



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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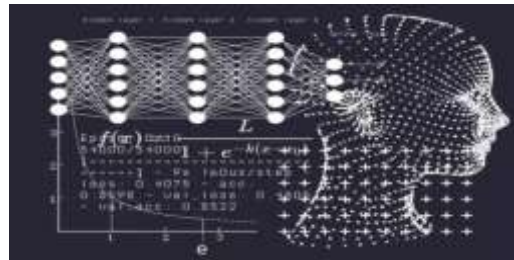
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ARTIFICIAL INTELLIGENCE FOR ELECTRICAL ENGINEERING

UNIT III

TOPIC : **MEMBERSHIP FUNCTION**





CONTENT

❖ **MEMBERSHIP FUNCTION**

Features of Membership Function
Fuzzy Membership Function Types
of Membership Function

❖ **APPROXIMATE REASONING**

Linguistic Variables
If Then Rules
Example





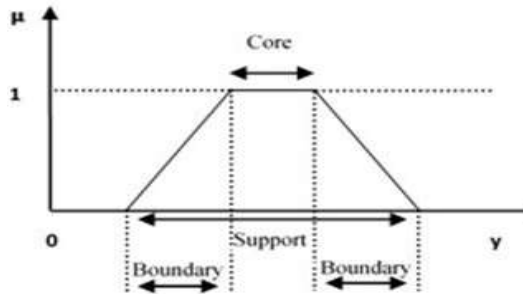
MEMBERSHIP FUNCTION

- ❖ Membership functions can be defined as **a technique to solve practical problems by experience rather than knowledge**. Membership functions are represented by graphical forms. Rules for defining fuzziness are fuzzy too.
- ❖ Membership function essentially embodies all fuzziness for a particular fuzzy set, its description is essential too fuzzy properties or operation.

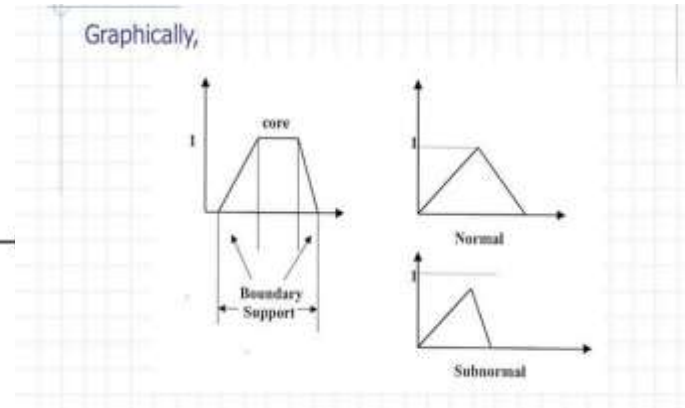


FEATURES OF MEMBERSHIP FUNCTION

- Membership functions **characterize fuzziness (i.e., all the information in fuzzy set)**, whether the elements in fuzzy sets are **discrete or continuous**. Membership functions can be defined as a technique to solve practical problems by experience rather than knowledge.



