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A replacement of marriage matchmakers: a measurement of love value for a married life using fuzzy logic

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Abstract: In this paper, we propose a new measurement metric of love/attraction between a male and a female for getting married based on a few inputs by using fuzzy logic technology. A difference in physical attraction, social status and success in their respective fields are necessary to be measured for the calculation of love. As the behaviours and status of persons are full of uncertain, fuzzy logic technology is a perfect to be used in this context. In this paper, all the inputs are taken as fuzzy, and finally, the measurement metric of love is formulated by using a fuzzy inference system. A survey in a semi-urban place Tamluk, West Bengal, India is conducted, and their love value is calculated based on the proposed approach. Our new measurement metric of love value will replace the matchmakers in traditional marriage, especially in the survey place. We hope that this approach will also stimulate future studies on fuzzy logic based measurement metrics.

Keywords: Fuzzy logic, love value, physical attraction, social status, success

Introduction: Mediators/ matchmakers of marriage are a middleman who ascertains links between the two parties in a marriage. In the past, it was not the character of Indian society to allow boys and girls to mix freely. This is why the co-operation of mediators was widely adopted to arrange marriages. Numerous were professionals, when the matchmaking resulted in a marriage, the mediators used to be rewarded by both parties.

It shows these matchmakers had a significant role while considering the marriages of their sons and daughters; people practised looking for brides and grooms of higher castes. However, this data was available only with the matchmakers who used to sustain a complete record of different families.

Mediators/matchmakers managed to perform a significant social responsibility by collecting and providing information and helping establish social contacts.

Modern education and foreign culture have significantly decreased the need for mediators today. Professional mediators have almost disappeared. Significant percentages of divorces of marriages are from socially arranged marriages due to mediators. This is one reason for effecting mediator's popularity. Besides, mediators target to match a couple by any cost. They manipulate the records and display among the parties. Thus, they are not an honest source of matchmakers now. This study will replace the methodology of current trends of mediators.

Today, men and women often fall in love and choose to get married without any outside aid. Often friends or relatives, make a formal meeting between the two families. Though the professional mediators are dying, the need for his services persists. In recent researches, it is found that several organisations have commenced doing the work previously done by mediators. There are also some websites on the internet, set up for this purpose. These websites provide advertisements with photographs and complete bio-data of brides and grooms. This study will enhance the criteria of such websites too.

Baron, Kelley & Carroll [1] investigated the negative relationship between materialism and marital satisfaction and mediators that possibly describe this relationship have not been widely examined. They found evidence of partial mediation in that materialism was negatively correlated with the perception of marriage importance, and this corporation partially explained why being materialistic was correlated with lower marital satisfaction. Thus financial planners work with married clients; it is essential that they consider how their clients' materialistic tendencies may influence the family both financially and relationally. Suggestions for future research are discussed.

The inputs for the matchmakers have primarily collected information. This information is not crisp. Thus fuzzy sets are very relative option to represent such information. After, the introduction of the fuzzy set by Zadeh [15], the use of fuzzy logic to remove ambiguity is increased rapidly. Fuzzy inference system is being used to combine several fuzzy inputs to a crisp output. This study includes such an inference system to measure love value. As this measurement is based on fuzzy logic, it does not count human partiality.

1. Preliminaries

The basic notions which are used in the paper, are discussed in this section. The fuzzy set theoretic notations have been defined with diagrams.

1.1 Fuzzy set:

The concept of a fuzzy set is an extension of the classical set. Each member of the fuzzy set has some degree of membership between 0 and 1. Mathematically, a fuzzy set Z in X is defined by

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$$Z = \{x, \mu_z(x): x \in X\}$$

Where $\mu_z(x)$ is called mema bership function of x in Z and the value of $\mu_z(x)$ is lies between 0 and 1.

$$\mu_z(x) = \begin{cases} 1, x\ is\ strongly\ lies\ in\ X \\ (0,1), x\ is\ partially\ lies\ in\ x \\ 0, x\ is\ not\ in\ X. \end{cases}$$

An example of a membership function is shown in the following Fig.1.

