



## Fuzzy Rule Based Candidate Selection Evaluator by Political Parties

Tohida Rehman

Assistant professor

Department of Computer Science

Surendranath College (C.U) 24/2 M.G Road

Kolkata, India

**Abstract:** Selection is a most important word in the Universe. As per the definition selection is a method to select a something or someone among a group of things or people as being the best or most suitable. So in this paper I describe how a soft computing technology is used to select a candidate from a group of candidate by a political party. The main motive of this work is to show the accurate political decision and increase the faith among parties top leader with other members of that party as well as increase the impression of a political party to the citizens which is sometimes not possible using the traditional nomination procedure. There are no hard and fast rules for calculating the accurate political decision so I think fuzzy logic is the best and suitable tool to used human perception, knowledge, imprecision, vagueness to get the exact selection result.

**Keywords:** Fuzzy Logic, Expert Knowledge, Membership Function, Fuzzy controller, Candidate selection

### I. INTRODUCTION

All party members are interested in winning elections depending on the best selection of a candidate on the ballot paper. Selection can be done for local election, legislative election, and parliamentary election, senate election or any team leader selection. In practice political parties use different institutions to select their candidate but some factors are common for all political parties. So in each selection there are more than hundreds of people willing to stand for election. But it would be impossible for general voters to make a suitable choice. So its party leader responsibility to select an appropriate candidate to win the election using some useful properties such as publicity, number of years attach actively in politics ,responsiveness ,behavior, criminal records ,age and education etc [6] [7].

### II. CONCEPT OF FUZZY LOGIC

The characteristic function of a crisp set assigns a value of either 0 or 1 to each individual in the universe set, thereby discriminating between members and nonmembers of the crisp set under consideration[2] [3]. This function can be generalized such that the values assigned to the elements of the universal set fall within a specified range and indicate the membership grade of these elements in the set. Larger values denote higher degrees of set membership. Such a function is called a membership function, and the set defined by it a fuzzy set.

The most commonly used range of values of membership functions is the unit interval  $[0, 1]$  [1] [8].

Let us consider your family member and their ages Grandfather(80),Grandmother(75),papa(50),mama(45),uncle (40),aunty(38),brother(24),sister(10)

From the above data you can easily defined a set of male members

$A = \{\text{Grandfather, papa, uncle, brother}\}$

But if you want to defined a set of young members? Then how can you define this set using the conventional set

theory? Then you have to use the fuzzy set. In fuzzy logic everything is a matter of degree.

### III. PROPOSED WORK

In this research work, the concept of fuzzy logic Inference system is used to calculate the percentage of chances of selection of a candidate to win the election. There are basically Mamdani and Sugeno types of most commonly used fuzzy inference systems are present in Matlab toolbox named Fuzzy Logic Toolbox[1].

So in this research I have used Mamdani type of FIS to design a fuzzy logic controller to evaluate the chances of selection of a candidate. It has basically five steps to design any fuzzy logic controller such as Fuzzification of the input values, Applications of fuzzy operators on the antecedent part of fuzzy rules, Evaluation of the fuzzy rules, Aggregation of fuzzy sets across the rules i.e. combines the result of the evaluation and Defuzzification of the aggregate fuzzy set to obtain the crisp output values .Here I have used five input parameter and one output parameter.

### IV. DESIGN METHODOLOGY

There is many more parameter which is directly or indirectly depends to win an election. So it's so much Challenging situation to select a most appropriate candidate to winning an election. But after discussion with some expert I have grouped all important factor into five input variable such as publicity-higher publicity have higher chances to win, number of years attach in politics actively-highly attachment have higher chances to selection, Responsiveness, age and education of a candidate .The percentage of chances of selection is an only one output parameter. Here I assumed that the range of all membership functions and the Input and output variables are  $[0, 10]$ .Each input variable has 3 output variable has five membership functions. Here I have used Gaussian membership function to fuzzify the input values.

Each of the values for each input and output linguistic variable is defined below.