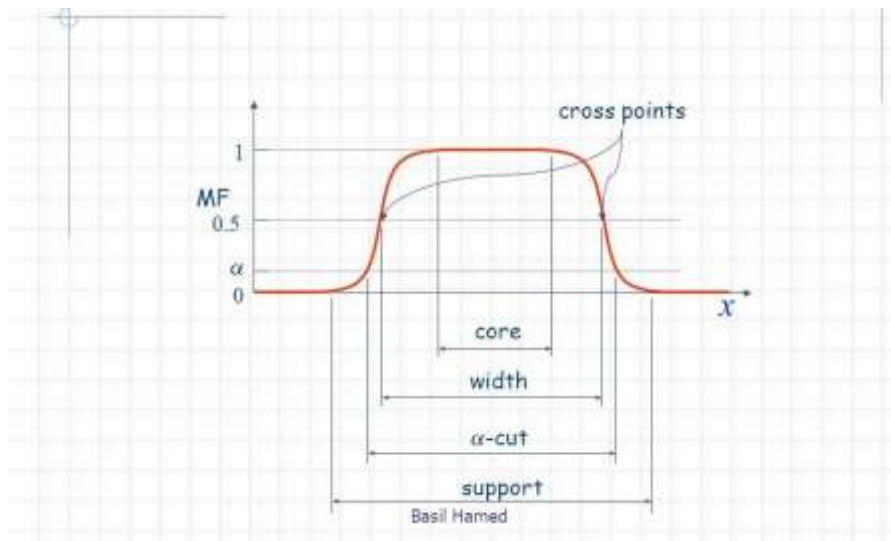
Features of Membership Function





MF TERMINOLOGY

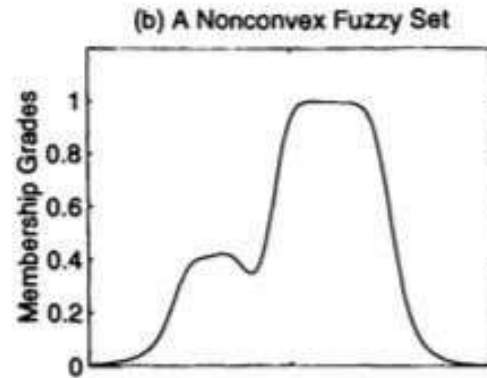
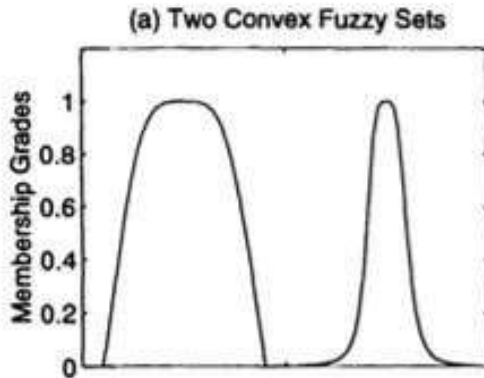
- A membership function **maps items in a set to numbers in the real interval [0, 1]**. This can be a one-to-one mapping where one item is a member of one and only one other set, or it could be a fuzzy and/or probabilistic relationship. Membership functions are often used in fuzzy logic.





CONVEXITY OF FUZZY SETS

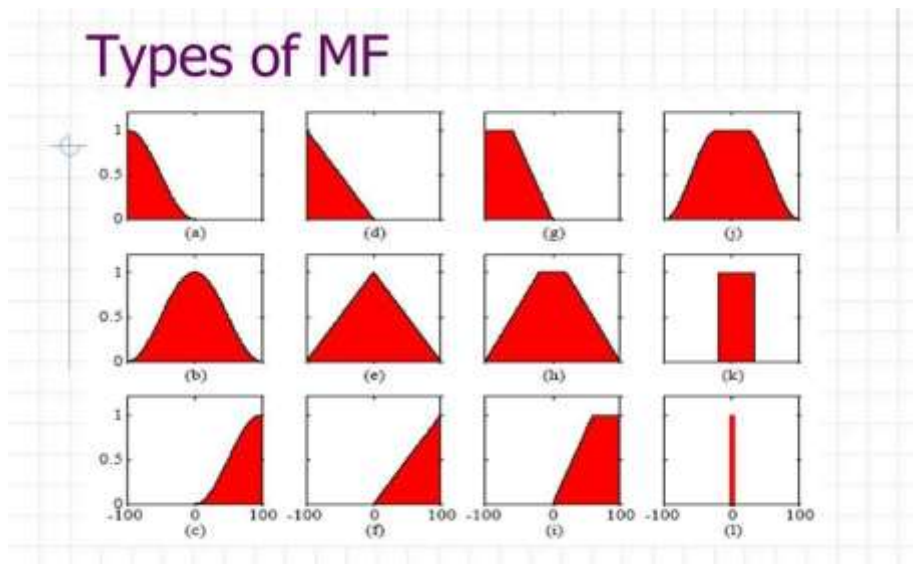
- A convex fuzzy set has a membership function whose membership values are strictly monotonically increase ignore strictly monotonically decreasing or strictly monotonically increasing than strictly monotonically decreasing with increasing values for elements in the universe..





