Development of Fuzzy system

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***Abstract*: In mathematical programming problem the functional relationship between the decision variables and the objective function is not completely known. The antecedent part of the rules contains some linguistic values of the decision variables, and the consequence part is a linear combination of the crisp values of the decision variables. This paper solve the resulting programming problem to find a fair special solution to the original fuzzy problem.**

***Keywords*: fuzzy logic, Mamdani method, fuzzy logic controller**

Introduction

Fuzzy development problems under linguistic constraints can be stated and solved in many different ways [3, 4, 15, 22, 23]. Usually, the authors consider development problems of the for

$$\max/\min f(\Xi);\ \text{subject to } \Xi \in \varphi \qquad (1)$$

where f or/and φ are defined by fuzzy terms. Then they are searching for a crisp $\Xi\ *$ which (in a certain) sense maximizes f under the (fuzzy) constraints φ. For example, fuzzy linear programming problems can be stated as [9, 14, 16, 20]

$$\max/\min f(\Xi) = c\tilde{}\ \Xi;\ \text{subject to } \omega\tilde{}\ \Xi \leq \gamma\tilde{} \qquad (2)$$

Fuller and Zimmermann [12] interpreted fuzzy linear programming problems (1) with fuzzy coefficients and fuzzy inequality relations as multiple fuzzy reasoning schemes, where the fact of the scheme is the objective of the fuzzy linear programming problem. Unlike in (1) the fuzzy value of the objective function f (Ξ) may not be known for any $\Xi \in \mathcal{Z}^n$. More often than not we are only able to describe the causal link between Ξ and f (Ξ) linguistically using fuzzy if-then rules.
we consider constrained fuzzy development problems of the form

$$\max/\min f(\Xi) \text{ s.t. } \{ \mathfrak{Z}_1(\Xi) \ldots \mathfrak{Z}_m(\Xi) | \Xi \in \gamma \} \qquad (3)$$

Where $\mathfrak{Z}_p$ is given by

$$\mathfrak{Z}_p(\Xi): \text{If } \mathfrak{Z}_1 \text{ is } \omega_q^p\ \Xi_n \text{ is } \omega_n^p$$

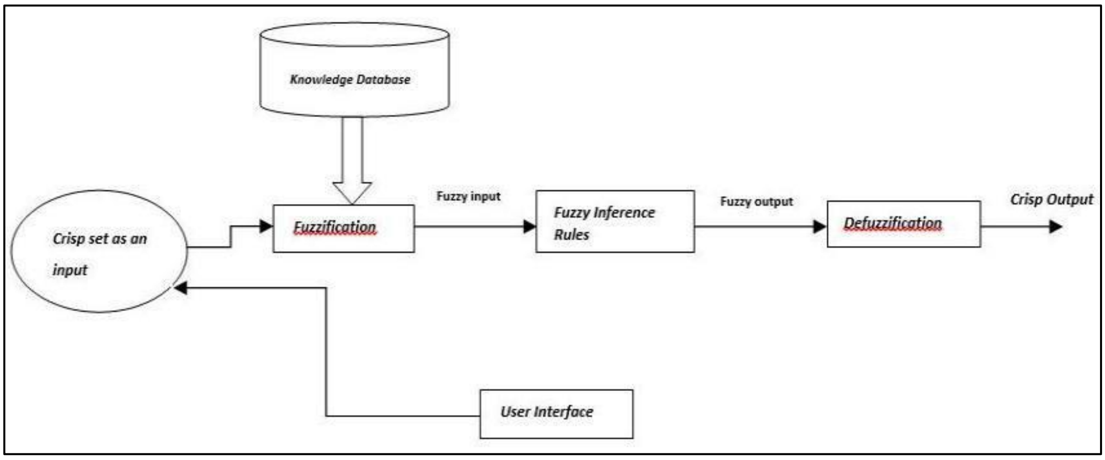
Ξ_q is a linguistic variable, $\Xi \subset \mathcal{Z}^n$ is a (crisp) set of constraints on the universe of discourse of Ξ_q, and ω_q^p is a linguistic value of Ξ_q
Generalizing the fuzzy reasoning approach introduced in [12] we determine the crisp value of f at Z $\in \gamma$ by the Mamdani fuzzy reasoning method, and obtain an special solution to (2) by solving the resulting (usually nonlinear) development problem

$$\max/\min f(Z);\ \text{subject to } Z \in \gamma.$$

Deign of the fuzzy Regulator

A fuzzy Regulator [1, 2, 8, 10, 13, 17, 18] will be portrayed with the assistance of a diagram as shown in Figure 1. It is composed of 4 main components:

1. Fuzzification
2. inference engine
3. knowledge base
4. defuzzification module.



(1) Fuzzification Module

Fuzzification is the way toward changing a real scalar incentive into a fuzzy value. Fuzzy Linguistic Variables are utilized to speak to characteristics crossing a specific range. In this module.

The data is received from input device in the form of crisp sets. These input sets are transforms to the fuzzy input (linguistic variables) and these converted variables are transferred to the next phase. Fuzzy sets are created by taking discrete inputs like integers and translating them into fuzzy sets. Sensors collect and transmit crisp inputs like temperature, pressure, and rotations per minute to the control system.

(2) Knowledge Base Module

Application domain and procedural knowledge are held in this repository. It has a database and a set of linguistic (fuzzy) control rules stored in it.

All the supporting data related to linguistic control rules is provided by this module. A rule base portrays the control objectives and control approach of the area expert by set of linguistic control rules.

RULE BASE is a collection of rules and IF-THEN conditions developed by professionals to assist the decision-making system when it is presented with linguistic data. Recent breakthroughs in fuzzy theory have resulted in the development of a variety of feasible ways for developing and tuning fuzzy controllers. The bulk of these developments result in a reduction in the number of fuzzy rules.

(3) Inference Engine

Like human brain, this module is having the capability to take the decisions. Under this module the output is mapped with every input by using expert rules already stored on the database. It compares the current fuzzy input to each rule and determines which rules should be activated based on the input field. Following that, the control actions are constructed by merging the fired rules.

(4) Defuzzification Module

Fuzzy output (linguistic variables) from the previous module has been sent to this module for defuzzification process. The defuzzification process will convert the fuzzy output to the crisp set and further send this crisp set to the user interface. It is used to turn the fuzzy sets used by the inference engine into a clear value. There are a lot of ways to get rid of fuzzy data, but the best one is when it's used with an expert system to make sure there aren't any mistakes Finally results produced from typical fuzzy inference in terms of linguistic 3 terms again transformed into crisp value in defuzzification transformation. This demonstrates the richness of fuzzy controllers but also the need for some guidelines for their practical design.

Conclusion

In Conclusion, Mamdani Fuzzy Reasoning method to solve fuzzy linguistic development problem in which the functional relationship between the decision variables and the objective function is not defined crisply. We have determined the crisp functional relationship between the objective function and it is converted into nonlinear programming problem to find solution to the original fuzzy problem.

This design is capable of operating with any type of input data, regardless of its accuracy, distortion, or volume. Fuzzy Logic Systems are straightforward to implement and grasp.

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