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HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

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DATA MINING PRACTICES: A STUDY PAPER

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ABSTRACT

In this paper, the thought of data mining was précised and its importance towards its methodologies was showed. The data mining based on Neural Network and Genetic Algorithm is researched in detail and the key technology and ways to achieve the data mining on Neural Network and Genetic Algorithm are also surveyed. This paper also conducts a formal review of the area of rule extraction from ANN and GA.

KEYWORDS
Data Mining, Neural Network, Rule Extraction. Genetic Algorithm.

I. INTRODUCTION

Data mining talk about extracting or mining the knowledge from large amount of data. The word data mining is properly named as 'Knowledge mining from data' or "Knowledge mining".

Data collection and storage technology has made it likely for organizations to store huge amounts of data at lesser cost. Taking advantage of this stored data, in order to extract useful and actionable information, is the overall goal of the generic activity termed as data mining.

Data mining comprises of computational process of bulky data sets patterns discovery. The aim of this innovative analysis process is to extract information from a data set and transform it into an reasonable structure for further use. The procedures used are at the occasion of artificial intelligence, machine learning, statistics, database systems and business intelligence. Data Mining is all about solving problems by exploring data at present in databases.

HOW DOES DATA MINING WORK?

Despite the fact information technology has been evolving separate transaction and analytical systems; data mining offers the link between the two. Data mining software investigates relationships and patterns in stored transaction data based on flexible user queries. Numerous analytical software are available: statistical, machine learning, and neural networks. Four types of relationships are hunted:

Classes: Stored data is used to detect data in predetermined groups. For example, a restaurant chain could mine customer purchase data to decide when customers visit and what they naturally order. This information could be used to increase traffic by devouring daily specials.

Clusters: Data items are clustered according to logical relationships or consumer preferences. For example, data can be mined to categorize market segments or consumer attractions.

Associations: Data can be mined to identify associations. The beer-diaper example is an example of associative mining.

Sequential patterns: Data is mined to forestall behaviour patterns and trends.

Data mining involves of five key elements:

- Extract, transform, and load transaction data onto the data warehouse system.
- Store and manage the data in a multidimensional database system.
- Provide data access to business analysts and information technology professionals.
- Analyse the data by application software.
- Present the data in a useful format, such as a graph or table.

Data mining functionalities are used to specify the kind of patterns to be found in data mining tasks. Data mining tasks can be classified in two categories-descriptive and predictive. Descriptive mining tasks characterize the general properties of the data in database. Predictive mining tasks perform inference on the current data in order to make predictions.

The purpose of a data mining effort is normally one or the other to create a descriptive model or a predictive model. A descriptive model presents, in concise form, the main characteristics of the data set. It is fundamentally a summary of the data points, making it possible to study key aspects of the data set. Typically, a descriptive model is found through undirected data mining; i.e. a bottom-up approach where the data "speaks for itself". Undirected data mining finds patterns in the data set but leaves the interpretation of the patterns to the data miner. The purpose of a **predictive model** is to allow the data miner to forecast an unfamiliar value of a specific variable; the target variable. If the target value is one of a predefined number of discrete labels, the data mining task is so-called classification. If the target variable is a real number, the task is regression.

The predictive model is thus formed from given known values of variables, possibly comprising previous values of the target variable. The training data consists of pairs of measurements, each consisting of an input vector x (i) with a corresponding target value y(i). The predictive model is an estimation of the function y=f(x; q) able to predict a value y, given an input vector of measured values x and a set of estimated parameters q for the model f. The process of finding the best q values is the core of the data mining technique.

At the core of the data mining process is the use of a data mining technique. Some data mining techniques directly acquire the information by carrying out a descriptive partitioning of the data. However, data mining techniques utilize stored data in order to build predictive models. General point is that there is strong pact among both researchers and executives about the criteria that all data mining techniques must meet. Significantly, the techniques should have great performance. This criterion is, for predictive modeling, understood to mean that the technique should produce models that will generalize well, i.e. models having high accuracy when performing predictions based on data.

Classification and prediction are two forms of data analysis that can be used to extract models describing the important data classes or to predict the future data trends. Such analysis can help to provide us with a better understanding of the data at large. The classification predicts categorical (discrete, unordered) labels, prediction model, and continuous valued function.