Therefore, the membership function is a mapping from an input set to the degree of membership between 0 and 1. The following equation gives a triangular membership function (Fig.2)

$$\mu_z(x) = \begin{cases} \dfrac{x-a}{b-a}\ if\ a \le x < b \\ 1\ if\ x = b \\ \dfrac{c-x}{c-b}\ if\ b \le x < c \\ 0\ otherwise \end{cases}$$

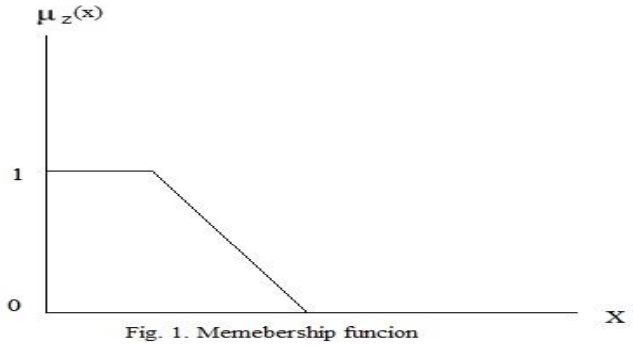

Fig. 1. Memebership funcion

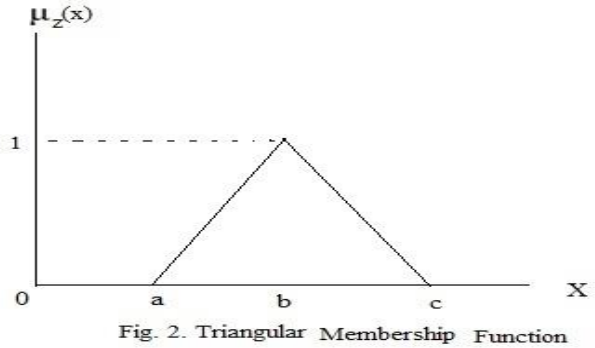

Fig. 2. Triangular Membership Function

1.2 Fuzzy logic:

Fuzzy logic is one of the branches of the fuzzy set [11] theory. It is different from traditional logic that an element in the set has two values 1 (true) and 0 (false), which indicates either the element belong entirely to the set or not. In the real world, we

have more ambiguities, vague concepts which humans feel easy to communicate and understand. Fuzzy logic [12] can deal with these real-world ambiguities and fuzziness. Fuzzy logic has applications in many fields [14] ranging from control, automation technology, robotics, image processing, pattern recognition, medical diagnosis etc. Every day many home appliances are being upgraded using fuzzy logic to save time and to conserve electricity.

1.3 Linguistic variables:

Linguistic variable [13] plays an essential role in the application of fuzzy logic. Linguistic variables are variables whose values are words in a language. 'Age' is a linguistic variable whose values are young, middle age, old and very old. Every value of the linguistic variable has a membership function. Graphical presentation of the linguistic variable 'age' is shown below (Fig.3).

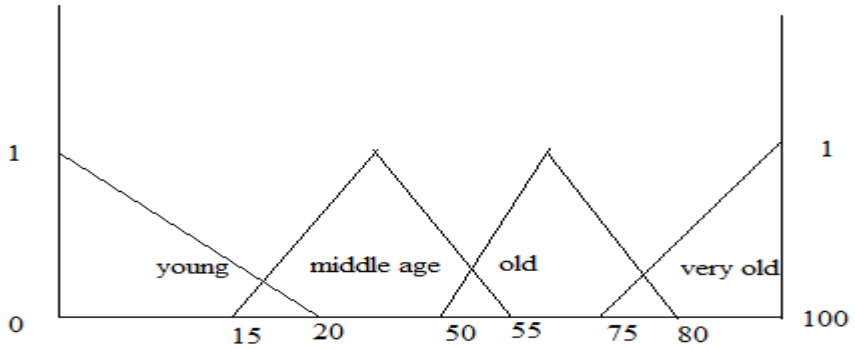

Fig. 3. Linguistic variable 'age'.

1.4 Fuzzy Inference System:

The process of formulating a mapping from a given input set to output using fuzzy logic is known as fuzzy inference system. Fuzzy inference system consists of four parts: fuzzification, fuzzy rule base, fuzzy inference, and defuzzification. The system is shown below (Fig.4).