Publicity{low,medium,high},noofyears{low,medium,high}, responsiveness{low,medium,high},Age {suitable, most suitable, rare suitable}, education {low, medium, high}, Chancesofselection {less, below-average, average, mid high, high}.

The Gaussian Membership Function is defined by  $G(x; c, \sigma) = \exp[-0.5\{(x-c)/\sigma\}^2]$ . The parameters  $c$  and  $\sigma$  control the center and width of the membership function [9] [12]. Here we consider the value of the  $\sigma=1.75$  input variable and  $\sigma=0.75$  for output variable.

For multiple conjunctive antecedents I have used product method such as for a rule IF  $x$  is  $A^1$  and  $A^2$  and  $A^3$  and  $A^4$  .....and  $A^L$  THEN  $y$  is  $B^s$  [11].

$$(1) \mu A^S(x) = \mu A^1(x) * \mu A^2(x) * \mu A^3(x) \dots * \mu A^L(x)$$

Defuzzification is a process of converting the aggregate output sets into one crisp number for each output variable this is the last step in fuzzy inference variable [4]. The final desired output for each variable is generally a single number. Since the aggregate of the number of fuzzy sets is itself, a fuzzy set. There are several defuzzification methods, such as - Centroid method, Centre of sum method (COS), Mean of Maximum method (MOM) etc [5].

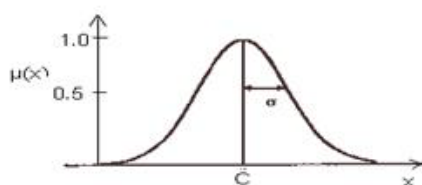


Figure 1 Gaussian membership function

### A. INPUT MEMBERSHIP FUNCTION

The FIS Editor handles the high-level issues for the system. It concerns with number of input and output variables and their names in Matlab. To start this system from scratch, type fuzzy at the MATLAB prompt. The generic untitled FIS Editor opens, with one input, labeled input1, and one output, labeled output1. Then I edited this according to my need as five inputs each of with three membership functions and one output with five membership functions.