II. PROCEDURES OF DATA MINING

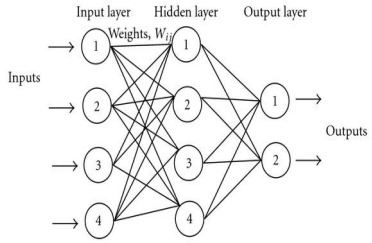
NEURAL NETWORK

An artificial neuron network (ANN) is a computational model constructed on the structure and functions of biological neural networks. Information that runs through the network disturbs the structure because a neural network changes in a sense based on that input and output. It is a nonlinear statistical data modelling tool wherever the complex relationships between inputs and outputs are modelled or patterns are established.

An ANN has numerous pluses but one of the most familiar is the fact that it can actually learn from witnessing data sets. In this way, ANN is used as a random function estimate tool. These types of tools help estimate the most cost-effective and ultimate methods for arriving at solutions while describing computing functions or distributions. It takes data samples rather than full data sets to arrive at solutions, which saves both time and money. ANNs are considered fairly simple mathematical models to increase existing data analysis technologies.

ANNs have three layers that are intersected. The first layer comprises of input neurons. Those neurons send data on to the second layer, which in turn sends the output neurons to the third layer.

FIG. 1: NEURAL NETWORK WITH HIDDEN LAYERS



DECISION TREES

Decision tree is a widely used data mining method. In decision theory, a decision tree is a graph of decisions and their possible consequences, represented in form of branches and nodes.

This data mining method is been used in various fields in business and science for many years and has given outstanding results. Decision trees offer a symbolic decision-making model with high level of interpretability.

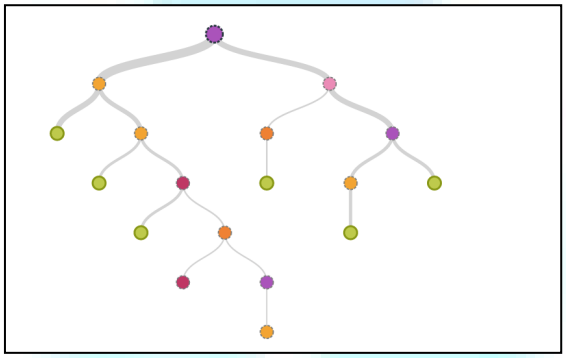
A decision tree is a special form of tree structure. The tree consists of nodes where a logical decision has to be made, and connecting branches that are chosen according to the result of this decision.The nodes and branches that are followed constitute a sequential path through a decision tree that reaches a final decision in the end. Decision trees are generated from the training data in a top-down direction. The root node of a decision tree is the trees initial state - the first decision node. Each node in a tree contains some data.

On a basis of an algorithm some calculations are completed, and the decision tree node is been split into two or more branches. In some cases, the node cannot be split, in this case it will be the final decision node.

The process is repeated until obtaining a completely discriminating tree. At this very point the decision tree might have nodes that are too specific to noise, that might be present in the training data. This is called over-fitting. To avoid over-fitting, a decision tree is generalized, by eliminating sub-trees.

Once a decision tree solution is generated from the learning data, it can be used for predictive analysis or estimating the best decision.

FIG. 2: VIEW OF DECISION TREE



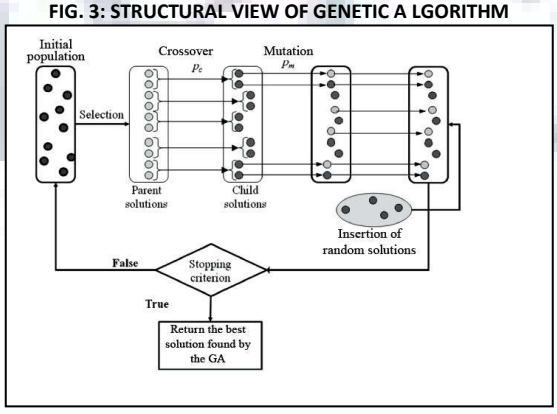
Decision trees can be viewed from the business perspective as creating a segmentation of the original data set. Thus marketing managers make use of segmentation of customers, products and sales region for predictive study. These predictive segments derived from the decision tree also come with a description of the characteristics that define the predictive segment. Because of their tree structure and skill to easily generate rules the method is a favoured technique for building understandable models.

GENETIC ALGORITHM

Genetic Algorithm challenge to incorporate ideas of natural evaluation The common idea behind GAs is that we can shape a better solution if we one way or another combine the "good" parts of other solutions similar to the nature does by joining the DNA of living beings.

