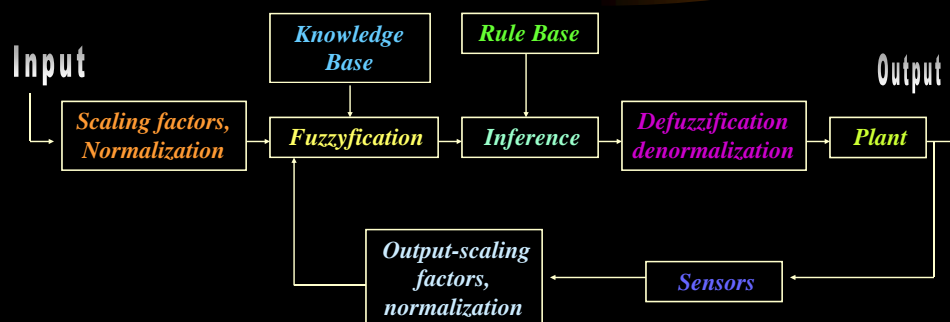


Decision Making Using Fuzzy Logic

Lecture 9

1

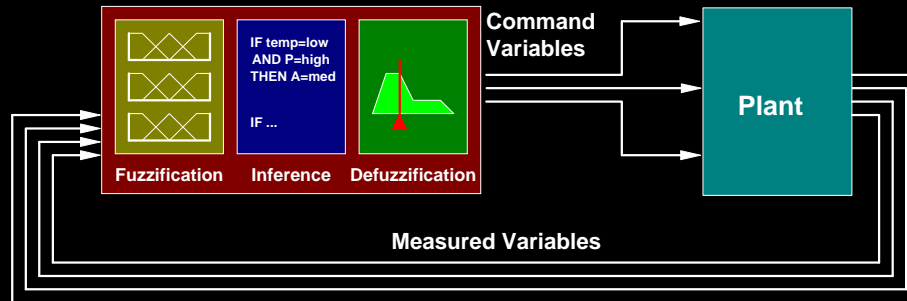
Simple Fuzzy Logic Control System block diagram



2

Types of Fuzzy Controllers: - Direct Controller -

The Outputs of the Fuzzy Logic System Are the Command Variables of the Plant:

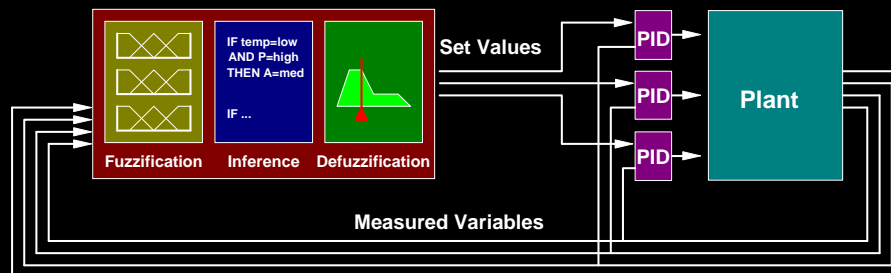


Fuzzy Rules Output
Absolute Values !

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Types of Fuzzy Controllers: - Supervisory Control -

Fuzzy Logic Controller Outputs Set Values for Underlying PID Controllers:



PID → Proportional-Integral-Derivative

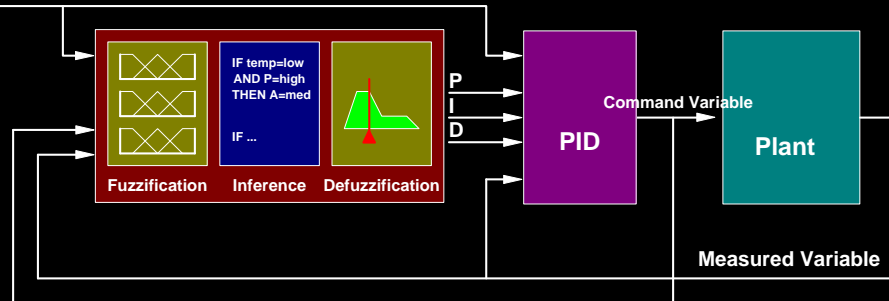
Human Operator
Type Control !

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Types of Fuzzy Controllers: - PID Adaptation -

Fuzzy Logic Controller Adapts the P, I, and D Parameter of a Conventional PID Controller:

Set Point Variable



PID → *Proportional-Integral-Derivative*

The Fuzzy Logic System
Analyzes the Performance of the
PID Controller and Optimizes It !

