is individually useful in many different applications. In addition to the mathematical methods, further approaches from the area of pattern recognition are applied. These do not draw the knowledge from the statistical properties of the variables, but rather the information stored in the form of patterns in the data set. Since the applied methods are often free from any structural and functional requirements, this form of modeling is also referred to as model-free modeling. In this area, Methods from machine learning, also known as artificial intelligence (AI)[1]. Examples are artificial neural networks (ANN), genetic algorithms, adaptive agents or cellular automata. In practice, the different modeling approaches are not mutually exclusive, mixing and cross-fertilization, e.g. then when the multivariate statistics are used in the mechanistic modeling in the context of parameter estimation.

The different application areas of pattern recognition [2,3] are like letter recognition/handwritten digit, voice, document classification, speech recognition, image analysis, , terrorist detection, data mining, electroencephalogram analysis, industrial automation, Smog detection and measurement, biometric recognition, remote sensing, credit fraud detection, medical diagnosis behavior analysis etc

Nowadays, demands on automatic pattern recognition systems are expanding enormously

Due to the availability of huge databases and stringent performance requirements (accuracy, speed and

Cost) In [4] many of the emerging applications, it is obvious that no single approach for classification is optimal and that several methods and approaches is to be used. Consequently, combining several sensing modalities and classifiers is now become frequently used practice in pattern recognition.

Pattern Recognition

Pattern recognition involves finding pattern and similarities among smaller problems to help us to solve more complex problem. The identification problem is solved by pattern recognition systems deployed electronic sensor and by implementing algorithm which is approximate to the functioning of the perceptual and cognitive ability of living organisms. A pattern recognition system [5] based on any PR method generally includes the three mutual-associate and differentiated processes i.e. Data building, pattern analysis and pattern classification.

 ISSN: 2321-8169
258 – 262

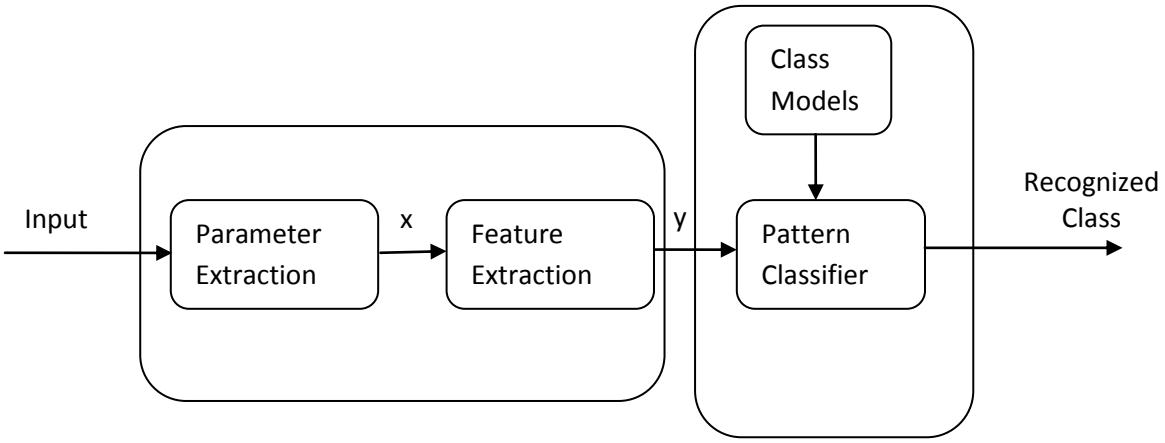

Fig. 1. Conventional pattern recognition system

Feature extraction can be conducted jointly or independently with either parameter extraction or classification [6].Feature extraction is a vital step in the building of any pattern association. Its main aim is to extract the appropriate information to characterize each class. Feature extraction techniques support a different variety of image processing applications such as static image. As features describe the behavior of an image, they give you an idea about its position in terms of storage space, effectiveness in classification and time utilization [7]. Feature extraction is a technique generally used in pattern recognition. It is a technique that Compute features for inputs at the run-time. Feature extraction can be conducted independently or jointly with either parameter extraction or classification.

Pattern Recognition Approaches (Methods).

Pattern recognition is a process that takes raw data and makes an action based on the category of the pattern. There are so many methods are available in pattern recognition. Here we will discuss four approaches of the pattern recognition.