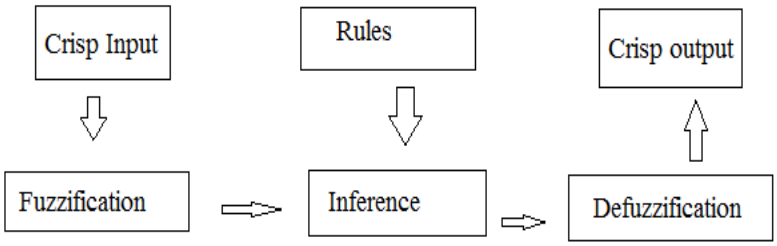

Fig. 4. Fuzzy Inference System

2. Calculation of Love Value:

In the proposed calculation, nine inputs have been taken. It is classified into three major categories as follows.

1. A difference in the physical attraction (phy_attr_diff): It is a significant parameter for the measurement of love between a couple. Moreover, hence it can not be ignored while thinking of replacement of mediator/ matchmaker in marriage. This input has three sub-inputs
    - The **age difference** between a couple
    - A **height difference** between a couple
    - **Skin colour difference** between a couple
2. The difference in social status (soc_diff): Social status is also an essential parameter for marriage. It also has three inputs.
    - **Cast difference** between a couple
    - **Religion difference** between a couple
    - **Culture difference** between a couple
3. The difference in success (suc_diff): Success in terms of jobs, economy and education background plays a significant role in the calculation of proposed love value. The sub-inputs are as follows.
    - **Profession difference** between a couple
    - **Economy difference** between a couple
    - **Education difference** between a couple

In this study, the fuzzy logic toolbox of MATLAB 16a MAMDANI has been used. Three linguistic values LOW, MEDIUM (AVERAGE) and HIGH are used for these sub-inputs (see Table 1). For each category, the outputs (intermediate layers) are taken same as inputs LOW, MEDIUM (AVERAGE) and HIGH. At first, the rule base for the parameter on the difference of physical attraction (phy_attr_diff) is created and run for the results. Similar approaches have been taken for other two parameters, i.e. difference on social status (soc_diff) and the difference in success (succ_diff). After the compilation of all three categories, these three outputs (intermediate layers) are taken as inputs for love measurement (love_value).

Table 1: Structure of calculation of love value

Inputs	Intermediate layers	Output
Age difference	Difference in the physical attraction	
Height difference		
Skin colour difference		
Cast difference		

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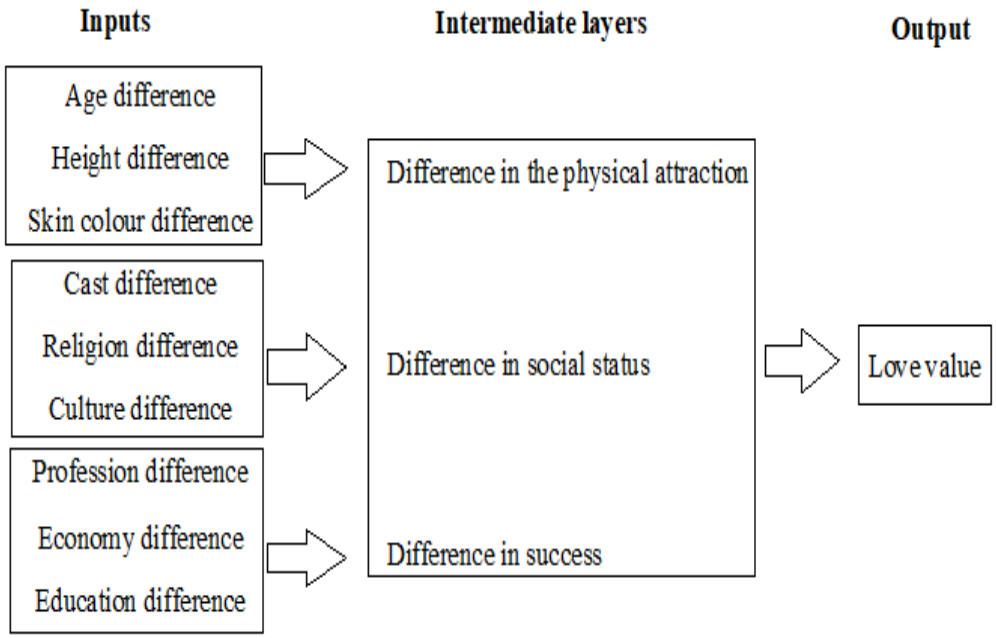
Religion difference	Difference in social status	Love value
Culture difference		
Profession difference	Difference in success	
Economy difference		
Education difference		