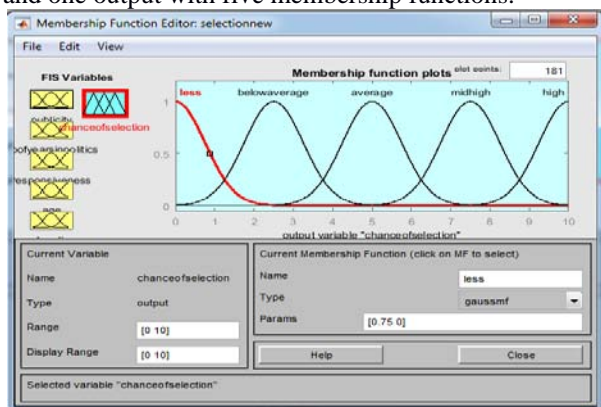


Figure 2 Membership function for input variable

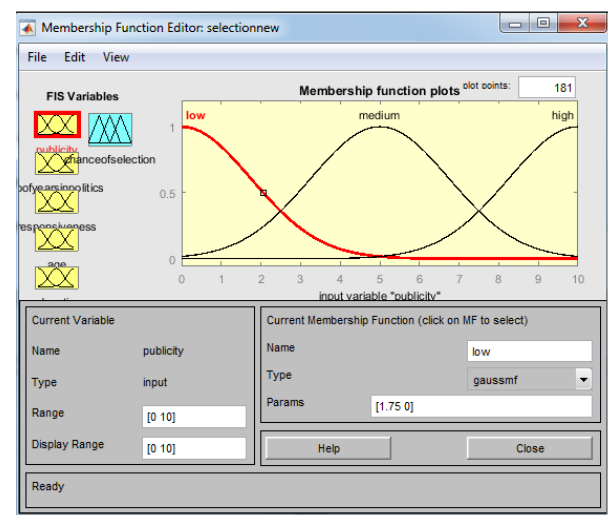


Figure 3 membership functions for output variable

Table 1: Membership Functions for linguistic variables

Values for Linguistic Variables	Membership Functions
Low/ suitable(L/S)	$\mu(x) = \begin{cases} 1 & \text{If } x=0 \\ \exp[-0.5\{(x-0)/1.75\}^2] & \text{If } 0 < x < 5 \\ 0 & \text{Otherwise} \end{cases}$
High/Rare Suitable(H/RS)	$\mu(x) = \begin{cases} 1 & \text{If } X=10 \\ \exp[-0.5\{(x-10)/1.75\}^2] & \text{If } 5 < x < 10 \\ 0 & \text{otherwise} \end{cases}$
Medium/ most suitable(M/ MS)	$\mu(x) = \begin{cases} 1 & \text{If } x=5 \\ \exp[-0.5\{(x-5)/1.75\}^2] & \text{If } 0 < x < 5 \text{ and } 5 < x < 10 \\ 0 & \text{otherwise} \end{cases}$

### B. DETERMINING WHICH RULES TO USE

Each of the input has 3 membership functions, so we would have at most  $3^5=243$  possible combination of if-then rules. But using some Expert's knowledge I have sorted it to 99 rules. When publicity and noofyears both are low value then I consider all the possible combination of the remaining 3 input variables that means no of rules=  $(3*3*3)=27$ . Otherwise age is not mandatory factor for the remaining 8 possible combination of publicity and noofyears. So the remaining no of rules is=  $(8*3*3)=72$ . So the total number of rules is  $(27+72)=99$ . Here P-Publicity, N-Number of years, R-Responsiveness, A-Age, E-Education, CH-Chances of selection.