Genetic Algorithm is mainly used as a problem solving policy in order to provide with a optimal solution. They are the finest way to solve the problem for which little is branded. They will work well in any hunt space because they form a very universal algorithm. The only thing to be well-known is what the particular situation is where the solution performs very well, and a genetic algorithm will produce a high quality solution. Genetic algorithms use the principles of selection and evolution to yield numerous solutions to a specified problem.

FIG. 3: STRUCTURAL VIEW OF GENETIC A LGORITHM



RULE EXTRACTION

The taxonomy of Rule extraction comprises three main principles for evaluation of algorithms: the scope of use, the type of dependency on the black box and the format of the extract description. The first dimension concerns with the possibility of use of an algorithm either regression or classification. The second dimension emphases on the extraction algorithm on the core black-box: independent versus dependent algorithms. The third criterion focuses on the attained

rules that might be advisable: predictive versus descriptive algorithms.Moreover this taxonomy the evaluation criteria appears in almost all of these surveys- Quality of the extracted rule; Scalability of the algorithm; uniformity of the algorithm.

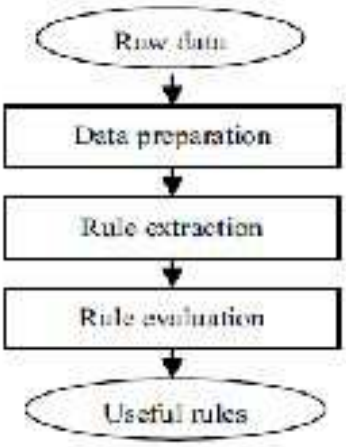
Generally a rule comprises two values. A left hand antecedent and a right hand consequent. An antecedent can have one or multiple conditions which must be true in order for the consequent to be true f or a given precision whereas a consequent is just a single condition. Thu s while mining a rule from a database antecedent, consequent, accuracy, and coverage are all targeted. Sometimes "interestingness" is also targeted used for ranking. The situation occurs when rules have high coverage and accuracy but deviate from standards. It is also essential to note that even though patterns are produced from rule induction system they all not necessarily mean that a left hand side should cause the right h and side part to come about. Once rules are created and interestingness is checked they can be used for predictions in business where each rule completes a prediction keeping a consequent as the target and the accuracy of the rule as the accuracy of the prediction which gives an opportunity for the overall system to improve and execute well.

For data mining domain, the non-existence of explanation facilities seems to be a serious problem as it produce opaque model, along with that accuracy is also required. To eradicate the deficiency of ANN and decision tree, we suggest rule extraction to produce a clear model along with accuracy. It is becoming increasingly outward that the absence of an explanation capability in ANN systems bounds the realizations of the packed potential of such systems, and it is this precise deficiency that the rule extraction process looks for to reduce. Experience from the field of expert systems has shown that an explanation capability is a vital function provided by symbolic AI systems. In particular, the ability to generate even limited

Explanation is totally crucial for user acceptance of such systems. Meanwhile the purpose of most data mining systems is to support decision making, the need for explanation abilities in these systems is apparent. But many systems must be regarded as black boxes; i.e. they are opaque to the user.

For the rules to be useful there are two pieces of information that must be supplied as well as the actual rule:

FIG. 4: PROCESS OF RULE EXTRACTION



- Accuracy - How often is the rule correct?
- Coverage - How often does the rule apply?

Only because the pattern in the database is expressed as rule, it does not mean that it is true always. So like data mining algorithms it is likewise important to identify and make clear the uncertainty in the rule. This is called accuracy. The exposure of the rule means how much of the database it "covers" or applies to.

III CONCLUSIONS

If the formation of computer algorithms being based on the evolutionary of the organism is amazing, the richness with which these methodologies are realistic in so many areas is no less than shocking. At present data mining is a new and important area of research and ANN itself is a very suitable for unravelling the problems of data mining because its features of good robustness, self-organizing adaptive, parallel processing, distributed storage and high grade of fault tolerance. The commercial, educational and scientific applications are gradually dependent on these methodologies.

Five criteria for rule extraction, and they are as follows:

- **Comprehensibility**: The extent to which extracted representations are humanly comprehensible.
- **Fidelity:** The extent to which extracted representations accurately model the networks from which they were extracted.
- **Accuracy:** The ability of extracted representations to make accurate predictions on previously unseen cases.
- **Scalability:** The ability of the method to scale to networks with large input spaces and large numbers of weighted connections.

Generality: The extent to which the method requires special training.

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