

Unit 1

Soft Computing.

* What is soft computing:-

* What is Fuzzy logic computing

- A knowledge that exist in real world in the form of imprecise, uncertainty, approximation. This type of knowledge is called as Fuzzy knowledge.
- Human thinking is also involve in fuzzy knowledge.
- ~~Sometimes~~ it is not classification computing way not capable to handle subjective data representation. Sometimes not be capable to answer all the question as human.
- In classical system 1 represent absolute truth value and 0 represent absolute false value but in Fuzzy there is no logic for false and truth value.
- It is used intermediate value, partially truth partially false.

Boolean logic

IS Aarif boy?

True/yes/1

false/no/0

Fuzzy logic

IS Awaiz married?

Extremely ~~married~~ married

very (0.85)

something maybe (0.35)

Extremely not married (0.0)

• What is supervised and unsupervised learning

• Supervised learning:-

- In supervised learning we assume that correct target output of input data.
- In this learning data is labelled form, and create model.
- In this model put new output input to check the desired output is correct or not.
- To maintain this learning we need supervisor or teach to train machine on the basis of data.
- It produce the output on the basis of previous experience
e.g.:- We train the machine to showing Apple
it shape is rounded and colour is red.
Shape is curving and cylinder is Banana.

• Unsupervised learning:-

- In unsupervised learning, the learning perform without a teacher or trainer.
- In this learning data is unlabelled form.
- The process of machine, to learn and cluster the information on the basis of similarities.
- Self recognition of object on the basis of similarity
e.g. we show the group of picture it may include
two types of animal like dog and cat

So, machine on the basis of similarities it categories in two group like group A - dog
group B - cat.

• Reinforcement learning:-

- The reinforcement learning is a form of supervised learning.
- It is process based on feedback from the environment.
- Action perform on the basis of feedback positive feedback or negative feedback.

Types of activation function.

- Activation function F is applied on the net input to calculate the ANN.
- The types of activation function is depend on the situation of problem.
- The common types of activation function are.

1) Identity function.

- It is used in linear function.
- Is defined $f(x) = x$ for all x .

2) Binary step function.

is defined

$$f(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$$

Here 0 is represent threshold value.

3) Bipolar function

This function can be defined as

$$f(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ -1 & \text{if } x < 0 \end{cases}$$

4) Sigmoid function.

- This types of function used in back-propagation

it two types

- Binary Sigmoid

It known as unipolar sigmoid function

$$f(x) = \frac{1}{1 + e^{-x}} \quad \text{it always in } 0 \text{ to } 1$$

Bipolar Sigmoid function

$$f(x) = \frac{1 - e^{-x}}{1 + e^{-x}} \quad \text{it always } -1 \text{ to } 1$$

5) Ramp function

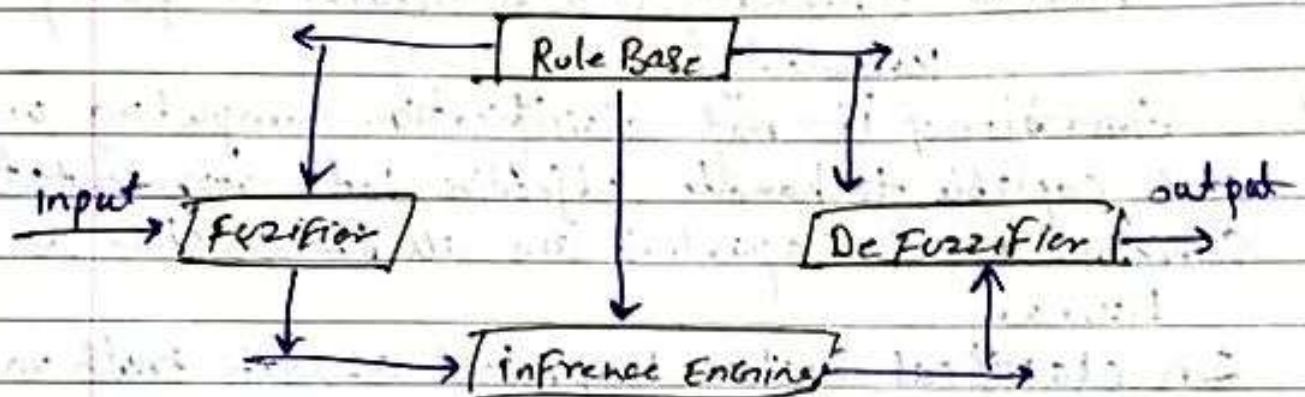
Is defined as

$$F(x) = \begin{cases} 1 & \text{if } x > 1 \\ x & \text{if } 0 \leq x \leq 1 \\ 0 & \text{if } x < 0 \end{cases}$$

• Characteristic of Fuzzy Logic

- It is flexible and easy to implement.
- It help to represent human logic
- It is easy and understandable
- It used for commercial and practical purpose

Fuzzy Logic Architecture.