Table 2-Total 99 rules for chances of selection

#	P	N	R	A	E	CH	#	P	N	R	E	CH	#	P	N	R	E	CH
1	L	L	L	S	L	L	34	L	M	H	L	A	67	M	H	M	L	MH
2	L	L	L	S	M	L	35	L	M	H	M	A	68	M	H	M	M	H
3	L	L	L	S	H	BA	36	L	M	H	H	MH	69	M	H	M	H	H
4	L	L	L	MS	L	L	37	L	H	L	L	A	70	M	H	H	L	H
5	L	L	L	MS	M	BA	38	L	H	L	M	A	71	M	H	H	M	H
6	L	L	L	MS	H	BA	39	L	H	L	H	MH	72	M	H	H	H	H
7	L	L	L	RS	L	L	40	L	H	M	L	A	73	H	L	L	L	A
8	L	L	L	RS	M	L	41	L	H	M	M	MH	74	H	L	L	M	A
9	L	L	L	RS	H	BA	42	L	H	M	H	MH	75	H	L	L	H	MH
10	L	L	M	S	L	L	43	L	H	H	L	MH	76	H	L	M	L	A
11	L	L	M	S	M	BA	44	L	H	H	M	MH	77	H	L	M	M	MH
12	L	L	M	S	H	A	45	L	H	H	H	H	78	H	L	M	H	MH
13	L	L	M	MS	L	BA	46	M	L	L	L	BA	79	H	L	H	L	MH
14	L	L	M	MS	M	BA	47	M	L	L	M	BA	80	H	L	H	M	H
15	L	L	M	MS	H	A	48	M	L	L	H	A	81	H	L	H	H	H
16	L	L	M	RS	L	L	49	M	L	M	L	BA	82	H	M	L	L	MH
17	L	L	M	RS	M	BA	50	M	L	M	M	A	83	H	M	L	M	MH
18	L	L	M	RS	H	A	51	M	L	M	H	A	84	H	M	L	H	H
19	L	L	H	S	L	BA	52	M	L	H	L	A	85	H	M	M	L	MH
20	L	L	H	S	M	BA	53	M	L	H	M	A	86	H	M	M	M	H
21	L	L	H	S	H	A	54	M	L	H	H	MH	87	H	M	M	H	H
22	L	L	H	MS	L	BA	55	M	M	L	L	MH	88	H	M	H	L	H
23	L	L	H	MS	M	A	56	M	M	L	M	MH	89	H	M	H	M	H
24	L	L	H	MS	H	MH	57	M	M	L	H	H	90	H	M	H	H	H
25	L	L	H	RS	L	BA	58	M	M	M	L	MH	91	H	H	L	L	MH
26	L	L	H	RS	M	BA	59	M	M	M	M	H	92	H	H	L	M	MH
27	L	L	H	RS	H	A	60	M	M	M	H	H	93	H	H	L	H	H
28	L	M	L		L	BA	61	M	M	H	L	MH	94	H	H	M	L	H
29	L	M	L		M	BA	62	M	M	H	M	H	95	H	H	M	M	H
30	L	M	L		H	A	63	M	M	H	H	H	96	H	H	M	H	H
31	L	M	M		L	BA	64	M	H	L	L	MH	97	H	H	H	L	H
32	L	M	M		M	A	65	M	H	L	M	MH	98	H	H	H	M	H
33	L	M	M		H	A	66	M	H	L	H	H	99	H	H	H	H	H