Thus, to find the final love value, three major inputs such as phy_attr_diff, Soc_diff, Succ_diff are assumed as mentioned earlier. The outputs are taken into five categories AMBIGUOUS (very low), HEDONISTIC (low), VOLAPCHOICE (average), INTELLECTUAL (high) and WELL ROUNDED (very high). The rule base is taken maintaining uniformity

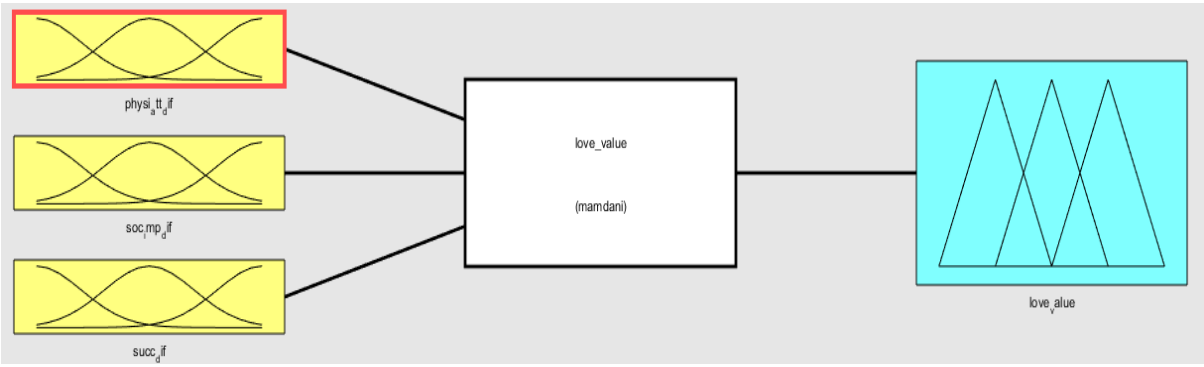


Fig. 5: Structure of fuzzy inference system for love_value

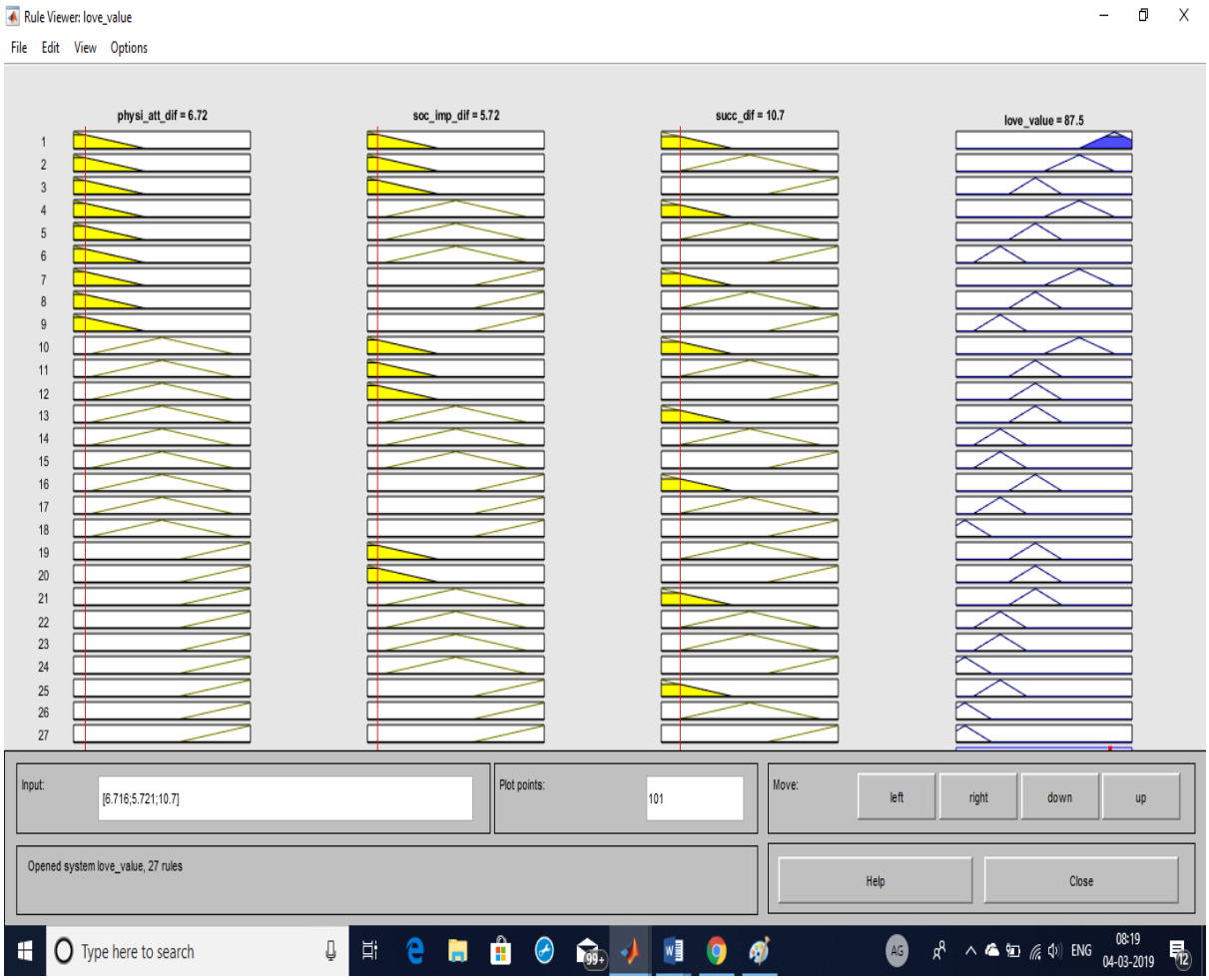


Fig. 6: Low differences as inputs resulted in high love_value as output

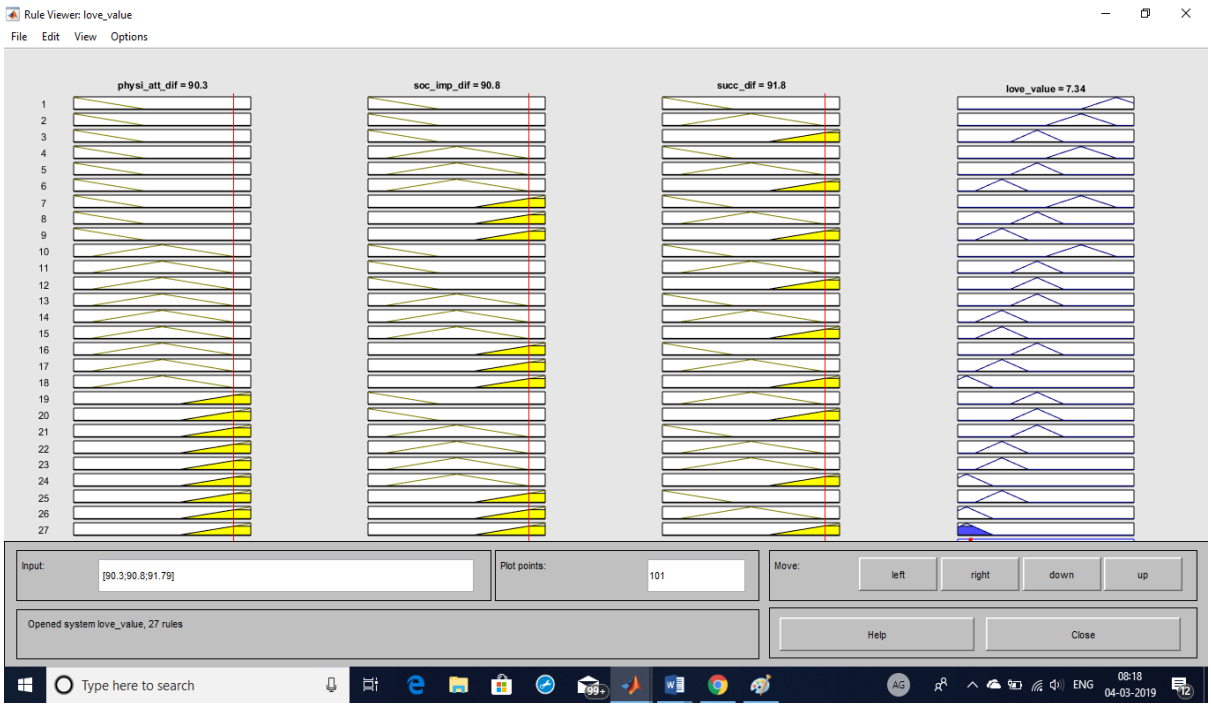


Fig. 7: High difference inputs resulted in low love_value as output

