Fuzzy Logic

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VIRGINIA TECH

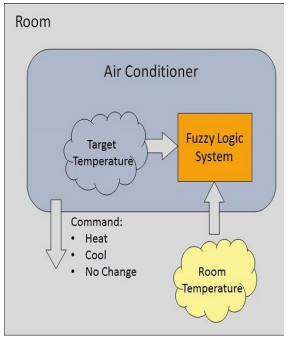
Introduction

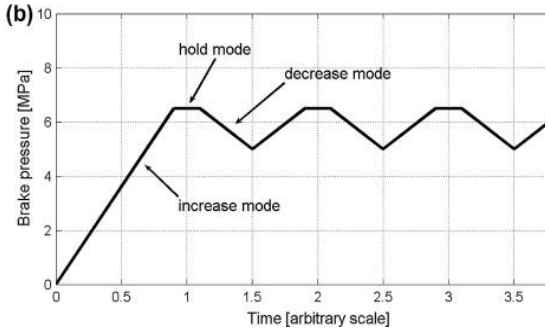
"Fuzzy Logic - An approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based" [1]

- Created in the 1960's by Dr. Zadeh (University of CA)
- Fuzzy Logic includes 0 and 1 as extreme truths (facts) t-norms

Real LIfe Uses

- Facial pattern recognition
- Air conditioners
- Anti lock brakes
- Control of subway control system
- Microwave oven
- Unmanned helicopters
- Aerospace field (Satellites)

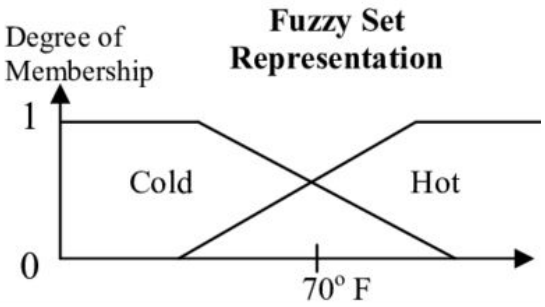




Characteristics

Fuzzy Set Theory

- Alternative to the classical Crisp Set; elements have degrees of membership to the sets.
- Involves the pair (**U,** m),
- **U** is a non-empty set, "Universe of discourse"
- m represents the membership function. For each element x, m(x) represents the membership grade of x in (**U,** m).
- m = μ_{Δ} is the membership function of the fuzzy set A. [5]



Linguistic Variables

- In the form of simple words or sentences (e.g. cold, hot).
- Better represents human intuition and allows space for inaccuracy. [2] [4]

Membership Function

- Identifies the degree to which an input subject belongs to a given set, with an output value on the interval [0, 1]. [2]

Pros and Cons

Advantages:

- The system can function with many different inputs
- The mathematical concepts are simple and efficient
- Provides simple solutions to scenarios of life, resembles human reasoning/decision making
- Algorithms require little data [3]

Disadvantages:

- Results aren't exact or 100% accurate
- Uses imprecise with precise data, which can compromise accuracy [3]

Further Questions

- How can fuzzy logic evolve?
- Will it be used in more systems?
- How can fuzzy logic be improved/perfected?
- Can it be modified to take in multiple accounts of data, while producing an accurate solution?
- Can Fuzzy Logic implement A.I into their system? [6]

Sources

1) "t-norms ". Wikipedia, 5th April, 2021
2) "Artificial Intelligence: Fuzzy Logic systems". TutorialsPoint. 27 April, 2021.
3) "Fuzzy Logic". GeeksForGeeks. 31 October, 2019.
4) "What Is Fuzzy Logic". MathWorks. April, 2021.
5) "Fuzzy Set". Wikipedia. 14 January, 2020
6) "Evolving Fuzzy Systems". Scholarpedia. Plamen Agnleov. 2008