www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 5 Issue 5 May 2016, Page No. 16580-16583

Applications of Pattern Recognition Algorithm in Health and Medicine: A Review

Priyanka Mahajan

ABSTRACT:
A pattern is an entity that could be named, e.g. fingerprint image, handwritten word, human face, speech signal, DNA sequence and many more. Pattern recognition has its roots in artificial intelligence(AI). Pattern recognition is the study of how machines can learn to distinguish patterns and make some decisions about the categories of the patterns. Medical and healthcare sector are a big industry nowadays. Image based medical diagnosis is one of the important service areas in this sector. Various artificial intelligence techniques such as artificial neural network and fuzzy logic are used for classification problems in the area of medical diagnosis. Most of these computer-based systems are designed by using artificial neural network techniques. Electronic health records (EHR) provide detailed, time-stamped, and highly multivariate data for a large patient population, enabling the use of AI techniques to connect care practices and outcomes.
Keywords: Classification, Data Acquisition, Feature Extraction, Pattern Recognition models, Medical, Tumor

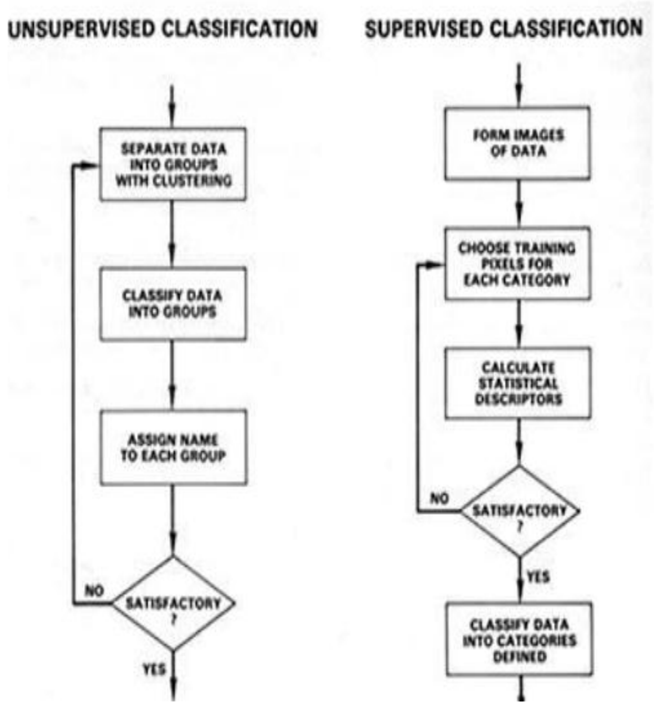
INTRODUCTION

Pattern recognition as a field of study developed significantly in the 1960s. It is an interdisciplinary subject, covering developments in the areas of medical, engineering, artificial intelligence, computer science, psychology and physiology, among others. Human being has natural intelligence and so can recognize patterns. Pattern recognition is the study of how machines can observe the environment, learn to distinguish patterns of interest from their background, and make sound and reasonable decisions about the patterns. But in spite of almost 50 years of research, design of a general purpose machine pattern recognizer remains an elusive goal. The best pattern recognizers in most instances are humans, yet we do not understand how humans recognize patterns. There are four different models for pattern recognition. They arise from two different viewpoints. The *Platonic approach* starts from generally accepted concepts and global ideas of the world. The primary task of the researcher using this approach is to recognize in his observations of the world the concepts and ideas that are already accepted by him. For the Platonic researcher, it is not an extrapolation, but an adaptation of previous versions of the theory to new facts. In the *Aristotelean approach* the observations are of primary interest. Scientific descriptions stay as closely as possible to them. It is avoided to speculate on larger, global theories that go beyond the facts.

Fig 1 Two different viewpoints of pattern recognition system

PATTERN RECOGNITION TASK:

Given a pattern, its recognition/classification may

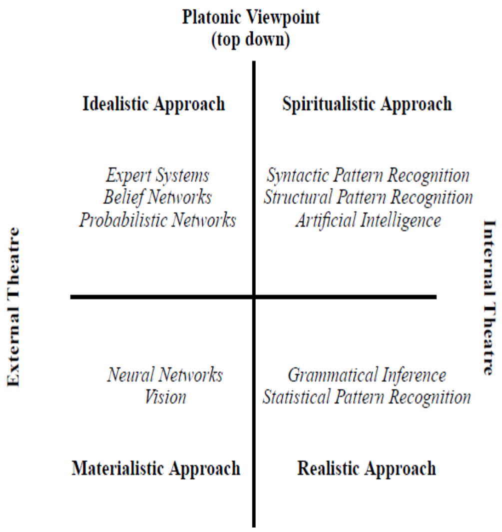


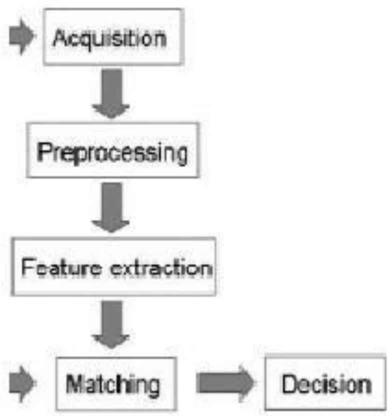
consist of one of the following two tasks: 1)

DOI: 10.18535/ijecs/v5i5.41

supervised classification in which the input pattern is identified as a member of a predefined class, 2) unsupervised classification (e.g., clustering) in which the pattern is assigned to an unknown class. Three steps take place in pattern recognition task. First step is data acquisition. Data acquisition is the process of converting data from one form (speech, character, pictures etc.) into another form which should be acceptable to the computing device. Second step is data analysis. After data acquisition the task of analysis begins. During data analysis step the learning about the data takes place and information is collected about the

Fig 2 Two Main Approaches of Pattern Recognition





different events and pattern classes available in the data. Third step used for pattern recognition is classification. Its purpose is to decide the category of new data on the basis of knowledge received from data analysis process. Data set presented to a Pattern Recognition system is divided into two sets: training set and testing set. System learns from training set and efficiency of system is checked by presenting testing set to it. The various models opted for pattern recognition are:
Statistical Techniques, Structural Techniques, Template Matching, Neural Network based techniques, Fuzzy models and Hybrid Models.

PATTERN RECOGNITION MODELS

1. Template Matching

One of the simplest and earliest approaches to pattern recognition is based on template matching. Matching is a generic operation in pattern recognition which is used to determine the similarity between two entities (points, curves, or shapes) of the same type. In template matching, a template (typically, a 2D shape) or a prototype of the pattern to be recognized is available. The pattern to be recognized is matched against the stored template.

2. Statistical Approach

In the statistical approach, each pattern is represented in terms of d features or measurements and is viewed as a point in a d-dimensional space. The goal is to choose those features that allow pattern vectors belonging to different categories to occupy compact regions. establish decision boundaries in the feature space which separate patterns belonging to different classes.

3. Syntactic Approach

The simplest/elementary subpatterns to be recognized are called primitives and the given complex pattern is represented in terms of the interrelationships between these primitives. In syntactic pattern recognition, a formal analogy is drawn between the structure of patterns and the syntax of a language. The patterns are viewed as sentences belonging to a language, primitives are viewed as the alphabet of the language, and the sentences are generated according to a grammar. Thus, a large collection of complex patterns can be described by a small number of primitives and grammatical rules. this approach also provides a description of how the given pattern is constructed from the primitives.

4. Neural Networks

Neural networks can be viewed as massively parallel computing systems consisting of an extremely large number of simple processors with many interconnections. Neural network models attempt to use some organizational principles (such as learning, generalization, adaptivity, fault tolerance and distributed representation, and in a network of weighted directed graphs in which the nodes are artificial neurons and directed edges (with weights) are connections between neuron outputs and neuron inputs. The main characteristics of neural networks are that they have the ability to learn complex nonlinear input-output relationships, use sequential training procedures, and adapt themselves to the data.

5. Fuzzy Based Model

The importance of fuzzy sets in Pattern Recognition lies in modelling forms of uncertainty that cannot be fully understood by the use of probability theory. 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.

6. 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.

APPLICATIONS OF PATTERN RECOGNITION IN MEDICINE

Below listed is the some of the contributions of pattern recognition in health and medicine domain:

Clinical decision support systems (CDSS) were one of the first successful applications of AI, focusing primarily on the diagnosis of a patient's condition given his symptoms and demographic information. Work on CDSS for medical diagnosis began in the early 1970s with Mycin3-a rule based expert system for diagnosing diseases.

David Heckerman and his colleague developed Pathfinder[2], which used Bayesian networks (a graphical model that encodes probabilistic relationships among variables of interest) to help pathologists more accurately diagnose lymph-node diseases.

AI has also been useful for computer-aided detection of conspicuous structures (such as tumors or polyps) in medical images.

