NIFS 1 (1995) 48-50

ON INTUITIONISTIC FUZZY WEIGHT PRODUCTION SYSTEMS

Stefka P. Stoeva
Bulgarian National Library, V. Levski 88, Sofia-1504, Bulgaria

Mechanisms of drawing inferences from domain and problem knowledge, where both knowledge and its implications are less than certain, become more important in rule-based expert systems [3-6]. Knowledge bases in the form of fuzzy production systems with weighting coefficients are studied in [7].

In the paper fuzzy production systems with two weight components are studied. The terminology and the notations about the theory of fuzzy objects are according to [2] and about the theory of intuitionistic fuzzy objects are according to [1].

The knowledge base is supposed to be a set of rules of the form:

$$\text{Rule}_1: \text{ IF } X_1 \text{ THEN } Y_1 \text{ WITH WEIGHT } \langle v_1, w_1 \rangle,$$

$$\text{Rule}_2: \text{ IF } X_2 \text{ THEN } Y_2 \text{ WITH WEIGHT } \langle v_2, w_2 \rangle,$$

$$\cdots$$

$$\text{Rule}_N: \text{ IF } X_N \text{ THEN } Y_N \text{ WITH WEIGHT } \langle v_N, w_N \rangle,$$

where X_i and Y_i $(1 \le i \le N)$ are fuzzy sets in the sets $\bar{X} = \{x_1, x_2, \ldots, x_m\}$ and $\bar{Y} = \{y_1, y_2, \ldots, y_l\}$, respectively, and m, l and N are natural numbers.

After the i-th rule there are numbers v_i and w_i, where $v_i, w_i \in [0, 1]$ and $v_i + w_i \le 1$, reflecting the degree of the relative significance and relative non-significance of the i-th rule in the given set of rules, respectively. Further on such knowledge base will be called <u>an intuitionistic fuzzy weight production system</u>.

The rule-firing algorithm accepts as input a fuzzy set X in $\bar{X}$, which defines the initial state of the data base. Since the matching between X and any condition X_i, is partial, all the rules of the intuitionistic fuzzy weight production system are fired. The resultant conclusion Y is a fuzzy set in the set $\bar{Y}$.

The rule-firing algorithm for intuitionistic fuzzy weight production systems is represented by the following scheme:

$$\frac{\begin{array}{l}\text{IF A IS } X_i \text{ THEN B IS } Y_I \text{ WITH WEIGHT } \langle v_I, w_I \rangle \\ \text{A IS X}\end{array}}{\text{THEN B IS Y}}$$

where A and B are variables taking values in the sets $\bar{X}$ and $\bar{Y}$, respectively.

To get the resultant fuzzy conclusion Y, it is necessary to construct a suitable functional to perform the combination of the weights that the rules carry with the extents to which these rules are satisfied.

Let $R = \{Rule_1, Rule_2, \ldots, Rule_N\}$ be the set of rules of above type, let $P(R) = \{S : S \subset R\}$ and let $g: P(R) \to [0, 1]^2$ be a function, defined as follows:

$$g(\emptyset) = \langle 0, 1 \rangle,$$

$$g(\{Rule_i\}) = \langle v_i, w_i \rangle, \ 1 \le i \le j,$$

$$g(\{Rule_{i_1}, Rule_{i_2}, \ldots, Rule_{i_r}\})$$

$$= \langle \max(v_{i_1}, v_{i_2}, \ldots, v_{i_r}), \min(w_{i_1}, w_{i_2}, \ldots, w_{i_r}) \rangle,$$

where $\{i_1, i_2, \ldots, i_r\} \subset \{1, 2, \ldots, N\}$,

$$g(\{Rule_1, Rule_2, \ldots, Rule_N\}) = \langle 1, 0 \rangle.$$

In a future research it will be proved that the function g is a kind of intuitionistic fuzzy measure on P(R).

Acknowledgement:
The author is grateful to K. Atanassov for his helpful comments.

REFERENCES:

[1] Atanassov K., Intuitionistic fuzzy sets, Fuzzy sets and Systems, Vol. 20 (1986), No. 1, 87-96.

[2] Dubois D., Prade H., Fuzzy Sets and Systems: Theory and Applications, Academic Press, New York, 1980.

[3] Eddy W., Pei G., Structures of rule-based belief functions, IBM J. Res. Develop., 30 (1) (1986), 93-101.

[4] Giordana A., Saitta L., An expert system oriented to complex pattern recognition problems, Information Sciences, 36 (1985), 157-177.

[5] Lesmo L., Saitta L., Torasso P., Fuzzy production rules: a learning methodology, in: P. Wang (Ed.), Fuzzy Sets and Decision Processes, Plenum Press, New York, 1983, 181-198.

[6] Quinlan J. R., INFERNO: A cautious approach to uncertain inference, The Computer Journal, 26 (3) (1983), 255-269.

[7] Stoeva S., A weight-learning algorithm for fuzzy production systems with weighting coefficients, Fuzzy Sets and Systems 46 (1992), 87-97.