Statistical pattern Approach:-

Statistical pattern recognition is based on well-known concepts in the statistical decision theory, in order to distinguish data from different groups on the basis of quantitative characteristics of the data. In a statistical model, a probability theory and decision theory applies to find an algorithm. In the past, there have been advances in the theory and applications of "Statistical Pattern Recognition" Sensing, feature extraction, and classification are the major issues encountered in the design of statistical pattern recognition system. The quantitative nature of statistical pattern recognition makes it difficult to distinguish between Groups based on the morphological [8](i.e. shape-based or structural) sub-patterns and their interrelationships embedded in the data.

Structural/ Syntactic Approach:

Structural/ Syntactic method is generally involved in complex patterns. Structural features, frequently referred to as primitives, represent the sub-patterns [2] (or building blocks) and the relationships between them that form the data. The semantics associated with each feature is determined by the coding scheme (i.e., the selection of morphologies) used to identify primitives in the data.

Methodologies used for extracting structural features from image data such as morphological image processing techniques [2] lead to primitives such as curves, edges and regions. High dimensional patterns need high dimensional grammars such as web grammars, tree grammars, graph grammars and shape grammars for efficient description [9].

 ISSN: 2321-8169
258 – 262

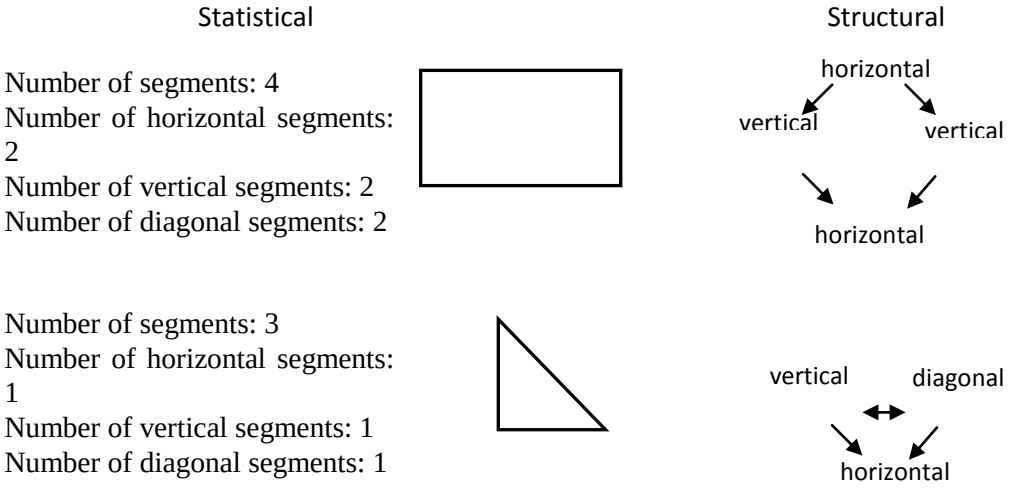

Fig 2. Pattern recognition applied for a common identification problem in the statistical and structural approaches

The aim is to distinguish between the rectangle and the right angle triangle. Quantitative features such as the number of horizontal, vertical, and diagonal segments are extracted by statistical approach, which is then passed to a decision-theoretic classifier. A structural approach extracts morphological features and their interrelationships within each figure.

A brief summary of the differences between statistical and structural approaches is shown in table 1.

Table 1 The differences between statistical and structural approaches

Approach	Statistical	Structural
Foundation	Statistical decision theory	Human perception and cognition
Description	Quantitative features	Morphological primitives
	Fixed number of features	Variable number of primitives
	Ignores features relationship	Captures primitive relationships
	Semantics from feature position	Semantics from primitives encoding
Classification	Statistical classifiers	Parsing with syntactic grammars

Hybrid

Two or more methods are combined to produce the result of hybrid model. In [9] several applications only one model is not sufficient for classification. Statistical and Structural models are jointly together to solve hybrid problems. Statistical approach is utilized to classify pattern primitives as well as syntactic approach is used for the recognition of sub-patterns and pattern itself. In hybrid system both approaches can be combined in a mode to compensate the drawback of each and conserving the benefit of each approach.

Neural network

ANN is a computational models that are very helpful and have a number of neurons and are capable of enabling machine learning algorithms, pattern recognition and prediction problem[10]. They are also parallel processors that run at the same time. It is used in the Matlab as learning algorithms which are very helpful. The most commonly used family of neural networks for pattern classification tasks [11] is the feed-forward network, which includes multilayer perceptron and Radial-Basis Function (RBF)[12] networks. These networks are organized into layers and have unidirectional connections between the layers. Another popular network is the Self-Organizing Map (SOM), or Kohonen-Network [13], which is mainly used for data clustering, feature mapping and segmentation tasks. The SOM[14] model generate stable and consistent results. The learning process involves updating network architecture and connection weights so that a network can efficiently perform a specific classification/clustering task.