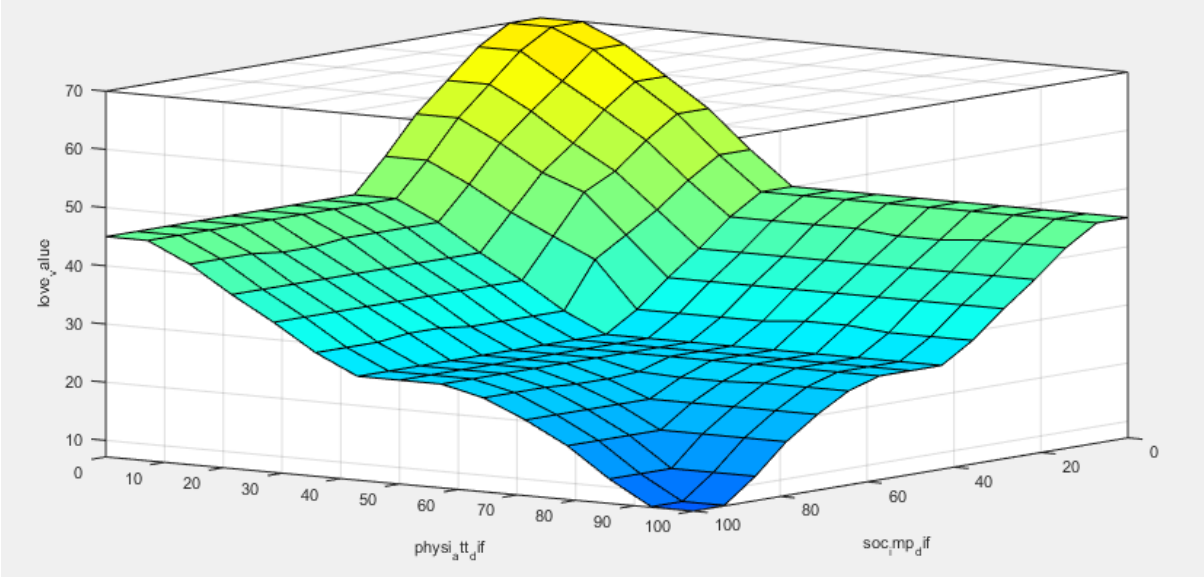


Fig. 8: Surface view of the proposed rule base

Justification of the results:

In Figure 5, the fuzzy inference system based on three inputs and one output is shown. In Figure 6, the three inputs have been given with very low value. Moreover, the expected love_value is very high. In this case, the input values and output values are tabulated in the first row in Table 1 as follows. In the second row, the values corresponding to Figure 7 has been shown. It is noticeable that if a difference is very high then corresponding love_value is very low as expected.

	phy_attr_diff	soc_diff	Suc_diff	Love_value
Figure 6	6.72%	5.72%	10.7%	87.5%
Figure 7	90.3%	90.8%	91.8%	7.34%

Table 1: Input and output values of Figure 6 and Figure 7

The complete idea can be drawn from Figure 8, where a three-dimensional surface view has been shown. This view reflects our proposed rule base. From the surface view, one can find the love_value for any point in the space where three axes denote phy_attr_diff, suc_diff, soc_diff respectively.

Field Survey of Love Value

A sample size of 500 couple in the town Tamluk, WB, India has been captured in this study. The details of few such surveys have been displayed as follows. The extreme right column displayed the love_value calculated by the proposed method.

