Available online at http://scik.org
J. Math. Comput. Sci. 11 (2021), No. 1, 832-838
https://doi.org/10.28919/jmcs/5211
ISSN: 1927-5307

AN APPLICATION OF SIMILARITY OF FUZZY SOFT SETS IN RECRUITMENT PROBLEM

TRIDIV JYOTI NEOG*, BIJU KUMAR DUTTA

Department of Mathematics, Assam Kaziranga University, Jorhat, India

Abstract: Uncertainty plays an important role in everyday life. The theory of fuzzy soft sets is an important tool to deal with uncertainty. This paper aims to study the notion of similarity of fuzzy soft sets and its application in a decision making problem. We have taken a hypothetical case study while applying the notion of similarity in a recruitment problem.

Keywords: fuzzy set; soft set; fuzzy soft set; similarity of fuzzy soft set.

2010 AMS Subject Classification: 03E72.

1. INTRODUCTION

In 1965, L.A. Zadeh [3] initiated Fuzzy Sets. Fuzzy set theory is a very useful tool to deal with uncertainty. In 1999, D.A. Molodstov [2] initiated Soft Set Theory and showed that fuzzy sets are special cases of Soft Sets. Use of parameters to describe a vague concept was indeed a window towards a new beginning. In 2001, P.K. Maji [5] combined fuzzy sets with soft sets and developed fuzzy soft sets. Ahmed and Kharal [1] studied the notion of fuzzy soft sets and developed some

*Corresponding author
E-mail address: tridivjyoti@gmail.com
Received November 15, 2020

new results.

Similarity measure between fuzzy soft sets has been very widely applied in different fields. It has been applied in pattern recognition, region extraction, coding theory, image processing and in many other areas. The notion of similarity between fuzzy soft sets has been studied by Majumder and Samanta in [4] and Neog and Dutta in [6]. In this paper, we are using our notion of similarity of fuzzy soft sets in solving a decision problem.

2. PRELIMINARIES

In this section, we recall some concepts and definitions which will be needed in the sequel.

2.1. Soft Set [2]

A pair (*F*, *E*) is called a soft set (over *U*) if and only if *F* is a mapping of *E* into the set of all subsets of the set *U*. In other words, the soft set is a parameterized family of subsets of the set *U*. Every set $F(\varepsilon),\ \varepsilon \in E$, from this family may be considered as the set of ε - elements of the soft set (*F*, *E*), or as the set of ε - approximate elements of the soft set.

2.2. Fuzzy Soft Set [5]

A pair (*F*, *A*) is called a fuzzy soft set over *U* where $F : A \to \tilde{P}(U)$ is a mapping from *A* into $\tilde{P}(U)$. Here $\tilde{P}(U)$ represents the fuzzy subsets of *U*.

3. SIMILARITY BETWEEN TWO FUZZY SOFT SETS

In order to define similarity of fuzzy soft sets in our way, first we define scalar cardinality of a fuzzy soft set in the following way.

3.1 Scalar cardinality of a fuzzy soft set

Let (*F*, *E*) be a fuzzy soft sets over (*U*, *E*), where $U = \{c_1, c_2, c_3, ...c_m\}$ and $E = \{e_1, e_2, e_3, ...e_n\}$. The scalar cardinality of (*F*, *E*) is defined as

$|(F, E)| = \sum_j |F(e_j)|$, where $|F(e_j)|$ represent the scalar cardinality of each fuzzy set $F(e_j)$.

3.2 Similarity between two fuzzy soft sets

Let (*F*, *E*) and (*G*, *E*) be two fuzzy soft sets over (*U*, *E*), where $U = \{c_1, c_2, c_3, ...c_m\}$ and $E = \{e_1, e_2, e_3, ...e_n\}$.

Let $(F,E)\tilde{\cup}(G,E) = (P,E)$ and $(F,E)\tilde{\cap}(G,E) = (Q,E)$. We assume that $A = [a_{ij}]$ and $B = [b_{ij}]$ are the fuzzy soft matrices corresponding to the fuzzy soft sets (*P*, *E*) and (*Q*, *E*) respectively.

Let $M((F,E),(G,E)) \in [0,1]$ denote the similarity between the fuzzy soft sets (*F*, *E*) and (*G*, *E*).

We define $M((F,E),(G,E)) = \dfrac{|(Q,E)|}{|(P,E)|}$

3.3. Proposition

Let (*F*, *E*), (*G*, *E*) and (*H*, *E*) be three fuzzy soft sets over (*U*, *E*). Then the following results are valid.

