

A Study on Neuro Fuzzy Systems and Fuzzy Set

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ABSTRACT: *The Neuro Fuzzy System is an intelligence system that is used to render systems intelligent. The Fuzzy System is an artificial intelligence technique focused on fuzzy logic, and neural networks are often used together. The combination of fuzzy logic and neural networks is used to minimize the issue of each system and its inherent limitations. It is referred to as the Neuro-Fuzzy method when fuzzy logic is used in neural networks. When they get input patterns, fuzzy logic and rules are modified in the fuzzy system. The Neuro-fuzzy system is a smart system used to execute the different programmers of artificial intelligence. The Neuro fuzzy system has numerous applications and uses that inventors and authors settle on. Neuro fuzzy system has different applications and uses according to which inventors and authors decide different models. This paper shows the different uses and applications of the neuro fuzzy systems advantage of using fuzzy logic in any system to make it smart. This paper also discusses the advantage of fuzzy systems.*

KEYWORDS: *Discrete set, Continuous set Fuzzy logic, Fuzzy system, Hybrid system, neural networks, and Artificial intelligence.*

INTRODUCTION

The experiment was conducted in such a way that it provides detailed details about the system, depending on the fuzzy logic and rule base, the system results. A system with some input that is a linguistic variable is fed into the system and begins operation of the system according to the requirement rule base and then gets fuzzy or crisp meaning in output systems.

In the engineering sector, the greatest impact of these techniques is given to the precise science areas and smart technology, as engineering becomes more about smart work. Two techniques have been used in the neuro fuzzy system, literally neuro fuzzy system, consisting of the combination of these two neural network techniques and fuzzy logic. These two techniques are neural networks and fuzzy logic are also used to solve fuzzy set two techniques.

Neuro fuzzy method provides precise results and the word or technique neuro fuzzy system was generated by fusing these two different techniques together to solve engineering problems where the classic techniques do not have a simple and precise solution.[1]

In almost all aspects of human understanding, advanced artificial intelligence technologies or smart systems have been implemented. Fuzzy reasoning, in an imprecise way, deals with stuff. Imprecision means that there does not need to be a certain value for any condition. E.g.

Digital way: Perform a certain task if the value of a certain variable is equal to 100(say).

Imprecision way: perform a certain task if the value of the variable is somewhat nearer to 100.

Every member or element let say x of a fuzzy set "B" is assumed a fuzzy index or degree called $u(x)$ in the interval of $[0, 1]$ which is often called as the grade of membership of x or degree of that function present in A.

In the classical set membership grade $u(x)$ is either 0 or 1.

Fuzzy Set: A set of ordered pairs or group of element given by

$$A = \{(x, u(x)) ; x \text{ belongs to } X\}$$

in which X is a universal set and $u(x)$ is the grade of membership of the object x in A. Usually $u(x)$ lies in $[0, 1]$ fuzzy index[2].

Membership Function: A membership function $u(x)$ is characterized by $u(x) = [0, 1]$, x belongs to X where x is a real number describing an object or its attribute and A is a subset of X .

Every and each inventor combines these two rules or techniques in different ways, due to which some misconception was created on the exact meaning of this term. Still inventors are finding the exact meaning of neuro fuzzy systems but for now it's known as a system established for fuzzy controllers having similar

structure where fuzzy sets and rules are adjusted using neural networks. Such systems show two stage behavior distinguish according to their work and both the stage differ from each other. In a first phase of fuzzy logic operation called learning phase, it behaves like neural networks learning its internal structure parameters off-line. Later, in the execution phase, it behaves like a fuzzy logic system or smart logic. Separately, each one of those method possesses advantages and disadvantages that, when mixed together, the mixture gives a good efficient results than the ones achieved with the use of any one isolated technique.

1. What is a fuzzy system?

The Fuzzy method is a smart logic-based system that converts the mathematical calculus into human understanding of the actual process. It is used to assess and function accordingly on the complexity of a system.

2. What is the operation of a fuzzy set?

Unlike traditional set operations on fuzzy sets, the key functional characteristics of fuzzy sets are typically defined in terms of membership function. [3].

2.1 Basic operation zone with fuzzy set are:

- 1) Intersection or minimum function.
- 2) Union or maximum function
- 3) Fuzzy complementation

3. What is a Neural Network?

Neural network is of two type

- Artificial neural network (ANN).
- Biological neural network (BNN).

The neural networks try to mimic the theory and thought process of the biological function of the human brain. This leads to the idealisation of the neurons as discrete units of distributed processing.

4. What is a fuzzy rule base system?

Fuzzy logic based information can be shown in form of a rule base or logic base system which consist of a group of rules in conventional way form such as:

Rule 1:

If x called as A, then y become B where A and B represents a fuzzy proposition.

Now suppose to introduce a new antecedent say A and consider the following rule[4].

Rule 2:

If x is A' then y is B'.

5. What is needed to use fuzzy control?

- Fuzzy logic is a method to embed human-like thinking into a control system.
- A fuzzy controller can be designed to mimic the brain neural network to emulate human deductive thinking, that is the process people use to infer (make) conclusions from what they know.
- Traditional control approach requires format modeling of a physical reality.

➤ Fuzzy control or fuzzy logic incorporate ambiguous human brain logic into computer programmed. It suits control problems that cannot be easily represented by mathematical models:

- i) Weak model or set
- ii) Parameter variation problem
- iii) Unavailable or incomplete data
- iv) Very complex plants
- v) Good qualitative understanding of plant or process operation is known.

Because unconventional approach design of such controls leads to faster development/implementation cycle.

LITERATURE REVIEW

Several papers have been published in a paper entitled Neuro-Fuzzy Systems: A Survey by Jose's Vieira and Alexandre Mota to disclose the information related to neuro fuzzy systems? This paper disclosed the fundamental knowledge of the neuro fuzzy system [7], the techniques of the neuro fuzzy system, the work of the neuro fuzzy system, the properties of the neuro fuzzy system. This paper also explored the neuro fuzzy system and fuzzy system architecture forms. A research paper titled Survey on Neuro-Fuzzy Systems and their Applications in Technical Diagnostics and Measurement by Dr. Zs. J. Viharos and K. B. Kis in which he disclosed about the application of Neuro-Fuzzy Systems to Technical Diagnostics and Measurement and prelude of neuro fuzzy systems [7].

The Architectures for Feed-Forward [9]. A research paper by Detlef D. Nauck and Andreas Nurnberger on Neuro-fuzzy Systems: A Brief Historical Review. A research paper entitled Neuro-fuzzy structures in construction engineering and management research by Getaneh Gezahegne Tiruneh revealed the types of controllers and algorithms used to understand the fuzzy structure, different methods used to control and solve fuzzy issues, and different methods [8].

CONCLUSION

In this paper, how modelling a nonlinear system with the help of neuro fuzzy logic can be achieved is described in a simple way. Most controllers used to explain various fuzzy logic techniques and how a fuzzy system works. Essentially, a neuro fuzzy system is a mixture of neural network and fuzzy logic together; both techniques are necessary to simulate the human brain. The Takagi-Sugeno style fuzzy inference system, several methods suggested among them for controlling and solving fuzzy related problems, gives an accurate result than that of the Mamdani type. Algorithms used to understand the system process flow. It reduces the complexity of the work.

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