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Interval Fuzzy Data Processing: Case When Degree of Belief Is Decribed by an Interval

Hung T. Nguyen and Elbert Walker

***Abstract*— The necessity to use intervals to describe degrees of belief in expert systems stems from the following three sources:**

- **Experts *are* often uncertain about their degrees of belief.**
- **Operations with degrees of belief are not uniquely defined. For example, if we know the degrees of belief (subjective probabilities) $a = d(A)$ and $b = t(B)$ of the statements A and B, then the only thing that we know about the degree of belief of $A\&B$ is that it lies between $\min(a + b - 1, 0)$ and $\min(a, b)$. Therefore, even if we start with precise values, e.g., $a = 0.3$ and $b = 0.4$, we get an *interval* $[0, 0.3]$ of possible values of $d(A\&B)$. This idea was proposed and used by L. Kohout.**
- **Even if for basic logical operations $*$ ($\&$, $\vee$, $\neg$), we fix a method of describing $d(A * B)$ as a function of $d(A)$ and $d(B)$, there is a third source of interval uncertainty: For a complicated formula, e.g., $A \to B$, there exists several methods of representing $A \to B$ in terms of $\&$, $\vee$, and $\neg$: $B \vee \neg A$, $(A\&B) \vee \neg A$ etc. These formulas are equivalent in classical logic, but they lead to different numerical values for $d(F)$. As a result, even if initially we had intervals, and if operations are chosen, if we take the smallest and the largest of them, we get the *interval* of possible values of $d(F)$. This idea has been proposed and used by I. B. Turksen.**

In this talk, we will survey the related mathematical results and applications. Some of them have been described during a special session of NAFIPS/IFIS/NASA-94 (see [1] and references therein).

References

[1] Vladik Kreinovich and Hung T. Nguyen, "Applications of fuzzy intervals: a skeletal outline of papers presented at this section", In: L. Hall, H. Ying, R. Langari, and J. Yen (eds.), *NAFIPS/IFIS/NASA'94, Proceedings of the First International Joint Conference of The North American Fuzzy Information Processing Society Biannual Conference, The Industrial Fuzzy Control and Intelligent Systems Conference, and The NASA Joint Technology Workshop on Neural Networks and Fuzzy Logic, San Antonio, December 18–21, 1994*, IEEE, Piscataway, NJ, pp. 461–463.

The authors are with the Department of Mathematical Sciences, New Mexico State University, Las Crices, NM 88003.