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Combination of Neuro Fuzzy Techniques Give Better Performance over Individual Techniques of Soft Computing

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Abstract— **Communication is becoming a hot topic in the world of internet. Information on the web is growing dramatically. Web mining and data mining can be defined as a primary means of information distribution and extraction. As a result, web mining and data mining are a field of computer science, which combines advanced information technology and artificial intelligence. Web data is typically referred to as unstructured data, distribute and time varying. To automatically retrieve the data from the database, evaluate it, extract and analyse information from Knowledge based system, web mining techniques uses the data mining approach. Web mining and data mining techniques helps in searching the business oriented applications, hidden patterns, database applications and making good business decision prospective. It makes user difficult to search a kind of data from more than one Database in a single application. To overcome this limitation and to retrieve data with high speed and greater accuracy the system uses neuro fuzzy approach.**

Keywords— **Computational Intelligence techniques, Machine earning, Soft Computing, Fuzzy Logic, Neural Networks, Neuro- Fuzzy System, Search engine.**

I. INTRODUCTION

Web Mining is used for retrieving data from database, it is used for mining the data online. It automatically search and fetch the useful Information from the web documents and web services. Web mining refers to the process of retrieving the Information from the web data or web services.

According to[1],basically data mining techniques are used in a web mining. Data mining is a work upon Off-line whereas web mining is work upon On-line. In data mining the data is being stored in the data ware houses and in web mining data is stored in server database and web log[1]. The function is to mine the transactional data which describes the behaviour of the database. Soft computing is a methodology that works in detail and provides in one form or another. Provides flexible information processing capability for handling real life ambiguous situations. Soft Computing consists of several computing paradigms like Neural Networks and Fuzzy logic and Genetic Algorithms. Soft computing uses Hybridization of these techniques [3]. In an online shopping, the customers can purchase items at a time from different database system. The algorithms used in the proposed system are Fuzzy logic(mumdani Fuzzy inference system),Neural Networks(feed forward neural networks) and combination of Fuzzy Logic and Neural Networks(Neuro Fuzzy) to access the data faster with better accuracy, space Compatibility, accurate time, performance.

Search Engine is immense scope of applying fuzzy logic to improve web search from the point of view of deduction, matching and ranking among others. The retrieved documents may then be clustered during/after search, or filtered at the client side, or both [12].

Clustering is one of the techniques of data mining whose use is versatile, which performs partitions of the data objects into subsets, the resulting subset is known as cluster. Clustering leads to the discovery of previously unknown groups within the data [4].

II. COMPUTATIONAL INTELLIGENCE TECHNIQUES

a) Fuzzy Logic Techniques

Fuzzy Logic which is one of the Soft Computing technique. Fuzzy Logic is a form of many – valued logic; It deals with reasoning that is approximate rather than fixed and exact. Compare to traditional binary sets where variables may take on true or false values [3]. Fuzzy logic handles the partial truth where the truth value can be between completely true and completely false values. The figure bellow shows the structure of Fuzzy logic algorithm [2].Fuzzy system propose a mathematic calculus to translate subjective human knowledge of the real processes. This is a way to manipulate practical knowledge with some level of uncertaininty.

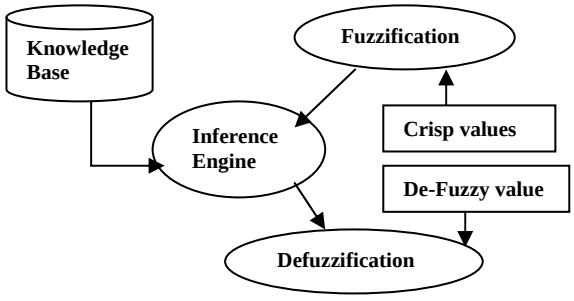


Figure.1 Architecture of Fuzzy logic

The basic structure of Fuzzy approach Consists of the following components:

1) Knowledge Base.
2) Fuzzification.
3) Inference Engine.
4) De-fuzzification.

Fuzzy logic architecture consists of Knowledge base. The Knowledge base stores the information which can be structured or unstructured. It also contains inference Engine which extracts information from Knowledge base and deduce new knowledge. Fuzzification and de-Fuzzification are the methods which are used to convert crisp values to grades of membership of linguistics and vice versa.

Crisp values or crisp set are the values where the element can be a member of a set or not. Linguistics value is a term which expresses knowledge and not the values.

Advantages of Fuzzy Logic

- Biggest impact on controlling problems.
- Helps to avoid discontinuity in behaviour.
- Allows use of fuzzy concept.
- Capacity to represent inherent uncertainties of the human knowledge with linguistics variables [13].
- Simple interaction of the expert of the domain with the engineer designer of the system [13].