Determining the applicability of each rule is called “matching.” We have to consider only that rule whose premise membership function  $\mu_{\text{premise}} > 0$  [10] [11].

For Implication method I have used product method to obtain the better result. So in rule editor I have entered 99 Rules such as **Rule 1:** If (publicity is low) and (noofyearsinpolitics is low) and (responsiveness is low) and (age is suitable) and (education is low) then (chanceofselection is less)

**Rule 33:** If (publicity is low) and (noofyearsinpolitics is medium) and (responsiveness is medium) and (education is high) then (chanceofselection is average)

Finally using the **centroid method** crisp output is measured.

### C. RULE EDITOR AND RULE VIEWER

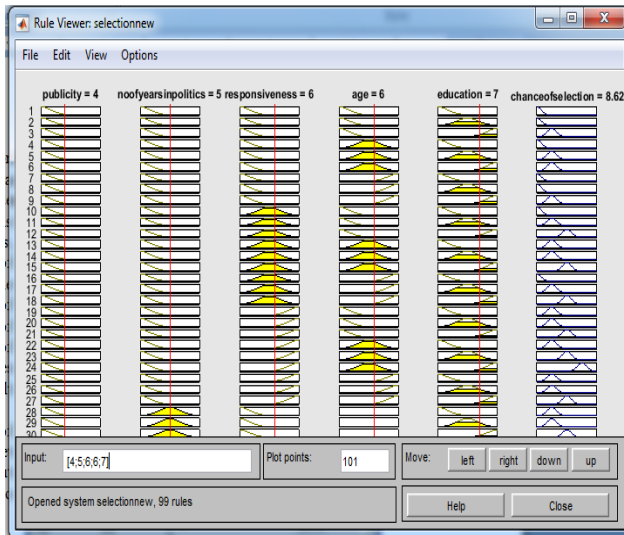


Figure 4 Rule editors in FIS

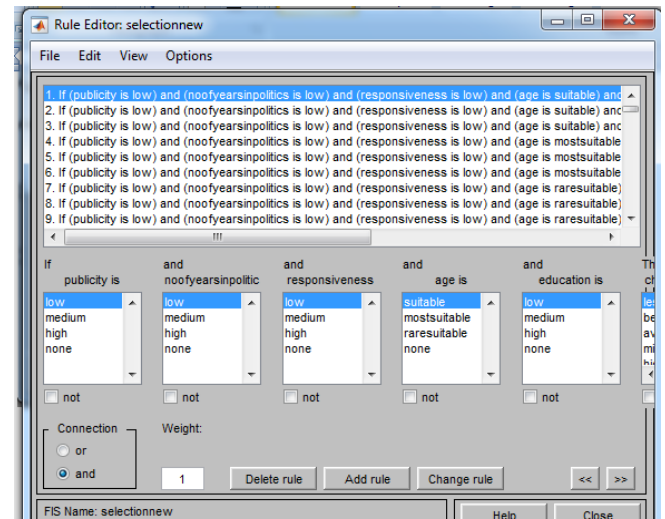


Figure 5 Rule viewers of chances of selection

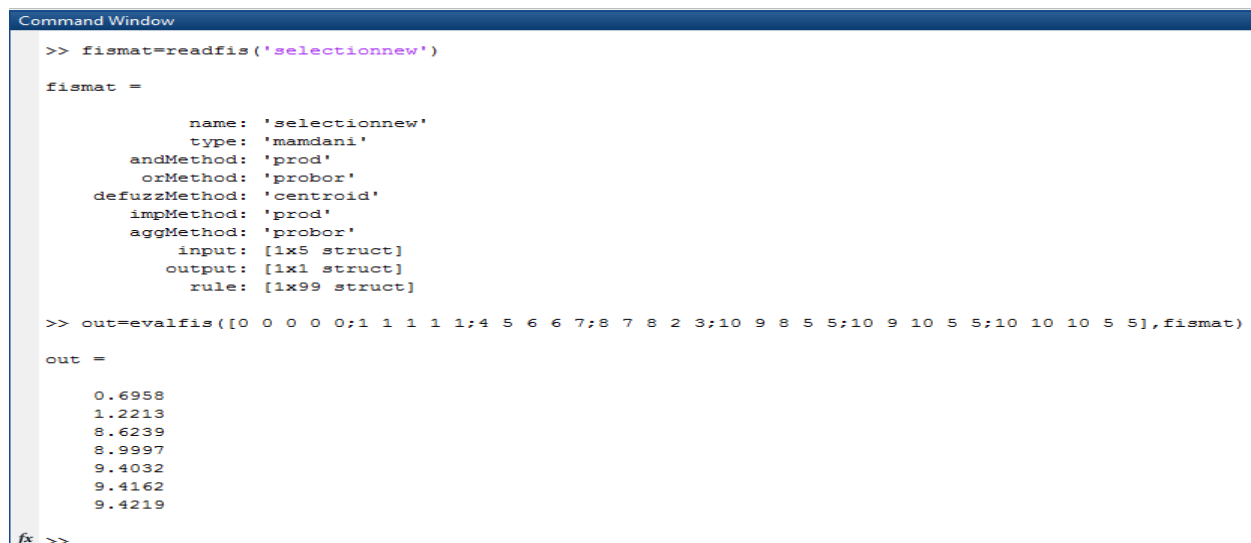


Figure 6 snapshot of output (chances of selection) using command window

Output 1: When input are [0, 0, 0, 0, 0] then output means chances of selection is 0.696  
 Output 2: When input are [1, 1, 1, 1, 1] then output means chances of selection is 1.221  
 Output 3: When input are [4, 5, 6, 6, 7] then output means chances of selection is 8.624  
 Output 4: When input are [8, 7, 8, 2, 3] then output means chances of selection is 8.999  
 Output 5: When input are [10, 9, 8, 5, 5] then output means chances of selection is 9.403  
 Output 6: When input are [10, 9, 10, 5, 5] then output means chances of selection is 9.416  
 Output 7: When input are [10, 10, 10, 5, 5] then output means chances of selection is 9.422

### IV. RESULT ANALYSIS USING GUI

Open GUIDE by typing guide at the MATLAB prompt. This displays the Guide Quick Start dialog. In the Quick Start dialog, select the Blank GUI (default) template. Click OK to display the blank GUI in the Layout Editor. To display the names of the GUI components in the component palette, select Preferences from the File menu, check the box next to Show names in component palette, and click OK. We can specify the size of the GUI by resizing the grid area in the Layout Editor. To resize click on the lower-right corner and resize the grid as required [13].

After laying out the GUI and setting component properties, the next step is to program it. In the FIS editor I have chooses range of an output variable is [0, 10]. So in the code I add that the output of fuzzy controller is multiplied by 100. In this way I have calculated percentage of chances of selection. From the output it is very clear that a small changes of input values output is also changes smoothly. Here I have taken snapshot of the output to the corresponding input.

