

Fuzzy, ANN & Expert Approaches

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ABSTRACT

The purpose of this paper is to explore the ability to continually change and obtain new understanding of driving power of Expert Approach. Expert systems are able to advantageously replace human experts in various application areas with the involvement of ANN and Fuzzy Logic. Finally this hybrid system is formed to gain the outstanding performance from a expert system. The basic concept of ANN and Fuzzy logic is also explained in this paper. Fuzzy logic is a tool and can only useful and powerful when combined with analytic methodologies and machine reasoning techniques and Artificial Neural network produces a artificial system capable of sophisticated computation similar to human brain.

Keywords-Expert System; ANN; Fuzzy Logic; Hybrid System

1. INTRODUCTION

Expert systems rely on logical inferences and decision trees and focus on modeling human reasoning. Neural networks rely on parallel data processing and focus on modeling a human brain. Knowledge in a rule-based expert system is represented by IF-THEN production rules. Domain knowledge can be put into a neuro-fuzzy system by human experts in the form of linguistic variables and fuzzy rules. Fuzzy logic and neural networks are natural complementary tools in building intelligent systems. Neural networks are low-level computational structures that perform well when dealing with raw data, fuzzy logic deals with reasoning on a higher level, using linguistic information acquired from domain experts.

2. EXPERT APPROACH

2.1 Introduction to Expert System

Expert system is a computer system that emulates the decision making ability of a human expert. Expert systems are designed to solve complex problems by reasoning

about knowledge, represented primarily as IF-THEN rules rather than conventional procedural code. Expert system is basically programming computers to make in real life situations. For example, some expert systems help doctors diagnose diseases based on symptoms.

2.2 Components of Expert System

Expert system has following basic components:-

2.2.1 Knowledge Base: -Stores all relevant information, data, rules, cases and relationships used by the expert system.

2.2.2 Inference Engine: - Seek information and relationships from the knowledge base and provide answers, predictions and suggestions in the way a human expert would.

2.2.3 Rule:- A conditional statement that links given conditions to actions or outcomes.

2.2.4 Fuzzy Logic:-A specialty research area in computer science that allows shaded of gray and does not require everything to be simply Yes/No, or True/False.

2.2.5 Backward Chaining:-A method of reasoning that starts with conclusions and works backward supporting facts.

2.2.6 Forward Chaining:- A method of reasoning that starts with the facts and works forward to the conclusion.

2.2.7 Explanation Facility:-A part of the expert system that allows a user or decision maker to understand how the expert system arrived at certain conclusions or results.

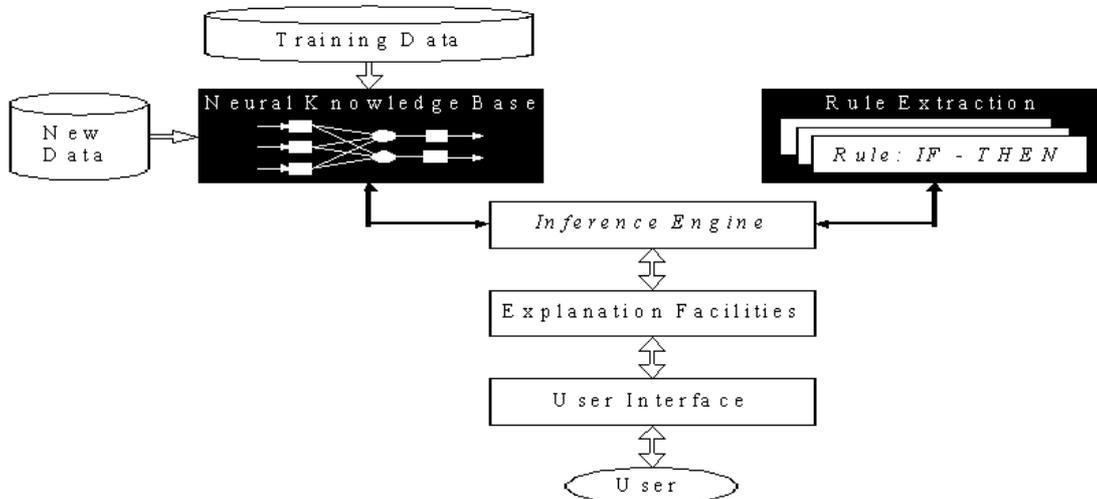


Figure 1- Expert System

3. ARTIFICIAL NEURAL NETWORK

3.1 Introduction to Artificial Neural Network

A neural network is a computer system modelled on the human brain and nervous system. An Artificial Neural network is a massively parallel distributed processor that has a natural propensity for storing experimental knowledge and making it available

for use. Knowledge is acquired by the network through a learning (training) process. The strength of the interconnections between neurons is implemented by means of the synaptic weights used to store the knowledge.

3.2 Architecture of Artificial Neural Network

Neural networks are typically organized in layers. Layers are made up of number of interconnected 'nodes' which contain an activation function. Patterns are presented to the network via the 'input layer' which communicates to one or more 'hidden layers' where the actual processing is done via a system of weighted 'connections'. Most ANNs contain some form of 'learning rules' which modifies the weights of the connections according to the input patterns that it is presented with.

