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FACULTY OF EGINEERING AND TECHNOLOGY

Soft Computing

LECTURE -14

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OUTLINE

- Fuzzy Control Methods
- Proportional to the error
- Conventional Control
- Fuzzy Controller
- Reference

Fuzzy Control Methods

❑The term control is generally defined as a mechanism used to guide or regulate the operation of a machine, apparatus or constellations of machines and apparatus.

❑Feedback control' is thus a mechanism for guiding or regulating the operation of a system or subsystems by returning to the input of the (sub)system a fraction of the output.

❑One can intuitively argue that the control signal, u, in part, is

- **Proportional to the error;**
- **Proportional to both the magnitude of the error and the duration of the error**
- **Proportional to the relative changes in the error values over time**

Conventional Control

In the case of classical operations of process control one has to solve the non-linear function u. Furthermore, it is very important that one also finds the proportionality constants KI , KD, and KP.

$$u(t) = K_P e(t) + K_I \int_0^t e(\tau)\, d\tau + K_D \frac{de}{dt}$$

In the case of fuzzy controller, the non-linear function is represented by a fuzzy mapping, typically acquired from human beings

Value	determines reaction to the
Proportional (K_P)	current error
Integral (K_I)	sum of recent errors
Derivative (K_D)	rate at which the error has been changing

Fuzzy Controller

❑ A Fuzzy Controller is a device that is intended to modelize some vaguely known or vaguely described process.

❑ Logical rules with vague predicates can be used to derive inference from vague formulated data. The idea of linguistic control algorithms was a brilliant generalization of the human experience to use linguistic rules with vague predicates in order to formulate control actions.

❑ A knowledge-based system for closed-loop control is a control system which enhances the performance, reliability, and robustness of control by incorporating knowledge which cannot be accommodated in the analytic model upon which the design of a control algorithm is based, and that is usually taken care of manual modes of operation, or by other safety and ancillary logic mechanisms.

There are two types of fuzzy controllers:

- Mamdani (linguistic) Controller
- Takagi-Sugeno-Kang Controller

Mamdani (linguistic) Controller

- Direct closed-loop controller

Takagi-Sugeno-Kang Controller

- Supervisory controller

MULTIPLE CHOICE QUESTION

1. Which combines inductive methods with the power of first-order representations?

a) Inductive programming

b) Logic programming

c) Inductive logic programming

d) Lisp programming

2. How many reasons are available for the popularity of ILP?

a) 1

b) 2

c) 3

d) 4

3. Which cannot be represented by a set of attributes?

a) Program

b) Three-dimensional configuration of a protein molecule

c) Agents

d) None of the mentioned

4. Which is an appropriate language for describing the relationships?

a) First-order logic

b) Propositional logic

c) ILP

d) None of the mentioned

5. Which produces hypotheses that are easy to read for humans?

a) ILP

b) Artificial intelligence

c) Propositional logic

d) First-order logic

REFERENCES

- https://www.maths.tcd.ie/~ormondca/notes/Fuzzy%20Logic%20Notes.pdf