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Survey of Pattern Recognition Methods

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Abstract: Pattern Recognition defined as a classification of input data via extraction important features from a lot of noisy data. The identification or interpretation of the pattern in an image can be described effectively with the help of Pattern Recognition (PR). It aims to extract information about the image to classify its contents. Inputs are in the form of digitized binary valued 2D images or textures containing the pattern to be classified. The analysis and recognition of the patterns such as images and textures are becoming more and more complex and multiform. This is because in general the patterns to be analyzed are shifting from simple to complex, and because the patterns of heavy variations and with heavy noise have to be treated. Therefore it is proposed to develop sophisticated strategies of pattern analysis to cope with these difficulties. Hybrid model is combination of two model so it best model as compared to others model.

Key Terms: Pattern Recognition, Statistical Pattern Recognition, Structural Pattern Recognition, Neural Networks and Fuzzy Sets

1. INTRODUCTION

Pattern recognition encompasses two fundamental tasks: description and classification. Given an object to analyze, a pattern recognition system first generates a description of it i.e., the pattern and then classifies the object based on that description i.e., the recognition. The essential problem of pattern recognition is to identify an object as belonging to a particular group. Assuming that the objects associated with a particular group share common attributes more so than with objects in other groups, the problem of assigning an unlabeled object to a group can be accomplished by determining the attributes of the object (i.e., the pattern) and identifying the group of which those attributes are most representative (i.e., the recognition). If information about the universe of all possible objects and the groups to which they can be assigned is known, then the identification problem is straightforward in that the attributes that best discriminate among groups and the mapping from attributes to groups can both be determined with certainty. When the information about the identification problem is imperfect or incomplete, then the attributes and mapping to use must be inferred from example objects whose group membership is known. pattern recognition is the assignment of some sort of output value (or label) to a given input value (or instance), according to some specific algorithm Pattern recognition (PR).

It was very much an interdisciplinary subject, covering developments in the areas of statistics, engineering, artificial intelligence, computer science, psychology and physiology, among others. Pattern recognition is generally categorized according to the type of learning procedure used to generate the output value. Supervised learning assumes that a set of training data (the training set) has been provided, consisting of a set of instances that have been properly labeled by hand with the correct output. A learning procedure then generates a model that attempts to meet two sometimes conflicting objectives: perform as well as possible on the training data, and generalize as well as possible to new data (usually, this means being as simple as possible, for some technical definition of "simple", in accordance with occam's razor). Unsupervised learning, on the other hand, assumes training data that has not been hand-labeled, and attempts to find inherent patterns in the data that can then be used to determine the correct output value for new data instances. A combination of the two that has recently been explored is semi-supervised learning, which uses a combination of labeled and unlabeled data i.e typically a small set of labeled data combined with a large amount of unlabeled data). Note that in cases of unsupervised learning, there may be no training data at all to speak of; in other words, the data to be labeled *is* the training data.

2. PATTERN RECOGNITION METHODS

Pattern recognition include a lot of methods which impelling the development of numerous applications in different filed. Models opted for pattern recognition can be categorized in to different categories depending upon the method used for data analysis and classification. Models can be independently or dependently used to perform a pattern recognition task. The different models used for pattern recognition task are as follow:

A. Statistical Model

In Statistical method of Pattern Recognition each pattern is described in terms of features. Features are chosen in such a way that different patterns occupy non-overlapping feature space. It recognizes the probabilistic nature both of the information we seek to process, and of the form in which we should express it. It works well when the selected features

lead to feature spaces which cluster in a recognizable manner, i.e. there is proper interclass distance. After analyzing the probability distribution of a pattern belonging to a class, decision boundary is determined. Here patterns are projected to pre-processing operations to make them suitable for training purposes. Features are selected upon analyzing training patterns.Test patterns are applied to check suitability of system to recognize patterns. Feature measurement is done while testing, then these feature values is presented to learned system and in this way classification is performed.

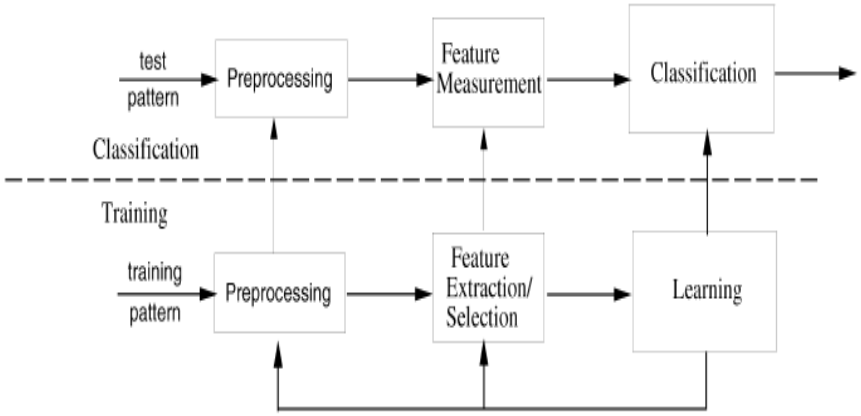

Fig-1: Statistical decision

Statistical decision and estimation theories have been commonly used in PR for a long time. It is a classical method of PR which was found out during a long developing process, it based on the feature vector distributing which getting from probability and statistical model. The statistical model is defined by a family of class-conditional probability density functions Pr(x|ci)(Probability of feature vector x given class ci) In detail, in SPR, we put the features in some optional order, and then we can regard the set of features as a feature vector. Also statistical pattern recognition deals with features only without consider the relations between features.

