



SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF CSE-IoT ENGINEERING



Artificial Intelligence & Natural Language Processing

FSM Application, Merits & Demerits

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Fuzzy Logic System - Example

- A fuzzy logic-based washing machine adjusts the wash cycle time, water level, and detergent amount based on the dirt level, fabric type, and load size.

Step-by-Step Fuzzy Logic Process in a Washing Machine

1. Fuzzification (Converting Inputs into Fuzzy Values)

Inputs:

Dirt Level → Low, Medium, High

Fabric Type → Delicate, Normal, Heavy

Load Size → Small, Medium, Large

Example:

If the **dirt level** is **high**, the machine categorizes it as **75% high** and **25% medium**.



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2. Knowledge Base (Rules for Decision Making)

Rules in the **IF-THEN** format:

IF Dirt Level is High AND Fabric is Heavy, THEN Wash Time is Long.

IF Load Size is Large AND Dirt Level is Medium, THEN Water Level is High.

IF Fabric is Delicate, THEN Spin Speed is Low.

3. Inference Engine (Applying Fuzzy Rules)

Based on the **fuzzy rules**, the system determines the best **wash cycle settings**.

Uses fuzzy operations like **AND, OR, NOT** to select the correct washing parameters.



Fuzzy Logic System (FLS)

4. Defuzzification (Converting Fuzzy Values into Crisp Outputs)

Final outputs:

Wash Time: 45 minutes

Water Level: 80%

Spin Speed: 600 RPM

Why Use Fuzzy Logic?

- ✓ Handles **imprecise and uncertain inputs** (e.g., slightly dirty vs. very dirty).
- ✓ **Mimics human decision-making** (adjusting wash settings like a human would).
- ✓ **Improves efficiency and energy savings** by optimizing cycle settings.



Merits of Fuzzy Logic Systems

Merits (Advantages) of Fuzzy Logic Systems

- ✓ **Handles Uncertainty and Approximation** – Unlike traditional logic (which works with binary values), fuzzy logic can handle imprecise and vague information.
- ✓ **Mimics Human Reasoning** – Works similarly to human decision-making by processing linguistic variables (e.g., "slightly cold," "very hot").
- ✓ **Flexible and Adaptable** – Can be easily modified and adjusted without requiring an exact mathematical model.
- ✓ **Works with Incomplete Data** – Can provide meaningful outputs even when inputs are incomplete or noisy.
- ✓ **Simple and Cost-Effective Implementation** – Fuzzy logic systems require fewer computations than complex mathematical models.
- ✓ **Used in a Wide Range of Applications** – Found in washing machines, air conditioners, medical diagnosis, robotics, and automation.



Demerits of Fuzzy Logic Systems

- ✗ **Lack of Learning Capability** – Unlike AI models such as neural networks, fuzzy logic does not learn or improve from data over time.
- ✗ **Requires Expert Knowledge** – Designing fuzzy rules and membership functions often depends on domain expertise.
- ✗ **Difficult to Tune and Optimize** – Setting up the right fuzzy rules and membership functions can be challenging.
- ✗ **Higher Processing Time for Complex Systems** – If a system has too many rules and fuzzy sets, processing speed may decrease.
- ✗ **Less Accurate Compared to Precise Mathematical Models** – In situations where exact values are needed, fuzzy logic may not be the best choice.



Thank
you