(*i*) $M((F,E),(G,E)) = M((G,E),(F,E))$

(*ii*) $(F,E) = (G,E) \Rightarrow M((F,E),(G,E)) = 1$

(*iii*) $(F,E)\tilde{\cap}(G,E) = \tilde{\varphi} \Leftrightarrow M((F,E),(G,E)) = 0$

(*iv*) $(F,E)\tilde{\subseteq}(H,E)\tilde{\subseteq}(G,E) \quad \Rightarrow M((F,E),(G,E)) \le M((H,E),(G,E))$

Proof

(*i*) Let $(F,E)\tilde{\cup}(G,E) = (P,E)$ and $(F,E)\tilde{\cap}(G,E) = (Q,E)$. Let $A = [a_{ij}]$ and $B = [b_{ij}]$ be the fuzzy soft matrices corresponding to the fuzzy soft sets (*P*, *E*) and (*Q*, *E*) respectively. Then $M((F,E),(G,E)) = \dfrac{|(Q,E)|}{|(P,E)|}$

Since $(F,E)\tilde{\cup}(G,E) = (G,E)\tilde{\cup}(F,E)$ and $(F,E)\tilde{\cap}(G,E) = (G,E)\tilde{\cap}(F,E)$, the proof is obvious.

(*ii*) Here $(F,E)\tilde{\cup}(G,E) = (F,E)\tilde{\cup}(F,E) = (F,E)$

and $(F,E)\tilde{\cap}(G,E) = (F,E)\tilde{\cap}(F,E) = (F,E)$.

respectively. Then $M((F,E),(G,E)) = \dfrac{|(F,E)|}{|(F,E)|} = 1$.

(*iii*) Here $(F,E)\tilde{\cap}(G,E)=\tilde{\varphi}$ so that $|(F,E)\tilde{\cap}(G,E)|=0$

and hence $M((F,E),(G,E))=0$.

(*iv*) Let $(F,E)\tilde{\subseteq}(H,E)\tilde{\subseteq}(G,E)$

Then $\forall e\in E, F(e)\le H(e)\le G(e) \Rightarrow \forall e\in E, F(e)\cap G(e)\subseteq H(e)\cap G(e)$.

It follows that $M((F,E),(G,E))\le M((H,E),(G,E))$

4. Application in Decision Making

4.1. Significantly Similar Fuzzy Soft Sets

Let (F,E) and (G,E) be two fuzzy soft sets over the same soft universe (u, e). these two fuzzy soft sets will be called significantly similar if $M((F,E),(G,E))\ge 0.5$

4.2. Illustration

Suppose an organization wants to recruit a person for the post of Personal Relation Officer.

Let U = {u_1, u_2} be the universal set, where u_1 = Can be recruited and u_2 = Can't be recruited.

Let E = {e_1(good communication skill), e_2(command over computer skill), e_3(pleasing personality), e_4(confident), e_5(confused)} be the set of parameters under consideration for recruitment by the organization.

Step 1. A model fuzzy soft set is set by an expert committee of the organization.

Step 2. We form the fuzzy soft set of parameters for each candidate.

Step 3. We find the similarity of the model fuzzy soft set and the fuzzy soft set for each candidate. In this way, we can find the significantly similar fuzzy soft sets.

Step 4. Higher the similarity value, greater is the chance for recruitment.

Table 1 (Model fuzzy soft set for recruitment as Personal Relation Officer)

(F,E)	e_1	e_2	e_3	e_4	e_5
u_1	1.0	0.8	0.9	0.9	0.2
u_2	0.0	0.2	0.1	0.1	0.8

Table 2 (Fuzzy soft set for 1st candidate)

(F,E)	e_1	e_2	e_3	e_4	e_5
u_1	0.6	0.5	0.8	0.7	0.4
u_2	0.5	0.3	0.2	0.1	0.5

Table 3 (Fuzzy soft set for 2nd candidate)

(F,E)	e_1	e_2	e_3	e_4	e_5
u_1	0.6	0.4	0.8	0.6	0.5
u_2	0.2	0.5	0.3	0.5	0.4

Case (I) (Similarity between (F,E) and (F_1,E))

$$(F,E)\tilde{\cup}(F_1,E)=(P_1,E)$$

(P_1,E)	e_1	e_2	e_3	e_4	e_5
u_1	1.0	0.8	0.9	0.9	0.4
u_2	0.5	0.3	0.2	0.1	0.8

$$(F,E)\tilde{\cap}(F_1,E)=(Q_1,E)$$

(Q_1,E)	e_1	e_2	e_3	e_4	e_5
u_1	0.6	0.5	0.8	0.7	0.2
u_2	0.0	0.2	0.1	0.1	0.5

The fuzzy soft matrices corresponding to these two fuzzy soft sets (P_1,E) and (Q_1,E) are given by,

$$A_1 = \begin{bmatrix} 1.0 & 0.8 & 0.9 & 0.9 & 0.4 \\ 0.5 & 0.3 & 0.2 & 0.1 & 0.8 \end{bmatrix}$$

$$B_1 = \begin{bmatrix} 0.6 & 0.5 & 0.8 & 0.7 & 0.2 \\ 0.0 & 0.2 & 0.1 & 0.1 & 0.5 \end{bmatrix}$$

