SOLVING OF THE PROBLEM OF DISCRETE FUZZY NUMBER CARRIER'S GROWING

© Oleg Iemets, Oleksandra Yemets'

Poltava University of Economics and Trade

Department of Mathematical Simulation and Social Informatics

e-mail: *yemetsli@mail.ru, yemets2008@ukr.net*

Abstract. *The algorithm of reduction of the number of carrier elements of a discrete fuzzy number with the realization of an opportunity to save the information about values is proposed in the article. It is proposed that the information is given by the fuzzy number.*

Introduction

During performing of a number of operations with fuzzy numbers [1–14], growing of the carrier of a discrete fuzzy number occurs. However several gradations are enough for describing qualitative phenomena. Therefore let set the problem of the reduction of the number of carrier elements with the realization of an opportunity to save the information about values. It is proposed that the information is given by the fuzzy number. One of methods is presented in the report.

Formulation of a problem

Let we have a fuzzy number $A = \{(a_1|\mu_1), ..., (a_n|\mu_n)\}$ for describing a variable. It is necessary to describe this variable by a fuzzy number with a carrier which has $k < n$ carrier elements.

Let us consider an example.

Let $A = \{(1|0,5), (2|0,8), (3|0,9), (4|0,6), (5|0,4)\}$. Here $n = 5$.

Let $k = 3$. Get a corresponding fuzzy number.

Split the interval $[1,\ 3]$ into three intervals with the length of $\frac{4}{3}$:

$$\left[1,\ 2\frac{1}{3}\right); \qquad \left[2\frac{1}{3},\ 3\frac{2}{3}\right); \qquad \left[3\frac{2}{3};\ 5\right].$$

Find the middles of intervals:

$$b_1 = \frac{1 + 2\frac{1}{3}}{2} = 1\frac{2}{3}; \qquad b_2 = \frac{2\frac{1}{3} + 3\frac{2}{3}}{2} = 3; \qquad b_3 = \frac{3\frac{2}{3} + 5}{2} = 4\frac{1}{3}.$$

These numbers make up the carrier of the fuzzy number.

Define membership functions in such way:

$$\mu_{b_1} = \frac{1 \cdot 0,5 + 2 \cdot 0,8}{1 + 2} = 0,7, \qquad \mu_{b_2} = \frac{3 \cdot 0,9}{3} = 0,9,$$

$$\mu_{b_3} = \frac{4 \cdot 0,6 + 5 \cdot 0,4}{9} = 0,4(8) \approx 0,49.$$

So, the result (see Fig. 1) is

$$B = \{(1\frac{2}{3}|0,7),(3|0,9),(4\frac{1}{3}|0,4(8))\}.$$

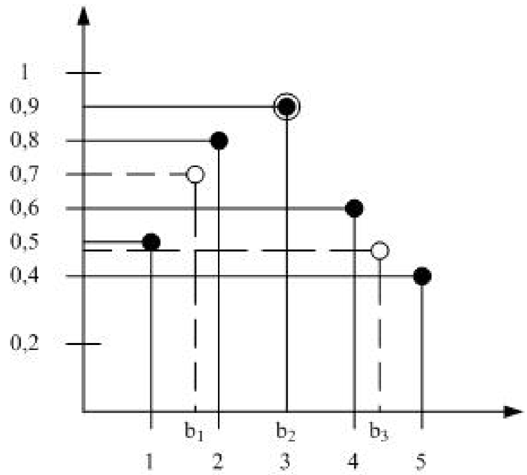

Fig. 1. Fuzzy number after the reduction

Describe this procedure by reduction A to B in a general view.

Let $A = \{(a_1|\mu_1),...,(a_n|\mu_n)\}$, without restricting the generality, consider $a_1 < a_2 < ... < a_n$. It is necessary to get the reduction of the number A down to the number B (corresponding A) with k elements.

Denote $B = \{(b_1|\eta_1),...,(b_k|\eta_k)\}$.

Split the interval $[a_1, a_n]$ into k intervals

$$\Delta_i = [a_1 + h(i-1),\ a_1 + hi), \qquad i = 1,2,...,k,$$

where

$$h = \frac{a_n - a_1}{k}.$$

For $i = k$ the right end of interval is included:

$$[a_1 + h(k-1),\ a_1 + hk].$$

Find their middles:

$$\mathrm{b_i} = a_1 + h(i - \frac{1}{2}) = a_1 + \frac{a_n - a_1}{k}(i - \frac{1}{2}), \qquad i = 1,2,...,k.$$

Find the value η_i of membership function for each b_i:

$$\eta_i = \sum_{j:\, a_j \in \Delta_i} a_j \mu_j \;/ \sum_{j:\, a_j \in \Delta_i} a_j, \qquad i = 1, 2, ..., k.$$

Thereby B is defined.

Conclusion

It is proposed to investigate the properties of the operation of reduction in further researches.

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