Disadvantages of Fuzzy Logic

- Hard to debug.
- Results are unexpected.
- Additional Computational overhead.
- Incapable to generalize, or either, it only answer to what is written in its rule base[13].
- Depends on existence of a expert to determine the inference logical rules[13].

Applications of Fuzzy Logic

- Artificial Intelligence.
- Operation Research.
- Robotics, search engine.
- Pattern Recognition.
- Cameras, Camcorders.
- Searching and matching images for certain pixel regions.

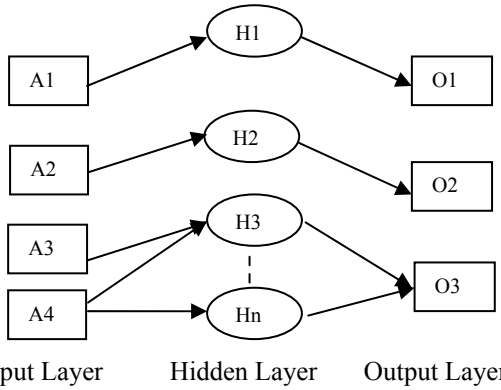
b) Neural Network Techniques

An Artificial Neural Network (ANN), usually called neural network (NN), is a mathematical model or computational model that is inspired by the structure and/or functional aspects of Biological Neural Networks [5].Neural Networks consist of interconnected group of artificial neurons. It processes data/information using connectionist approach to computation. In some cases neural network is an adaptive system, which changes its structure during a learning phase. Neural network are used to model complex relationship between input and output or to find patterns in data.

Neural network is a computational model; which is inspired by functional or structural aspects of biological neural network. Neural Networks may be either supervised or unsupervised, depending on the method of training. It performs retrieval based on nearest neighbour matching technique [11].

C) Feed Forward Neural Network Technique

Feed forward Neural Network is commonly used for pattern recognition/classification and function approximation. It allows signals to travel in one way only; from input to output. There is no feedback, loop or cycle that is the output of any layer does not affect the same layer[6]. Feed forward neural network is a straight forward network that associates input with output.



Figuer.2 Feed Forward Neural Network Structure

The figure shows the structure of feed forward neural network. There is three different layers.

1. Input Layer.
2. Hidden Layer.
3. Output Layer.

Advantages of Neural Network

- Provides a new alternative to logistic regression.
- Requiring less formal statistical training[7].
- Ability to implicitly detect complex non-linear relationship between dependent and independent variables [7].
- Availability of multiple training algorithms.
- Robustness in relation to disturbances [13].

Disadvantages of Neural Network

- Black box nature.
- Greater computational burden.
- Learning takes lot of processing.
- Impossible interpretation of the functionality [13].
- Difficulty in determining the number of layers and number of neurons [13].

d) Neuro-Fuzzy Technique

Fuzzy logic and neural networks are complementary tools in building some intelligent system[8]. Neural networks are low level computational structures that performs better work when deal with raw data. Whereas fuzzy logic deals with high level raw data; using different information acquired from domain experts. However fuzzy systems lack in ability to learn and cannot adjust themselves in new environment. On the other hand, neural networks can learn, they can opaque or cooperate the user[8].

Neuro Fuzzy computation is one of the most popular hybridizations widely reported in literature. It comprises a judicious integration of the merits of neural and fuzzy approaches, enabling one to build more intelligent decision-making systems [9].

Integrated neuro and fuzzy system can combine the parallel computation and learning ability of neural networks

with human life knowledge presentation and explanation abilities of a fuzzy logic system. As a result, neural network becomes more transparent and fuzzy system becomes capable of learning. The determination of fuzzy rules, input and output scaling factors and choice of membership functions depend on trial and error that makes the design of fuzzy logic system a time consuming task[10]. These drawbacks of neural networks and fuzzy logic systems are eliminated via. The integration between neural network technology and fuzzy logic systems in one combined approach [10].

The structure of neuro fuzzy system is similar to multilayer neural networks. In general neuro fuzzy has input and output layers and three hidden layers which is used to represent member functions and fuzzy rules. The Figure bellow shows the neuro fuzzy algorithm.