Rule Base :-

- It contain set of rule.
- If-then, condition provide expert decision system.

Fuzzifier :-

- It convert crisp number into Fuzzy set
- It measured by sensor and passed into processing

Inference engine :-

- It determine the which rule are satisfied with input and then final accordingly.

Defuzzification :-

These Fuzzy set obtain from inference engine is converted into Crisp value.

* Hamming network:-

- It is the most part of hamming network
- It used unsupervised learning.
- In hamming network every given input vector it would be cluster into different groups.
- It is a single layer network
- The input can be either binary (0,1) & bipolar (-1,1).
- It used to find the distance b/w two vector.

consider two vector x & y we use relation

$$x \cdot y = a - d$$

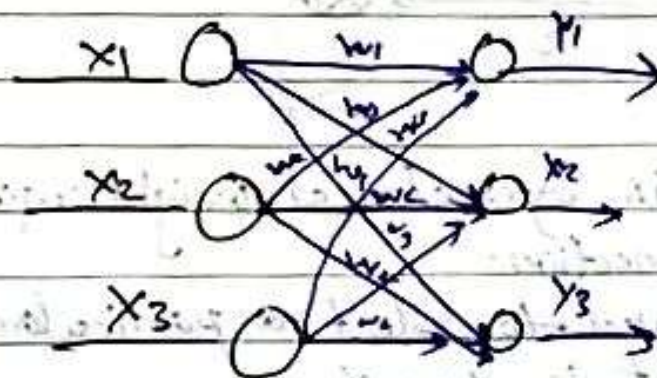
where a is the no. of component in which the vector agree, d is the number of component in which vector is disagree. The value of $a - d$ is hamming distance

$$n = a + d$$

$$d = n - a$$

$$\begin{aligned}
 x \cdot y &= a - d \\
 &= a - (n - a) \\
 &= a - n - a \\
 &= 2a - n = 2a = x \cdot y + n \\
 a &= \frac{1}{2}(x \cdot y) + \frac{1}{2}(n)
 \end{aligned}$$

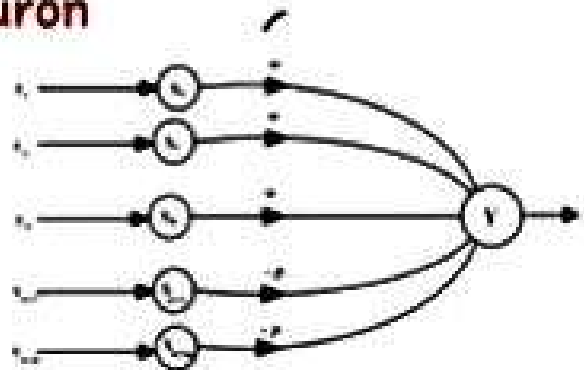
Architecture of hamming network.



McCulloch-Pitts Neuron

- 1) The McCulloch-Pitts neuron (M-P neuron) was the earliest neural network discovered in 1943.
- 2) The M-P neurons are connected by directed weighted paths.
- 3) The activation of M-P neuron is binary, hence either the neuron may fire or may not fire
- 4) The weights associated with the links may be positive (Excitatory) or negative (Inhibitory).
- 5) There is a fixed threshold for each neuron, if the net input to the neuron is greater than threshold then the neuron fires

Architecture of M-P neuron



- 1) M-P neuron has both excitatory and inhibitory connections. It is excitatory with weight ($w > 0$) or inhibitory with weight ($w < 0$)
- 2) Since the firing of the output neuron is based upon the threshold, the activation function is defined as

$$f(y_{in}) = \begin{cases} 1 & \text{if } y_{in} \geq \theta \\ 0 & \text{if } y_{in} < \theta \end{cases}$$

- 3) The M-P neuron has no particular training algorithm.
- 4) The weights are determined through some analysis
- 5) M-P neuron can be used to represent simple logic operations