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5

Simplified Examples of Applications

- Washing Machine
- Vacuum Cleaner

6



Traffic Control Example

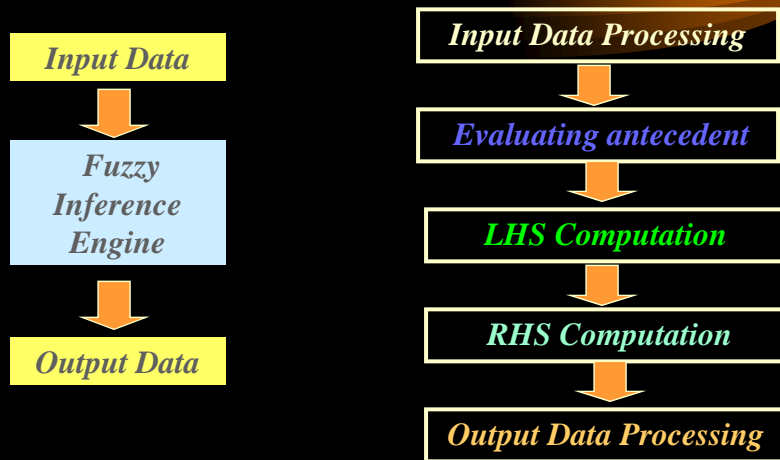
7



Overall Concept

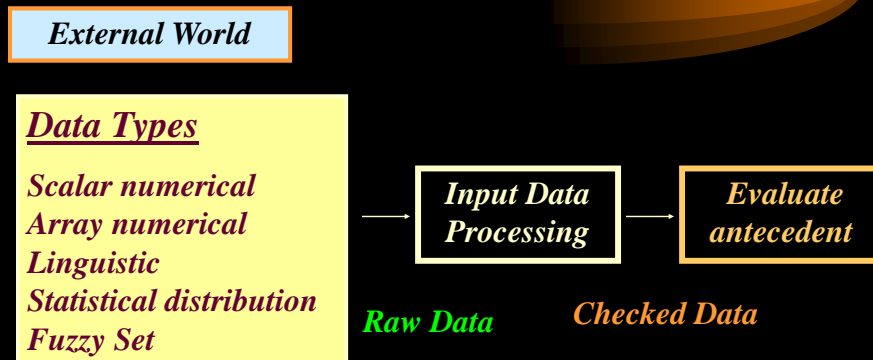
8

Overall Algorithm



9

Input Data Processing (IDP)



10

Data Processing of Mixed Inputs

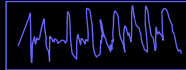
Age = 45

Sex = Male

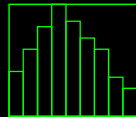
Last 5 heart rate
readings =
[54 55 51 59 61]

Chest pain =
Frequently sharp

Electrocardiogram



Patient's blood
pressure
measurement since
last week



IDP

Fuzzy
Inference
Engine

Risk of Heart Attack

General Fuzzy Logic Applications

Knowledge Based Expert Systems

- Fuzzy Implications
- Selection of fuzzy implications
- Multi-conditional Approximate reasoning
- Controllers
- Integration with Neural networks

General Fuzzy Logic Applications

- Clustering
- Pattern Recognition
- Image Processing
- Decision Making → Individual decision making, Multi-person decision making, Multi-criteria decision making, multistage decision making
- Many More...**Fuzzy Unlimited** ☺

13

Civil/Mechanical Engineering Applications

- Design decisions
- Damage assessment
- Optimization
- Non-destructive Testing Evaluation
- Control Problems

14

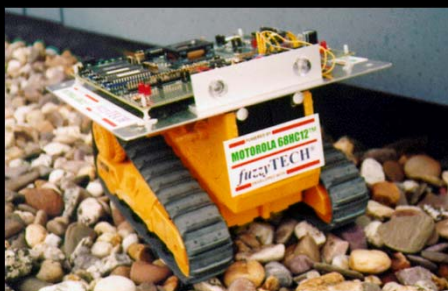
Industrial Engineering Applications

- Estimated service life of the equipment
- Designing built-in-test for industrial systems

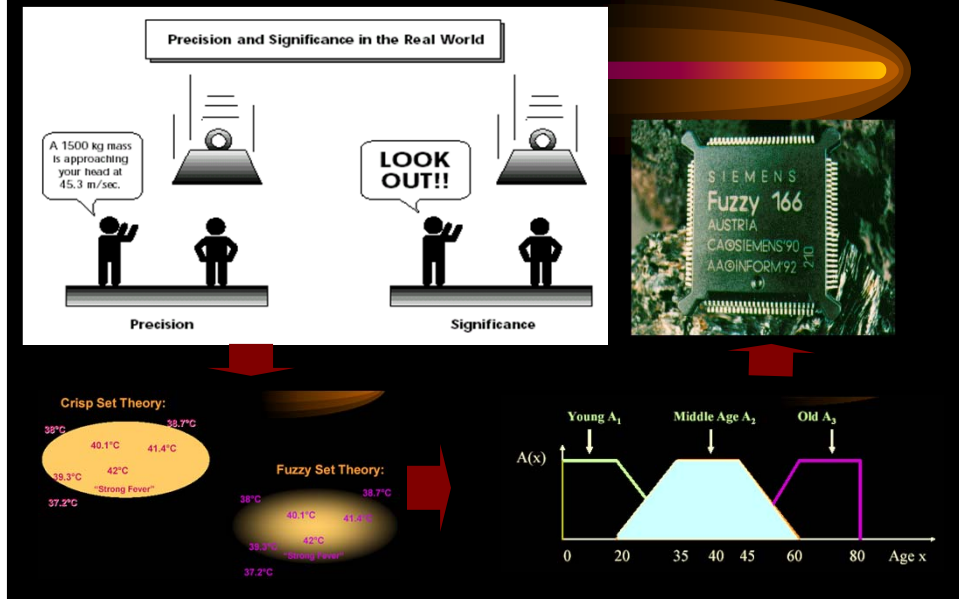
15

Computer Engineering

- Processing Algorithms
- Hardware Implementation – e.g. Tank Controller



Fuzzy Logic – In Nutshell



Self-Study

- Chapter 10: Constructing Fuzzy Sets and Operations on Fuzzy Sets
- Chapter 16: Engineering Applications
- Chapter 17: Miscellaneous Applications