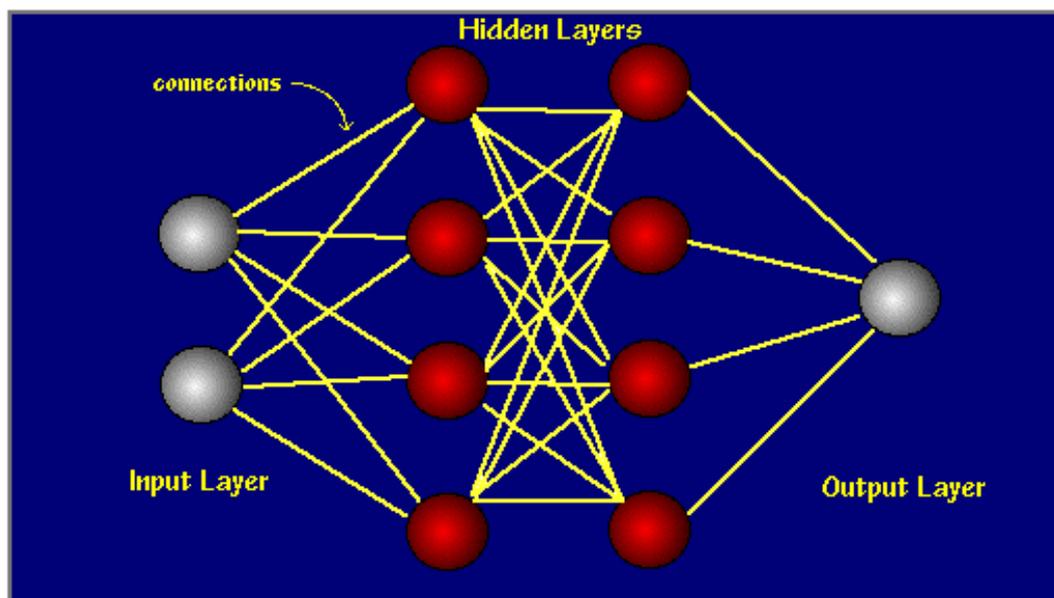


Figure 2-Basic ANN Structure

3.3 How ANN Learn a Task

An artificial neural network learn a task in following manner

- 3.3.1 Initialize the weights.
- 3.3.2 Use of learning algorithm.
- 3.3.3 Set of training examples.
- 3.3.4 Encode the examples as input.
- 3.3.5 Convert output into meaningful result.

The main application areas of ANNs are image, sound and pattern recognition, advanced robotics, machine vision, intelligent medicine devices, intelligent security systems, expert systems etc.

4. FUZZY LOGIC APPROACH

4.1 Introduction to Fuzzy Logic

Fuzzy logic is a tool and can only useful and powerful when combined with analytical methodologies and machine reasoning techniques. Fuzzy logic is not logic that is fuzzy, but logic that is used to describe fuzziness. Fuzzy logic is the theory of fuzzy sets that calibrates vagueness. Fuzzy logic is based on idea that all things admit of degrees. Temperature, height, speed, distance, beauty-all come on a sliding scale.

The motor is running slightly hot.

Tom is a very tall guy.

Many decision making and problem solving tasks are too complex to be understood quantitatively, however, people succeed by using knowledge that is imprecise rather than precise. Since knowledge can be expressed in a more natural way by using fuzzy sets, many engineering and decision problems can be greatly simplified. Fuzzy IF-THEN rules are used for capturing knowledge.

4.2 Elements of Fuzzy Logic Controller

Usually fuzzy logic control system is created from four major elements presented on Figure 3: fuzzification interface, fuzzy inference engine, fuzzy rule matrix and defuzzification interface.

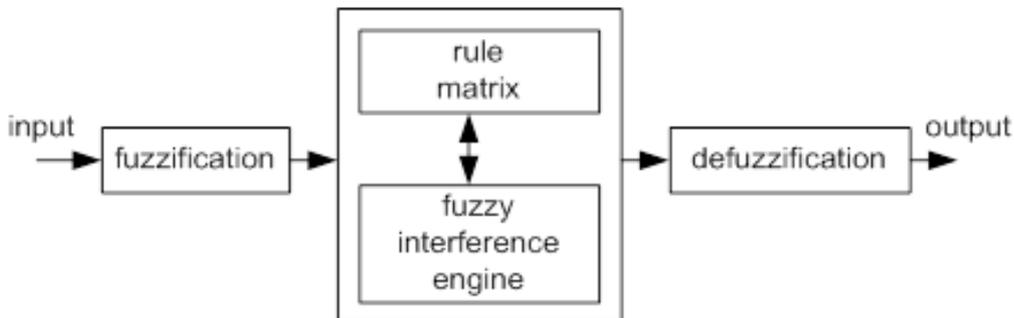


Figure 3- Fuzzy Logic Controller

4.3 Fuzzy Logic analysis methods

The fuzzy logic analysis and control methods can be described as:

4.3.1 Receiving one or large number of measurements or other assessment of conditions existing in some system that will be analyzed or controlled.

4.3.2 Processing all received inputs according to human based, fuzzy "if-then" rules, which can be expressed in simple language words, and combined with traditional non-fuzzy processing

4.3.3 Averaging and weighting the results from all the individual rules into one single output decision or signal which decides what to do or tells a controlled system what to do. The result output signal is a precise defuzzified value.

The main applications of fuzzy theory are ABS Brake, video camera, automatic transmission, air conditioner, control units, expert systems etc.

4. APPLICATION AREAS OF FUZZY, ANN AND EXPERT APPROACHES



Figure 4- Applications

5. CONCLUSIONS

Finally we can conclude that by combining two or more representation schemes, which is known as hybrid systems can make the system more efficient and improve the knowledge representation. These systems develop a solution faster than human experts can. The benefit is that these systems provide expertise needed at a number of locations at the same time or in hostile environment that is dangerous to human health.

6. REFERENCES

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