

ANDROID APP FOR MATCH MAKING PROCESS USING FUZZY MULTI-ATTRIBUTE DECISION MAKING METHOD

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ABSTRACT

This paper examines the multi-attribute decision making problem using the attribute values and the fuzzy linguistic weights given by the users. Many online systems that available in Internet are lacking many features for match making process. Many of the online match making websites couldn't select perfect match because they follow simple DSS (Decision Support System). In order to overcome this problem, we propose an Android App using the fuzzy logic based multi-attribute decision making for the match making process. First of all, various criteria are considered for match making process. Second, the different criteria will be given linguistic fuzzy weight terms depends upon the importance given by the user. Third, depends upon the assigned weight terms Fuzzy Scaled Weight (FSW) is calculated for all the criteria. Fourth, Cumulative Fuzzy Value (CFV) is calculated for the specific male or female user from FSW values. Finally, all the opposite sex users found to be match for the male or female user will arranged according to the Cumulative Fuzzy Value. Android App based Match making system

using Fuzzy Decision Making method is developed to illustrate above match making process.

Key Words : Fuzzy decision making method; linguistic variables; fuzzy set.

I. INTRODUCTION

Decision Support Systems (DSS) are useful for business organizations for making right decision at the right time. A DSS Software supports the managers of any organization in the decision making process. DSS tool takes input from users past business experience or real time business data to solve any decision making problem. Intelligent Decision making systems make use of Artificial Intelligence concepts and provides solutions like an expert in the specific field. Many Decision Support Systems are implemented in the field like Medicine, purchase, sales, agriculture and provide real time intelligent decisions like our human brain. Nowadays Smart phones become like an essential organ of human being. Android Smart phones created a communication revolution in telecommunication industry. Online match making websites are used by today's youngsters and also adults who are still single and seeking for a soul mate. So matchmaking system is a useful source for them to get a perfect match in today's life. Since the available online match making websites are not providing proper and perfect match for males as well as females, we propose Android

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App based Decision Making System using Fuzzy Logic.

II. LITERATURE REVIEW

In [1], Baldwin and Gramlich provided a solution for on-line matchmaking intended to support the users by authenticating their matches and notify when both the male and female partners agree. In our earlier work [6], we proposed human resource recruitment process using Fuzzy triangular sets approach. In [12], Shanshan Wang *et al*, 2012, proposed a financial decision making using fuzzy logic. They developed a semantic model for financial decision making using fuzzy logic. In [9], Shuhadah Othman and Etienne Schneider, 2010 presented the use of fuzzy if-then rules for a decision support system in stock trading for giving benefits to investors. In [7], Ping-Teng Chang and Lung-Ting Hung, 2015 proposed an improved decision making approach based on Fuzzy numbers for medical diagnosis. We propose the fuzzy logic based multi-attribute decision making process for the Mobile App based match making process, which is based on fuzzy set theory.

III. BASIC CONCEPTS OF A FUZZY SET

In the year 1965, the Fuzzy Logic concept was introduced by Lotfi Zadeh in his seminal paper [11]. Let U be the universe of discourse, $U = \{u_1, u_2, \dots, u_n\}$. A fuzzy set N in the universe of discourse U can be represented by

$$N = \{u_i, f_N(u_i) \mid u_i \in U\} \quad (1)$$

Let N and L be two fuzzy sets of the universe of discourse U , $U = \{u_1, u_2, \dots, u_n\}$ and let

f_N and f_L be the membership functions of the fuzzy sets N and L , respectively, where

$$f_N : U \rightarrow [0,1], : U[0,1],$$

$$f_L : U \rightarrow [0,1], N = \{u_i, f_N(u_i) \mid u_i \in U\},$$

$L = \{u_i, f_L(u_i) \mid u_i \in U\}$. and . The union of the fuzzy sets N and L , denoted

as $N \cup L$, is defined by

$$N \cup L = \{u_i, f_{N \cup L}(u_i) \mid f_{N \cup L}(u_i) = \text{Max}(f_N(u_i), f_L(u_i)), u_i \in U$$

(2) The intersection of the fuzzy sets N and L , denoted as $N \cap L$, is defined by

$$N \cap L = \{u_i, f_{N \cap L}(u_i) \mid f_{N \cap L}(u_i) = \text{Min}(f_N(u_i), f_L(u_i)), u_i \in U$$

(3)

The cardinality $|N|$ of the fuzzy set N is defined by

$$|N| = \sum_{i=1}^n f_N(u_i) \quad (4)$$

[1] A fuzzy number is a fuzzy subset in the universe of discourse U that is both convex and normal [5].

