

What are Neuro-Fuzzy Systems



- *A neuro-fuzzy system is a fuzzy system that uses a learning algorithm derived from or inspired by neural network theory to determine its parameters (fuzzy sets and fuzzy rules) by processing data samples.*
- A neuro-fuzzy system can be viewed as a 3-layer feedforward neural network. The first layer represents input variables, the middle (hidden) layer represents fuzzy rules and the third layer represents output variables.

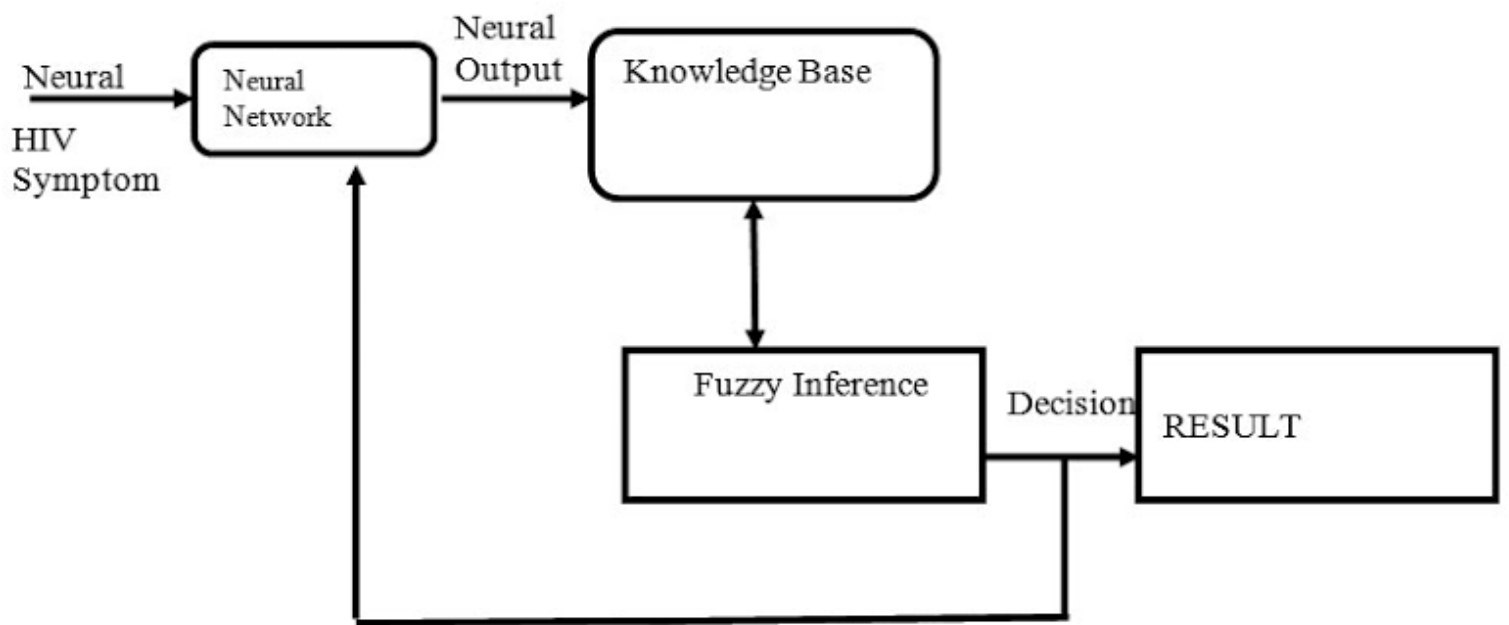


Fig. 1.0: A model of Neuro-Fuzzy system

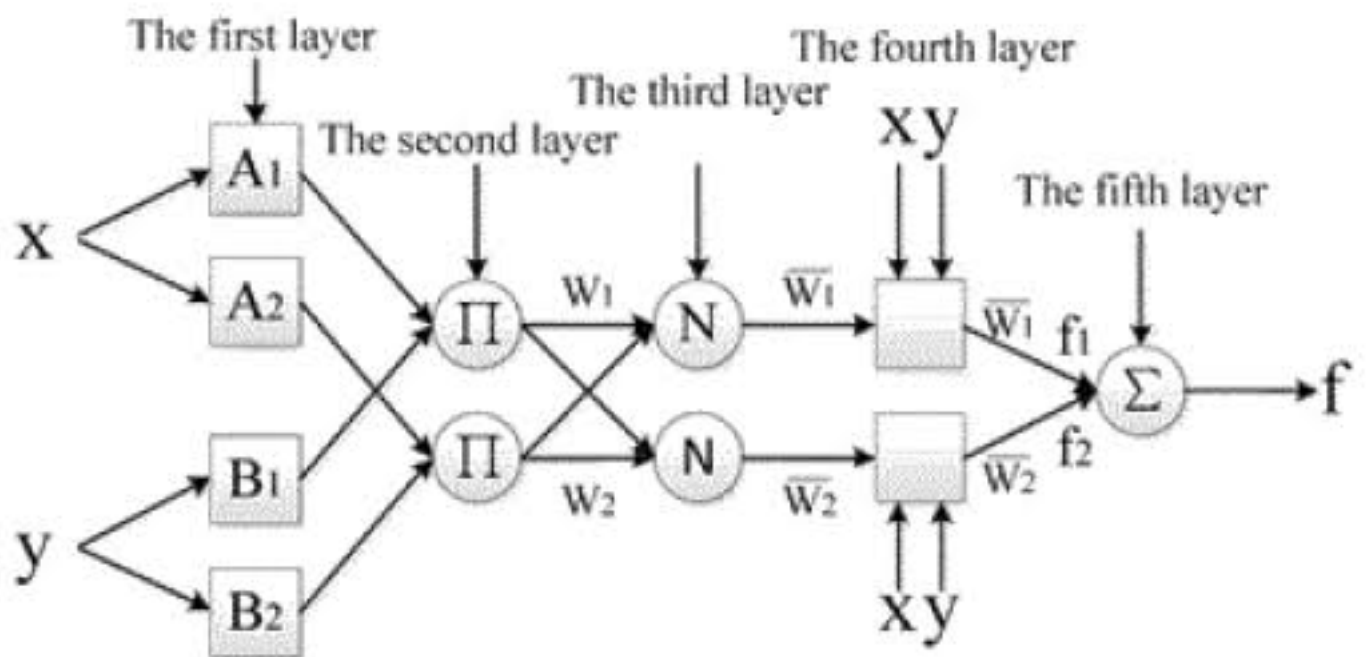


Figure 1 Adaptive Neuro Fuzzy Inference System with two inputs.

Neuro-fuzzy hybridization results in a **hybrid intelligent system** that these two techniques by combining the human-like reasoning style of fuzzy systems with the learning and **connectionist** structure of neural networks. Neuro-fuzzy hybridization is widely termed as fuzzy neural network (FNN) or neuro-fuzzy system (NFS). Neuro-fuzzy system (the more popular term is used henceforth) incorporates the human-like reasoning style of fuzzy systems through the use of **fuzzy sets** and a linguistic model consisting of a set of IF-THEN fuzzy rules.

- u **Neural Networks** are good at **recognizing patterns** but they are not good at explaining how they reach their **decisions**.
- u **Fuzzy logic** is good at explaining the **decisions** but cannot automatically acquire the rules used for making the decision.
- u These limitations act as a central driving force for the creation of **hybrid soft computing systems** where two or more techniques are combined in a suitable manner that overcomes the of individual techniques.

Hybrid System: - A Hybrid Intelligent System is one that combines at least two intelligent technologies.

u **For example,** combining a neural network with a fuzzy system results in a hybrid neuro-fuzzy system.

u **Hybridization:** The main aim of the concept of hybridization is to overcome the weakness in one technique while applying it and bringing out the strength of the other technique to find a solution by combining them.

Advantages of Neuro-fuzzy hybrid systems:

- u It can handle any kind of information (numeric, linguistic, logical, etc.)
- u It can manage imprecise, partial, vague or imperfect information.
- u It has self-learning, self-organizing and self-tuning capabilities.
- u It doesn't need prior knowledge of relationships of data.

Areas of Applications for the use of Hybrid System:

- u Engineering Design

- u Stock market analysis and prediction

- u Medical diagnosis

- u Process control

- u Credit card analysis

- u Few cognitive simulations