We have,

$$\begin{aligned}
|(P_1,E)| &= |A_1| \\
&= |P_1(e_1)|+|P_1(e_2)|+|P_1(e_3)|+|P_1(e_4)|+|P_1(e_5)| \\
&= 1.5+1.1+1.1+1.0+1.2 \\
&= 5.9 \\
|(Q_1,E)| &= |B_1| \\
&= |Q_1(e_1)|+|Q_1(e_2)|+|Q_1(e_3)|+|Q_1(e_4)|+|Q_1(e_5)|
\end{aligned}$$

$= 0.6 + 0.7 + 0.9 + 0.8 + 0.7$

$= 3.7$

Thus we have $M((F,E),(F_1,E)) = \dfrac{|(Q_1,E)|}{|(P_1,E)|} = \dfrac{3.7}{5.9} \approx 0.63$

Case (I) (Similarity between (F,E) and (F_2,E))

$(F,E)\tilde{\cup}(F_2,E) = (P_2,E)$

(P_2,E)	e_1	e_2	e_3	e_4	e_5
u_1	1.0	0.8	0.9	0.9	0.5
u_2	0.2	0.5	0.3	0.5	0.8

$(F,E)\tilde{\cap}(F_2,E) = (Q_2,E)$

(Q_2,E)	e_1	e_2	e_3	e_4	e_5
u_1	0.6	0.4	0.8	0.6	0.2
u_2	0.0	0.2	0.1	0.1	0.4

The fuzzy soft matrices corresponding to these two fuzzy soft sets (P_2,E) and (Q_2,E) are given by,

$$A_2 = \begin{bmatrix} 1.0 & 0.8 & 0.9 & 0.9 & 0.5 \\ 0.2 & 0.5 & 0.3 & 0.5 & 0.8 \end{bmatrix}$$

$$B_2 = \begin{bmatrix} 0.6 & 0.4 & 0.8 & 0.6 & 0.2 \\ 0.0 & 0.2 & 0.1 & 0.1 & 0.4 \end{bmatrix}$$

We have,

$|(P_2,E)| = |A_2|$

$= |P_2(e_1)| + |P_2(e_2)| + |P_2(e_3)| + |P_2(e_4)| + |P_2(e_5)|$

$= 1.2 + 1.3 + 1.2 + 1.4 + 1.3$

$= 6.4$

$|(Q_2,E)| = |B_2|$

$= |Q_2(e_1)| + |Q_2(e_2)| + |Q_2(e_3)| + |Q_2(e_4)| + |Q_2(e_5)|$

$= 0.6 + 0.6 + 0.9 + 0.7 + 0.6$

$= 3.4$

Thus we have $M((F,E),(F_2,E)) = \frac{|(Q_2,E)|}{|(P_2,E)|} = \frac{3.4}{6.4} \approx 0.53$

In view of our discussion, we can conclude that the first candidate has greater chance of recruitment.

5. Conclusion

We have applied the notion of similarity of fuzzy soft sets in a decision problem. It is hoped that our findings would help enhancing this study in fuzzy soft sets.

ACKNOWLEDGEMENT

Our special thanks to the reviewers and editor of the journal for their valuable comments and suggestions.

Conflict of Interests

The authors declare that there is no conflict of interests.

References

[1] B. Ahmad, A. Kharal, On Fuzzy Soft Sets, Adv. Fuzzy Syst. 2009 (2009), 586507.

[2] D.A. Molodstov, Soft Set Theory - First Result, Comput. Math. Appl. 37 (1999), 19-31.

[3] L. A. Zadeh, Fuzzy sets, Inform. Control, 8(3)(1965), 338-353.

[4] P. Majumdar, S.K. Samanta, On similarity measures of fuzzy soft sets. Int. J. Adv. Soft Comput. Appl. 3(2) (2011), 1-8.

[5] P. K. Maji, R. Biswas, A.R. Roy, Fuzzy Soft Sets, J. Fuzzy Math. 9(3) (2001), 589 - 602.

[6] T.J. Neog, B.K. Dutta, On Fuzzy Soft Relations and Similarity of Fuzzy Soft Sets, Int. J. Mod. Eng. Res. 9(4) (2019), 8-17.