In the following, I introduce the simplified arithmetic operations of triangular fuzzy numbers [5].

Let E and L be two triangular fuzzy numbers, where

$$E = (a_1, b_1, c_1)$$

$$L = (a_2, b_2, c_2)$$

(1) Fuzzy Numbers Addition \oplus :

$$E \oplus L = (a_1, b_1, c_1) \oplus (a_2, b_2, c_2)$$

$$= (a_1 + a_2, b_1 + b_2, c_1 + c_2).$$

Fuzzy Numbers Addition :

$$\begin{aligned}
 E \ominus L &= (a1, b1, c1) \ominus (a2, b2, c2) \\
 &= (a1 - c2, b1 - b2, c1 - a2).
 \end{aligned}
 \tag{6}$$

(3) Fuzzy Numbers Multiplication \otimes :

$$\begin{aligned}
 E \otimes L &= (a1, b1, c1) \otimes (a2, b2, c2) \\
 &= (a1 \times a2, b1 \times b2, c1 \times c2)
 \end{aligned}
 \tag{7}$$

(4) Fuzzy Numbers Division \oslash :

$$\begin{aligned}
 E \oslash L &= (a1, b1, c1) \oslash (a2, b2, c2) \\
 &= (a1/c2, b1/b2, c1/a2).
 \end{aligned}
 \tag{8}$$

IV. FUZZY DECISION MAKING METHOD

Representing the decision problem and evaluating the Fuzzy decision criteria are the two steps in the Fuzzy Decision Support System. We have to identify clearly the decision making criteria for Fuzzy Decision Support System, then only the system will provide correct decision. In the decision making step, first of all we need to linguistic variables depend upon the importance given by the specific user. Secondly, we need to evaluate weight value for the specific criteria. Thirdly, we need to find the sum of all weights for all criterial. The linguistic variable represents the numeric weight of the decision criteria. We need to find out the fuzzy membership function for each and every criteria of match making process. Fuzzy membership function will provide the fuzzy values from 0 to 1. We can identify the specific criteria weight by analyzing the fuzzy membership values. In our Android App based match making system, We the linguistic variables such as Very High,

High, Medium, Low, Very Low for all the match making criteria.

The following fuzzy membership function for the triangular fuzzy set is used in our match making process. The triangular Fuzzy membership values are calculated depends upon the importance given by the male or female partner. Although Trapezoidal Fuzzy membership function is also available, we strongly feel that Triangular fuzzy membership functions are most suitable for our Android App based match making process.

$$f_M(x) = \begin{cases} \frac{(x-a)}{(b-a)}, & a \leq x \leq b, \\ \frac{(x-c)}{(b-c)}, & b \leq x \leq c, \\ 0, & otherwise \end{cases} \tag{9}$$

Let W_i be the triangular fuzzy number of the decision criterion C_i , F_i be the fuzzy membership value of the decision criterion C_i and X_i be the FSW of the decision criterion C_i , that is obtained by fuzzy multiplication of F_i and W_i . I have applied the fuzzy arithmetic operations to calculate the FSW value for all the criteria considered and calculate CFV value [3]. (Fuzzy arithmetic operations are discussed in section 2).

Let say Fuzzy triangular number weight of the criterion C_i be (a_i, b_i, c_i) and Fuzzy membership set for the criterion C_i be (F_i, F_i, F_i) of any applicant, FSW value X_i for the criterion C_i is calculated as the following:

$$X_i = \frac{((a_i, b_i, c_i) \otimes (F_i, F_i, F_i))}{(a_i, b_i, c_i)} \quad (10)$$

For finding out the CFV for n criteria, the following formula can be applied

$$CFV = \frac{\sum_{i=1}^n F_i \cdot W_i}{\sum_{i=1}^n W_i} \quad (11)$$

Substituting F_i and W_i with triangular fuzzy numbers, we can calculate CFV triangular value all the applicants for the particular post they applied. After calculating CFV triangular values for all the applicants, FFV is calculated aggregating both IFV and CFV triangular values depends upon the weights assigned respectively by the HR manager using the following formula. [9]

$$FFV = \frac{(CFV \otimes W_1) \oplus (IFV \otimes W_2)}{(W_1 \oplus W_2)} \quad (12)$$

In order to defuzzify the fuzzy sets value, we must use any defuzzification method. There are various defuzzification methods are available in the Fuzzy sets. We use a defuzzification method followed by Shyi-Ming Chen and Yu-Chuan Chen to defuzzify the triangular fuzzy number K into a crisp value. Assume that K is a triangular fuzzy

number, $K=(x,y,z)$ and $DEF(K)$ denotes the defuzzified value of the triangular fuzzy number K , then

$$DEF(K) = \frac{(x+2y+z)}{4} \quad (13)$$

Finally, Online system administrator can send sms or email to specific user according to the defuzzified fuzzy value.