B. Structural Model

Structural pattern recognition sometimes referred to as syntactic pattern recognition due to its origins in formal language theory, relies on syntactic grammars to discriminate among data from different groups based upon the morphological interrelationships (or interconnections) present within the data. Structural pattern recognition systems have proven to be effective for data which contain an inherent, identifiable organization such as image data (which is organized by location within a visual rendering) and time series data (which is organized by time). The usefulness of structural pattern recognition systems, however, is limited as a consequence of fundamental complications associated with the implementation of the description and classification tasks.

Some structural pattern recognition systems justify the use of a particular set of feature extractors by claiming that the same set had been used successfully by a previous system developed for a similar application within the same domain; such claims simply shift the burden of feature extractor development onto previously implemented systems. Simplistic primitives are domain independent, but capture a minimum of structural information and postpone deeper interpretation until the classification step. At the other extreme, domain and application specific primitives can be developed with the assistance of a domain expert, but obtaining and formalizing knowledge from a domain expert, called knowledge acquisition, can be problematic.

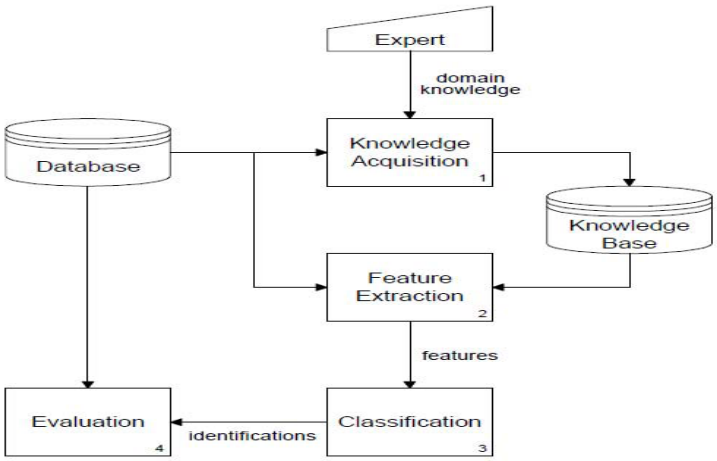

Fig 2 The process of knowledge acquisition for developing domain and Application specific feature extractors for structural pattern recognition.

C.Neural Network Based Model

Neural networks are the massively parallel structures composed of "neuron" like subunits. Neural networks provide efficient result in the field of classification. Its property of changing its weight iteratively and learning give it an edge over other techniques for recognition process. Perceptron is a primitive neuron model. It is a two layer structure. If output function of perceptron is step, then it performs classification problems, if it is linear than it perform regression problems. The performance of the neural networks enhances upon increasing the number of hidden layers up to a certain extent. Increased number of neurons in hidden layer also improves the performance of the system. No. of neurons must be large enough to adequately represent the problem domain and small enough to permit the generalization from training data. A trade-off must be maintained between size of network and complexity resulted because of network size.

D.Fuzzy Based Model

The importance of fuzzy sets in Pattern Recognition lies in modeling forms of uncertainty that cannot be fully understood by the use of probability theory. Kandel states, "In a very fundamental way, the intimate relation between theory of fuzzy sets and theory of Pattern Recognition and classification rests on the fact that most real world classes are fuzzy in nature", Kandel defined various techniques of fuzzy pattern recognition. Syntactic techniques are utilized when the pattern sought is related to the formal structure of language. Semantic techniques are used when fuzzy partitions of data sets are to be produced. Then a similarity measure based on weighted distance is used to obtain similarity degree between the fuzzy description of unknown shape and reference shape.

E.Hybrid Model

In most of the emerging applications, it is clear that a single model used for classification doesn't behave efficiently, so multiple methods have to be combined together giving result to hybrid models. Primitive approaches to design a Pattern Recognition system which aims at utilizing a best individual classifier have some drawbacks. It is very difficult to identify a best classifier unless deep prior knowledge is available at hand. Statistical and Structural models can be combined together to solve hybrid problems. In such cases statistical approach is utilized to recognize pattern primitives and syntactic approach is then used for the recognition of sub-patterns and pattern itself. Fu gave the concept of attributed grammars which unifies statistical and structural pattern recognition approach. To enhance system performance one can use a set of individual classifiers and combiner to make the final decision.

III. 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. In case of noisy patterns, choice of statistical model is a good solution. Practical importance of structural model depends upon recognition of simple pattern primitives and their relationships represented by description language. 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. To recognize unknown shapes fuzzy methods are good options. Hybrid model is combination of both statistical and structure model.So it is best method to solve the many problems. we use hybrid error model for super resolution of images.

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