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Letter to the editor

Comment on "A fuzzy soft set theoretic approach to decision making problems"

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Abstract

The algorithm for identification of an object in a previous paper of A.R. Roy et al. [A.R. Roy, P.K. Maji, A fuzzy soft set theoretic approach to decision making problems, J. Comput. Appl. Math. 203(2007) 412–418] is incorrect. Using the algorithm the right choice cannot be obtained in general. The problem is illustrated by a counter-example.

Keywords: Fuzzy soft set; Resultant fuzzy soft set; Comparison table; Object recognition; Choice value

1. Introduction

Researchers in economics, engineering, environmental science, sociology, medical science, and many other fields deal daily with the complexities of modeling uncertain data. Classical methods are not always successful, because the uncertainties appearing in these domains may be of various types. While probability theory, fuzzy sets [1], rough sets [2], and other mathematical tools are well-known and often useful approaches for describing uncertainty, each of these theories has its inherent difficulties as pointed out in [3]. Consequently, Molodstov [3] proposed a completely new approach for modeling vagueness and uncertainty. This so-called soft set theory is free from the difficulties affecting existing methods.

A soft set is a parameterized family of subsets of the universal set. We can say that soft sets are neighborhood systems, and that they are a special case of context-dependent fuzzy sets. In soft set theory the problem of setting the membership function, among other related problems, simply does not arise. This makes the theory very convenient and easy to apply in practice. Soft set theory has potential applications in many different fields, including the smoothness of functions, game theory, operations research, Riemann integration, Perron integration, probability theory, and measurement theory. Most of these applications have already been demonstrated in Molodtsov's book [4].

At present, work on the soft set theory is progressing rapidly. Aktas et al. [5] introduced the basic version of soft group theory, which extends the notion of group to include the algebraic structures of soft sets. Maji et al. [6] describe the application of soft set theory to a decision making problem using rough sets. The same authors have also published

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a detailed theoretical study on soft sets [7]. Chen et al. [8] present a new definition of soft set parameterization reduction, and compare this definition to the related concept of attributes reduction in rough set theory. Most results of fuzzy soft set may be found in [9]. And Maji et al. [6] researched the reduction of weighted soft set. Roy et al. [10] presented a method of object recognition from an imprecise multiobserver data. An example in [10] is used to validate this algorithm, which is only a special case in tabular representation of fuzzy soft set. A counter-example is found to illustrate the problem.

2. Counter-example

Algorithm [10]

1. Input the fuzzy soft sets (F, A), (G, B) and (H, C).
2. Input the parameter set P as observed by the observer.
3. Compute the corresponding resultant fuzzy soft set (S, P) from the fuzzy soft sets (F, A), (G, B), (H, C) and place it in tabular form.
4. Construct the comparison table of the fuzzy soft set (S, P) and compute r_i and t_i for $o_i, \forall i$.
5. Compute the score of $o_i, \forall i$.
6. The decision is S_k if $S_k = \max_i S_i$.
7. If k has more than one value then any one of o_k may be chosen.

Counter example

Let $U = \{o_1, o_2, o_3, o_4, o_5, o_6\}$ be the set of objects. The parameter set $E = \{e_1, e_2, e_3, e_4, e_5, e_6\}$. The tabular representation of the resultant fuzzy soft set and corresponding choice values of objects are as in Table 1.

The comparison table of the Table 1 resultant fuzzy soft set is as in Table 2. Next we compute the row-sum, column-sum, and the score for each o_i as shown in Table 3. According the algorithm in [6], it is clear that the maximum score is 6, scored by o_3, and the decision is in favour of selecting o_3. But here the optimal choice value $max c_i = c_6$ in Table 1; then o_6 is the optimal choice object which is contradictory to the result obtained with the algorithm for fuzzy soft set in decision making problem [10]. Thus the algorithm for fuzzy soft set in decision making problem is incorrect.

From the step 4, the algorithm is revised as below: c_{ij} and r_i should be redesigned as,

$$c_{ij} = \sum_{k=1}^{m} (f_{ik} - f_{jk})$$

Table 1
Resultant table

U	e_1	e_2	e_3	e_4	e_5	Choice value
o_1	0.1	0.5	0.3	0.4	0.3	$c_1 = 1.6$
o_2	0.3	0.5	0.2	0.3	0.6	$c_2 = 1.9$
o_3	0.1	0.7	0.4	0.5	0.1	$c_3 = 1.8$
o_4	0.7	0.2	0.2	0.2	0.3	$c_4 = 1.6$
o_5	0.2	0.6	0.3	0.2	0.3	$c_5 = 1.6$
o_6	0.9	0.2	0.1	0.1	0.8	$c_6 = 2.1$

Table 2
Comparison table

	o_1	o_2	o_3	o_4	o_5	o_6
o_1	5	3	2	4	3	3
o_2	3	5	2	4	3	3
o_3	4	3	5	3	3	3
o_4	2	2	2	5	3	3
o_5	4	2	2	4	5	3
o_6	2	2	2	3	2	5

Table 3
Score table

	Row-sum	Column-sum	Score
o_1	20	20	0
o_2	20	17	3
o_3	21	15	6
o_4	17	23	−6
o_5	20	19	1
o_6	16	20	−4

$$r_i = \sum_{j=1}^{m} c_{ij}$$

where f_{ik} is the membership value of object o_i for the kth parameter, m is the number of parameters. For Table 1, we can obtain $r_1 = -1.0$, $r_2 = 0.8$, $r_3 = 0.2$, $r_4 = -1.0$, $r_5 = -1.0$, $r_6 = 2.0$. Step 5: the decision is k if $r_k = \max_i r_i$. So the decision is object o_6, which is identical to the decision according to the method in [6].

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