Tusar Chandra & sudehna das

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			39.0
34/26	5.8/5.4	w/w	Obc/ GEN	Hindu/ Hindu	High/ Low	Army/H.W	High/Low	HS/HS	
53.6	33.2	0	50	0	100	50	100	0	
18.1			50			50			

Amitava khanara & Tanushree maity

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.5
32/20	5.6/5.3	w/w	Gen/ Gen	Hindu/ Hindu	Mid/ high	Army/H.W	Mid /High	B.A/H.S	
80.4	24.9	0	0	0	50	50	50	25	
44.4			13			50			

Ganesh Mondal &Moumita Mondal

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.5
25/20	5.9/5.2	w/Brown	Gen/ Gen	Hindu/ Hindu	Mid/ high	Govt S/H.W	High/Low	H.S/ B.A	
33.5	58.1	50	0	0	50	100	100	25	
50			13			58.9			

Somnath Jana &Gargi Samanta

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.5
28/21	5.7/5.1	Brown/w	Gen/ Gen	Hindu/ Hindu	Mid/ high	Busi/H.W	Mid /High	B.A/H.S	
46.9	49.8	50	0	0	50	25	50	25	
50			13			41.1			

Mritunjoy Chandra &Kalpana Patra

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.5
33/20	5.4/5.2	Brown/brown	Gen/ Gen	Hindu/ Hindu	Mid/ high	Busi/H.W	High/Low	8^{th}/H.S	
87.1	16.6	0	0	0	50	25	100	75	
48.9			13			58.9			

Kartik Maity &Suchitra Maity

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.3
34/22	5.2/4.4	Brown/Whait	Gen/Gen	Hindu/Hindu	Mid/High	Tech/HW	Mid/High	HS/BA	
80.4	83	50	0	0	50	75	50	25	
68			13			50			

Alak Kr Maji & Sefali Mondal

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
31/23	5.4/5.3	Black/Whait	Gen/Gen	Hindu/Hindu	High/Low	Tech/HW	High/Mid	M.Sc/HS	
53.6	8.3	100	0	0	100	75	50	75	
50			50			58.9			

Kushik Das & Bipasha Pal

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			61.1
31/23	5.9/5.5	W/W	SC/SC	Hindu/Hindu	Mid/High	Tech/HW	High/Mid	MA/MP	
53.6	33.2	0	0	0	50	75	50	100	
18.1			13			58.9			

Rajesh Dolai & Sanjukta Das

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
32/24	5.8/5.4	Brown/W	Gen/OBC	Hindu/Hindu	Mid/High	Tech/HW	Mid/High	M.Sc/B.A	
53.6	33.2	50	50	0	50	75	50	25	
50			50			50			

Manotosh bag &jhuma Barman

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
32/22	5.5/5.1	Brown/W	SC/OBC	Hindu/Hindu	High/Mid	Tech/HW	Mid/High	MPhill/BSC	
67	33.2	50	25	0	50	75	50	50	
53			41.1			58.9			

Raktim Das & Purabi Jana

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
32/24	5.7/5.1	Brown/W	SC/OBC	Hindu/ Hindu	High/ Mid	Tech/HW	Mid /Mid	M.tac/M.sc	
53.3	49.8	50	25	0	50	75	0	20	
50			41.1			41.1			

Suman Bag & Shilpa Das

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
34/20	5.5/5.4	Brown/W	SC/OBC	Hindu/ Hindu	High/ Mid	Doctor/ HW	Mid /High	Doctor/ BSC	
93.8	8.3	50	25	0	50	100	50	75	
50			41.1			58.9			

Pratap Patra & Mantu Das

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
30/22	5.5/5.1	Black/W	Gen/ OBC	Hindu/ Hindu	High/ Mid	Tech/HW	Mid /High	MA/BA	
53.5	33.2	100	50	0	50	75	50	25	
50			50			50			

Ratan Bagchi & Mita Singha

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.2
35/22	5.5/5.1	Brown/W	OBC/ OBC	Hindu/ Hindu	High/ Mid	Tech/Tech	Mid /High	M.SC/BA	
87.1	33.2	50	0	0	50	0	50	25	
69.5			13			41.1			

Shamal Barman & Susmita Barman

Physical (age_dif+height_dif+ Varna_dif)			Social (caste_dif+religion_dif+ culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
36/22	5.5/5.1	Brown/W	SC/OBC	Hindu/ Hindu	High/ Mid	Prof/HW	Mid /High	M.SC/BA	
93.8	33.2	50	25	0	50	100	50	25	
69.5			41.1			50			

Susil Giri & Namita Das

Physical (age_dif+height_dif+ Varna_dif)	Social (caste_dif+religion_dif+ culture_dif)	Economy(profession_dif+eco_dif+edu_dif)	25.0