TYPES OF MEMBERSHIP FUNCTION

- There are several types of membership functions such as **triangular**, **trapezoidal**, **sigmoidal**, **Gaussian**, **z-shape** and **s-shape** functions.





MF FORMULATION

◆ Triangular MF $\text{trimf}(x; a, b, c) = \max\left(\min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right)$

◆ Trapezoidal MF $\text{trapmf}(x; a, b, c, d) = \max\left(\min\left(\frac{x-a}{b-a}, 1, \frac{d-x}{d-c}\right), 0\right)$

◆ Gaussian MF $\text{gaussmf}(x; a, b, c) = e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$

◆ Generalized bell MF $\text{gbellmf}(x; a, b, c) = \frac{1}{1 + \left|\frac{x-c}{b}\right|^{2b}}$

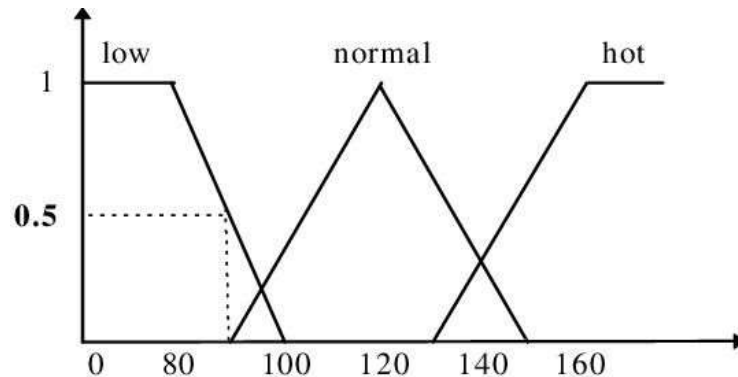
Basil Hamed



LINGUISTIC VARIABLES

Linguistic variables is “a variable whose **values** are **words** or **sentences** in a natural or artificial languages”.

Each linguistic variables may be assigned **one or more linguistic values**, which are in turn connected to a numeric value through the mechanism of membership functions.





RULES



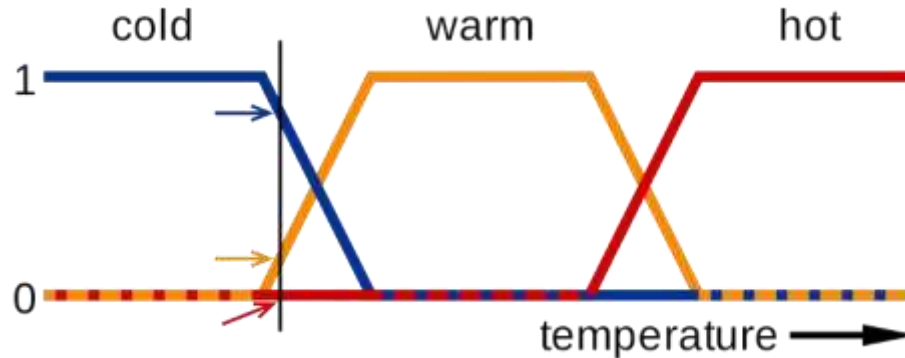
If its Sunny and Warm, Drive Fast

$\text{sunny}(\text{cover}) \wedge \text{warm}(\text{Temp}) \Rightarrow \text{Fast}(\text{Speed})$

If its Cloudy and Cool, Drive Slow

$\text{Cloudy}(\text{cover}) \wedge \text{Cool}(\text{Temp}) \Rightarrow \text{Slow}(\text{Speed})$

Driving Speed is the Combination of output of these Rules.....





EXAMPLES



$A \Rightarrow B$ = If x is A then y is B

- If pressure is high, then **volume is small.**
- If the road is slippery, then **driving is dangerous.**
- If a tomato is red, then **it is ripe.**
- If the speed is high, then **apply the brake a little.**



THANK YOU!