V. APPLICATION

The proposed Fuzzy Decision making is implemented for match making process for the registered male and female partners in the Android App.

We implement this Fuzzy Decision Support System is to select the suitable match for the registered male and female partners in the database. We fix the following decision criteria for the Fuzzy match making system: $C = \{C_1, C_2, C_3, C_4, C_5, C_6, C_7\}$, where $C_1 =$ age, $C_2 =$ Religion, $C_3 =$ height, $C_4 =$ weight, $C_5 =$ state name, $C_6 =$ color expected. The decision criteria are defined as follows: $C = \{\text{Age, Qualification, height, Languages Known, weight, religion, state}\}$. Decision making method is illustrated in the figure 2.

We use the linguistic variables of the decision criteria as High, Very High, Medium, Very Low, Low. The triangular fuzzy numbers for the above linguistic variables are defined in Table 1.

Linguistic Variable	Triangular Fuzzy Number
Very Low (VL)	(0.0,0.0,0)
Low (L)	(0.05,0.3,0.4)
Medium (M)	(0.4,0.5,0.6)
High (H)	(0.5,1.0,1.0)
Very High (VH)	(1.0,1.0,1.0)

Table 1 Triangular Fuzzy Number corresponding to each Linguistic Value

We implement the triangular fuzzy numbers for the respective linguistic variable using the above table. Fuzzy triangular set values are calculated using the Equation (11) and Equation (12). In order to identify the suitable life partner, we take many criteria such as age, height, weight, job, race, religion, caste, color, hobbies, personal interests, food habits, languages known, personal characteristics are considered. Android App based match making System model is explained in the following figure. (Fig. 1)

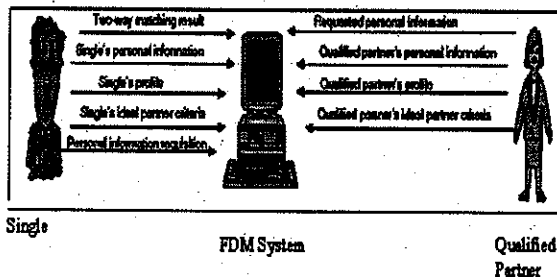


Figure 1 ANDROID APP BASED fdm system

VI. ANDROID APP BASED MATCH MAKING PROCESS USING FUZZY LOGIC

In the FDM model, first of all, the fuzzy triangular value will be calculated for the male or female user according to the linguistic values assigned by the male or female user for each criteria. Then

Cumulative Fuzzy Value (CFV) will be calculated for each user. Then, the FDM system will match the male or female user profile criteria with opposite sex profile. Then the FDM System will give Cumulative Fuzzy Values (CFV) according to the perfect matching. Finally, the CFV triangular values will be defuzzified by equation (13). The male or female user has to give linguistic weights for their ideal partner criteria as shown in the screen. (Fig 2). The Android App system administrator can notify through SMS or email regarding their match.

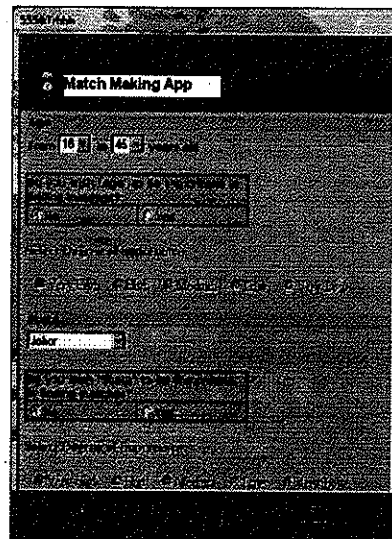


Figure 2. Android App Screen for setting ideal partner criteria

VII. CONCLUSION

We developed the Android App based match making process using Fuzzy logic based decision making for match making. Triangular Fuzzy sets concepts and Fuzzy arithmetics are working background in this Mobile App. This android application will be useful

for men and women who want to find their perfect match for them. This smart phone app is easy to use and will suggest most probable matching for men and women using their own criteria like age, color, height, job and so on. This Android App consider the various criteria for match making process and the different criteria will be given linguistic terms based fuzzy weights depends upon the importance given by the user. Since the Android App is using Artificial Intelligence Concept Fuzzy Logic, it mimics the human brain oriented decision making for match making process.

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