24/22	5.5/5.1	Black/W	SC/OBC	Hindu/Hindu	High/Mid	Farm/HW	Mid/High	BSC/HS	
13.4	33.2	100	25	0	50	25	50	25	
50			41.1			41.1			

Nandan Hait & Namita Sahoo

Physical (age_dif+height_dif+Varna_dif)			Social (caste_dif+religion_dif+culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
29/22	5.5/5.1	Black/W	Gen/OBC	Hindu/Hindu	High/Mid	Bank/HW	Mid/High	BSC/HS	
46.9	33.2	100	25	0	50	75	50	25	
50			41.1			50			

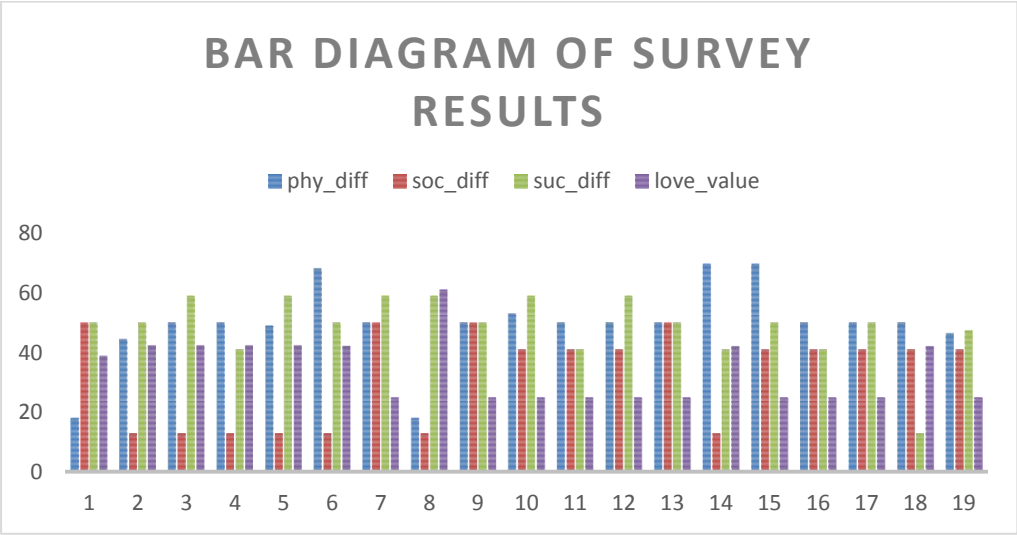
Sankar Sasmal & Madhu Maity

Physical (age_dif+height_dif+Varna_dif)			Social (caste_dif+religion_dif+culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			42.2
27/21	5.5/5.1	Brown/W	SC/OBC	Hindu/Hindu	High/Mid	Farmar/HW	Mid/High	HS/HS	
40.2	33.2	50	25	0	50	0	50	0	
50			41.1			13			

Nanda Garu & Mansi Das

Physical (age_dif+height_dif+Varna_dif)			Social (caste_dif+religion_dif+culture_dif)			Economy(profession_dif+eco_dif+edu_dif)			25.0
24/20	5.5/5.1	Brown/W	SC/OBC	Hindu/Hindu	High/Mid	Hotel/HW	Mid/High	MP/HS	
26.8	33.2	50	25	0	50	35	50	25	
46.4			41.1			47.3			

Conclusions and Remarks:



Actually, in the tradition of West Bengal, India mediators of social marriage collect information about the proposed matching. However, due to human calculation and partiality in mind, few cases of social marriage do not long expect time. This study shows that if nine inputs are collected, the love value can be calculated neutrally without the help of matchmakers. Based on the values, the couple may arrange their life accordingly.

Technically, this study has some drawbacks. For example, the height difference is taken without mentioning male and female. The current social trends that male height should be higher than female and hence some relaxation on female heights are assumed normal. Similarly, other cases are also relaxed for a female in the locality of West Bengal, India. These notions are ignored. Thus, the study results are slightly below the expectations of the couples in the survey.

The benefits of the study lie on the fact that unknown couple can arrange marriage based on only nine inputs as described in the study. The rule base is furnished based on uniformity. In future, this study will enhance the decision making criteria of robotics, i.e. without human experts for the social marriage.

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