

Fuzzy Inference Methods

M. Mizumoto and H. -J. Zimmermann

Institut für Wirtschaftswissenschaften
RWTH Aachen
Templergraben 64
5100 Aachen
West Germany

Abstract

In our daily life we often make such an inference that its antecedents and consequences contain fuzzy concepts. Such a inference can not be made sufficiently by the methods which are based on classical two valued logic and many valued logic. In order to make such an inference, Zadeh suggested an inference rule called "compositional rule of inference". Using this inference rule, he, Mamdani, and Mizumoto et al. suggested several methods for a fuzzy reasoning in which the antecedent contains a conditional proposition with fuzzy concepts:

$$\begin{array}{l} \text{Ant 1: If } x \text{ is } A \text{ then } y \text{ is } B. \\ \hline \text{Ant 2: } x \text{ is } A'. \\ \text{Cons: } y \text{ is } B'. \end{array} \quad (1)$$

where A , A' , B , B' are fuzzy concepts.

Mizumoto et al. have pointed out that for the type of fuzzy reasoning in (1) called "generalized modus ponens" the consequences inferred by Zadeh's and Mamdani's methods do not always fit our intuitions and suggested several new methods which fit our intuitions under several criteria.

As a continuation of our studies, this paper investigates the properties of their fuzzy inference methods in the case of "generalized modus tollens":

$$\begin{array}{l} \text{Ant 1: If } x \text{ is } A \text{ then } y \text{ is } B. \\ \hline \text{Ant 2: } y \text{ is } B'. \\ \text{Cons. } x \text{ is } A'. \end{array}$$

Moreover, by introducing the implication rules in many valued logic systems, we discussed the newly obtained 15 fuzzy inference methods in the cases of generalized modus ponens and generalized modus tollens. Finally, we treat with the properties of syllogism and contrapositive under each fuzzy reasoning method.