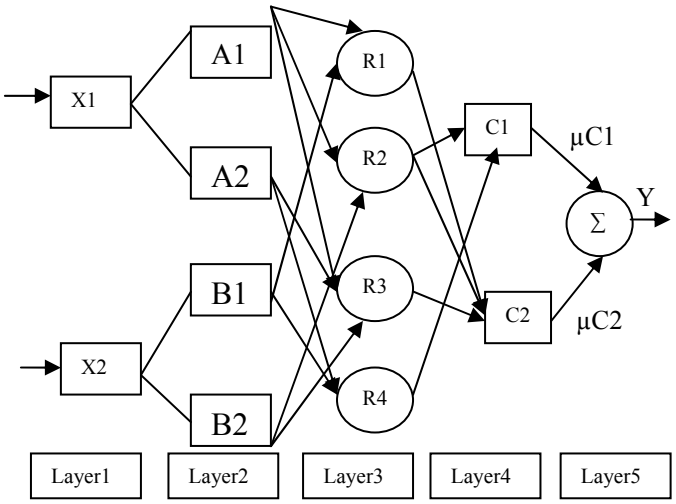


Figure: 3 Neuro Fuzzy System

Each layer in this system is associated with a particular step in the neuro-fuzzy process.

Layer1: Input Layer –

In this layer, each neuron transmits signals directly to the next layer.

Layer 2: Fuzzification layer-

In this layer, each neuron represents fuzzy sets. Fuzzification neuron receives input and output and determines the degree to which this belongs to the neuro fuzzy sets.

Layer3: Fuzzy set Layer-

In this layer, each neuron corresponds to the single fuzzy rule; a fuzzy rule neuron receives input from the Fuzzification neurons that represents fuzzy sets in the rule.

Layer4: Outer membership layer-

In this layer, each neuron represents fuzzy sets used in the consequent of fuzzy rule. This layer combines all its inputs by using fuzzy operation i.e. by union.

Layer5: Defuzzification layer-

In this layer, each neuron represents single output of neuro fuzzy system. It takes output fuzzy sets and combines them in a single fuzzy set.

Neuro fuzzy system can apply standard de-Fuzzification methods, including the centroid technique. A neuro fuzzy system is essentially a multilayer neural network and thus it can apply standard leaning algorithm developed for neural networks. When representative sets of examples are available, a neuro fuzzy system can automatically transform them into robust set of fuzzy IF-THEN rule and thereby reduce our dependence on expert knowledge when building intelligent system.

III PROPOSED SYSTEM ARCHITECTURE

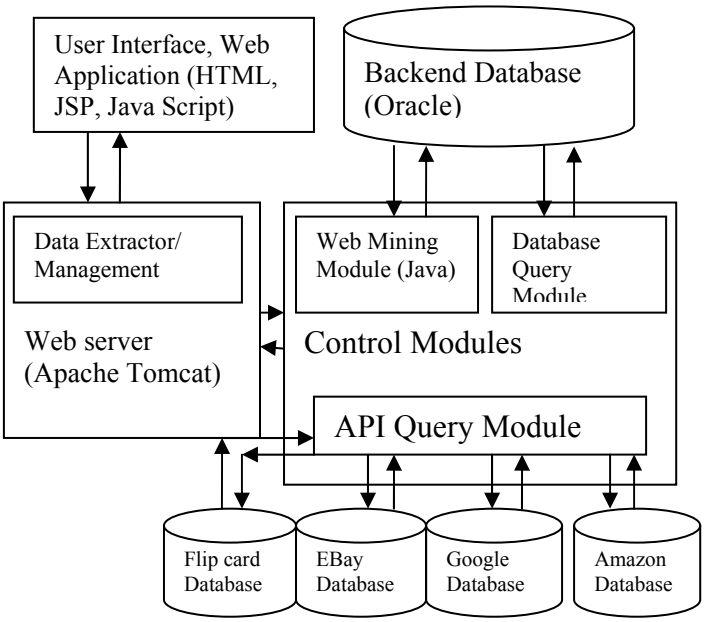


Figure4. Architecture of Proposed System

Proposed system which is a combination of neural network and fuzzy logic where the application is developed for online shopping system.

Architecture consists of user interface where the user interacts which is the front end of the system. Data extractor module is used for extracting the data from database. There are different modules such as query module, database query module, API query module and control module.

Web mining module is used for mining the data from the database. The database query module is used for extracting the data from the database where different sql queries are being processed.

API query module is used for displaying the actual result to the user. Control module contains the algorithms like madman's fuzzy inference system, feed forward neural network and adaptive neuro fuzzy inference system where the actual processing of data from the data base is done. The proposed system extracts the data faster with approximate result and faster execution time then the individual algorithm.

V CONCLUSION

To overcome the drawbacks of traditional system and to retrieve the data in faster manner with high speed and better performance, the system of neuro fuzzy technique giving better performance over individual techniques of soft computing is being developed.

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