Ying Zhang and Peter Szolovits developed an intensive care monitoring system to model individual patients' vital signs and produce patient-specific models and alarm thresholds. Decision trees and neural networks were used to generate binary classifiers of the patient state and determine when to issue an alarm.

Street W.N (2003), produced prediction results in to breast cancer data sets using a modification of ANN model. This model predicts probabilities of recurrence at different time intervals for each patient and has made an attempt to differentiate patients with 'good' or 'bad' prognosis.

Sansanee Auephanwiriyakul ,Siripen Attrapadung, Sutasinee Thovutikul and Nipon Theera-Umpon (2005) trained Neural Network using back propagation(BP-ANN) and achieved an accuracy level on the test data of breast cancer by approximately 94% .

Seker .H., Odetao M.,Petroric D. and Naguib R.N.G(2003) presented another BP-ANN attempt where they used 47 input features and achieved an accuracy of 95%.

Zhi-Hua Zhou, Yuan Jiand (2003) have described a artificial network ensemble, which is helpful for utilizing the power of artificial neural network ensembles in reliable applications such as diabetes, hepatitis and breast cancer.

Two very different AI approaches, each having great potential are respectively based on question-answering (QA) and on pattern detection. Continued advances in general QA led to the design of the DeepQA architecture by IBM

Research, in collaboration with Carnegie Mellon University, and the well-publicized victory of IBM's Watson system over human champions on the well-known TV quiz show, *Jeopardy*. IBM is currently partnering with the Memorial Sloan-Kettering Cancer Center to enable patient-specific diagnostic test and treatment recommendations for various types of cancer. Watson's features that led to its Jeopardy Challenge victory are also relevant to the healthcare domain, including its ability to incorporate huge volumes of unstructured text data (patients' electronic health records, medical literature, and so on),. Other QA systems such as the Semantic Research Assistant (SRA) focus specifically on the medical domain. SRA extends the large-scale knowledge base Cyc to answer ad hoc queries by physicians, justifying each answer with general medical facts, expert-articulated rules, and specific patient records. SRA is currently used by the Cleveland Clinic to answer clinical research queries involving cardiothoracic surgery, cardiac catheterization, and percutaneous coronary intervention, and has reduced the typical time to produce a satisfactory answer to such queries from weeks to minutes.

RESULTS For the American College of Surgeons' Patient Care Evaluation (PCE) data set, using only the TNM variables (tumor size, number of positive regional lymph nodes, and distant metastasis), the artificial neural network's predictions 2 of the 5-year survival of patients with breast carcinoma were significantly more accurate than those of the TNM staging system (TNM, 0.720; ANN, 0.770).

For the National Cancer Institute's Surveillance, Epidemiology, and End Results breast carcinoma data set, using only the TNM variables, the artificial neural network's predictions of 10-year survival were significantly more accurate than those of the TNM staging system (TNM, 0.692; ANN, 0.730;).

For the PCE colorectal data set, using only the TNM variables, the artificial neural network's predictions of the 5-year survival of patients with colorectal carcinoma were significantly more accurate than those of the TNM staging system (TNM, 0.737; ANN, 0.815;). Adding commonly collected demographic and anatomic variables to the TNM variables further increased the accuracy of the artificial neural network's predictions of breast carcinoma survival (0.784) and colorectal carcinoma survival (0.869).

CONCLUSIONS. Artificial neural networks are significantly more accurate than the TNM staging system when both use the TNM prognostic factors alone. New prognostic factors can be added to artificial neural networks to increase prognostic accuracy further. These results are robust across different data sets and cancer sites.

References:

1. M. P. Raj, P. R. Swaminarayan, "Applications of Pattern Recognition Algorithms in Agriculture: A Review". Int. J. Advanced Networking and Applications Volume: 6 Issue: 5 (2015).

2. Damodar Padubidri Bhat. " Data Collaboration for Insurance and Health Sciences: An Approach to Artificial Intelligence" Int. Journal of Advanced Research in Computer Science and Software Engineering , Volume 5, Issue 9, September- 2015.

3. M.Subba Rao et al." Comparative Analysis of Pattern Recognition Methods: An Overview", Indian Journal of Computer Science and Engineering (IJCSE), Vol. 2 No. 3 Jun-Jul 2011.

4. S. P. Shinde, V.P. Deshmukh, "Implementation of pattern recognition Techniques and overview of its applications in various areas of artificial intelligence", Int. Journal of Advances in Engineering & Technology, Vol. 1, Issue 4, Sept 2011.