II. Conclusion

A comparative view of all the models of pattern recognition has been shown which depicts that for various domains in this areas different models or combination of models can be used. The Important issues in the design of a Pattern system [15] are Sensing environment, Pattern representation, Feature extraction and selection and Performance evaluation. In case of noisy patterns, choice of statistical (decision-theoretic) model [16] is a good solution. Practical importance of structural (syntactic) model depends upon recognition of simple pattern primitives and their relationships represented by description language. It is not able to handle numerical semantic information. Hybrid approach provides better results combining both approaches (statistical and structural) for the solutions of complex pattern recognition problems alone. Low dependence of neural networks on prior knowledge and availability of efficient learning algorithms have made the neural networks famous in the field of Patten Recognitions.

References

[1] Kumar, S., Singh, M. P., Goel, R., & Lavania, R. (2013). Hybrid evolutionary techniques in feed forward neural network with distributed error for classification of handwritten Hindi “SWARS”. Connection Science, 25(4), 197–215. http://doi.org/10.1080/09540091.2013.869556

[2] Olszewski, R. T. R., Maxion, R., Siewiorek, D., & Banks, D. (2001). Generalized feature extraction for structural pattern recognition in time-series data. Engineering Education (Vol. 35). http://doi.org/10.1016/S0031-3203(01)00152-2

[3] de Ridder, D., & Handels, H. (2002). Image processing with neural networks - a review. Pattern Recognition, 35(10), 2279–2301. http://doi.org/10.1016/S0031-3203(01)00178-9

[4] Jain, A. K., Duin, R. P. W., & Mao, J. (n.d.).(2000) Statistical Pattern Recognition: A Review.IEEE transactions on pattern analysis and machine intelligence, 22(1).

[5] Jie, L., Jigui, S., & Shengsheng, W. (2006). Pattern Recognition: an Overview. International Journal of Computer Science and Network Security, 6(6), 57–61. http://doi.org/10.5923/j.ajis.20120201.04

[6] Wang, X., & Paliwal, K. K. (2003). Feature extraction and dimensionality reduction algorithms and their applications in vowel recognition. Pattern Recognition, 36(10), 2429–2439. http://doi.org/10.1016/S0031-3203(03)00044-X

[7] Goel Rajkumar, Kumar Vineet, Srivastava Saurabh, Sinha A. K.,(2017). A Review of Feature Extraction Techniques for Image Analysis. International Journal of Advanced Research in Computer and Communication Engineering, 6(special issue 2), 153–155. http://doi.org/10.17148/ijarcce

[8] Plaza, A., Martínez, P., Plaza, J., & Pérez, R. (2005). Dimensionality Reduction and Classification of Hyperspectral Image Data Using Sequences of Extended Morphological Transformations.pdf, 43(3), 466–479.

[9] Asht, S., & Dass, R. (2012). Pattern Recognition Techniques : A Review, International Journal of Computer Science and Telecommunications 3(8).

[10] Rajisha, T. M., Sunija, A. P., & Riyas, K. S. (2016). Performance Analysis of Malayalam Language Speech Emotion Recognition System Using ANN/SVM. Procedia Technology, 24, 1097–1104. https://doi.org/10.1016/j.protcy.2016.05.242

 ISSN: 2321-8169
258 – 262

[11] Jain, A.K., Mao, J. and Mohiuddin, K.M., "Artificial Neural Networks: A Tutorial.", Computer, pp. 31-44, (1996).

[12] Pradeepa, J., Srinivasan, E., & Himavathi, S. (2012). Neural network based recognition system integrating feature extraction and classification for English handwritten. International Journal of Engineering, Transactions B: Applications, 25(2), 99–106. http://doi.org/10.5829/idosi.ije.2012.25.02b.03

[13] Kohonen T., "Self-Organizing Maps", Springer Series in Information Sciences, vol. 30, (1995)

[14] Ramírez-Quintana, J., Chacon-Murguia, M., & Chacon-Hinojos, J. (2012). Artificial neural image processing applications: A survey. Engineering Letters, 20(1), 1–13. Retrieved from www.engineeringletters.com/issues_v20/issue_1/EL_20_1_09.pdf

[15] Shinde, S. P., V.P.Deshmukh, Vidyapeeth, B., Y.M.I.M.Karad, Vidyapeeth, B., & Karad, M. (2011). Implementation of pattern recognition techniques and overview of its applications in various areas of artificial intelligence. International Journal of Advances in Engineering & Technology, 1(4), 127–137.

[16] Kepka, J. I. R. I. (1994). THE CURRENT APPROACHES IN, 30(2).