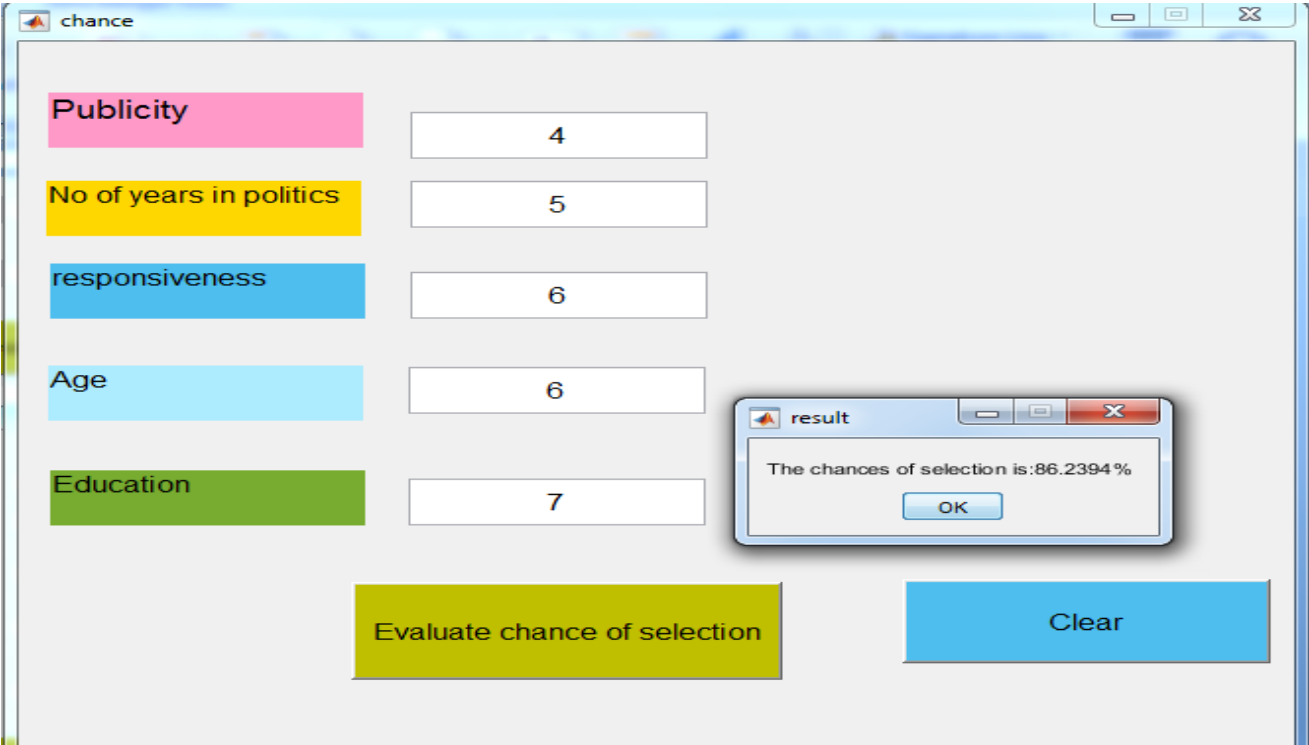


Figure 7: GUI Result

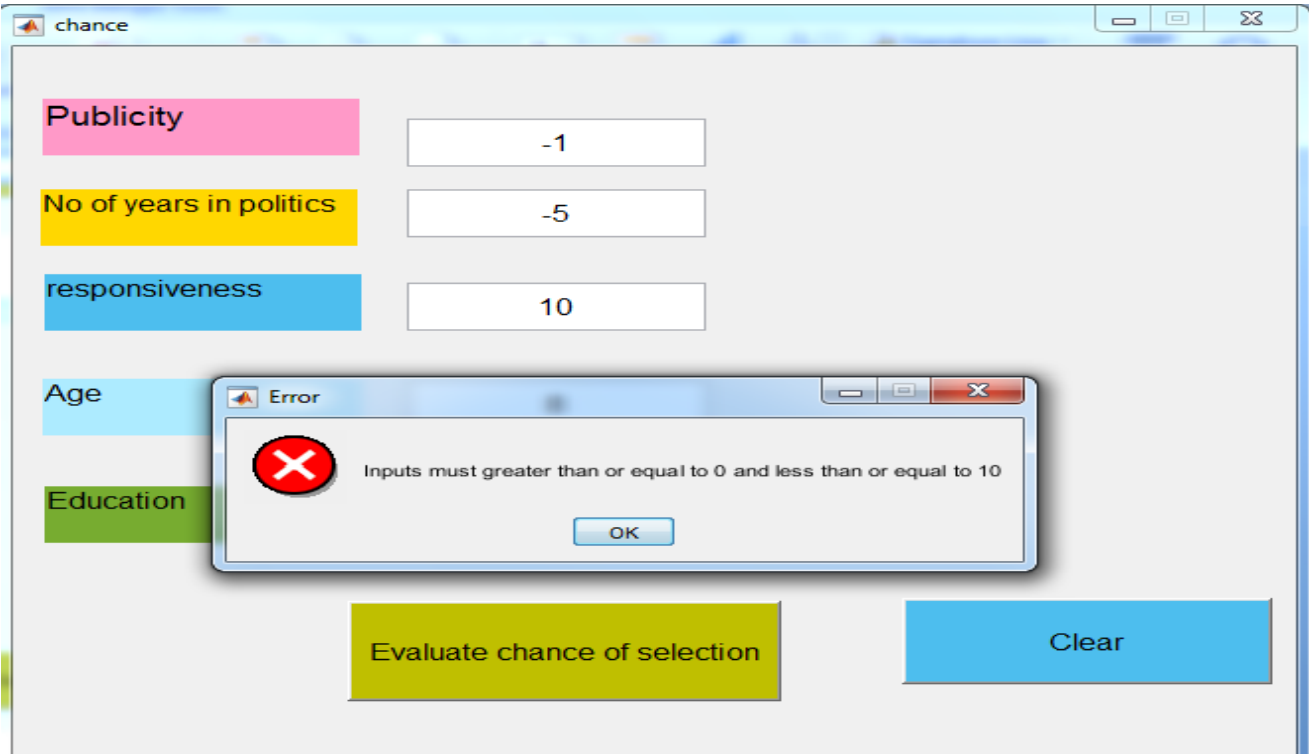


Figure 8: GUI Result

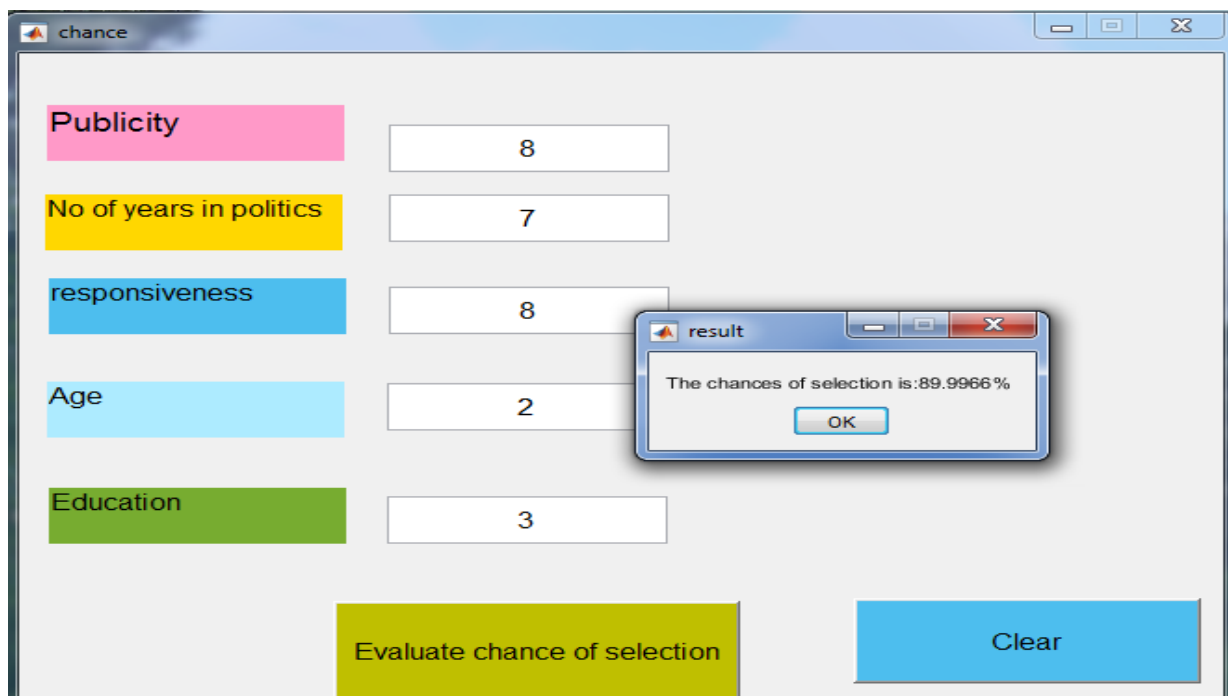


Figure 9: GUI Result

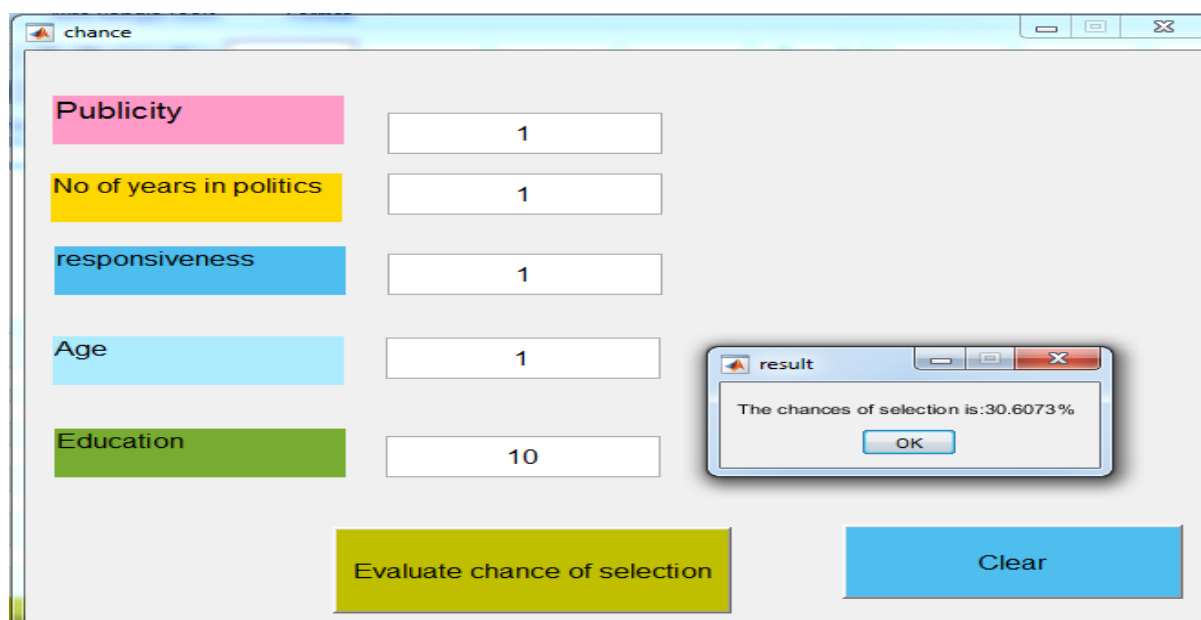


Figure 10: GUI Result

## VI. FUTURE SCOPE

First of all this research can be used further as an automatic selection evaluator in the field of election as well as other than election where group leader is to be chosen. Secondly more number of input parameters can be added to evaluate more accurate result.

## VII. CONCLUSION

Politics is a vital part of social science. So it party leader responsibility to choose an appropriate candidate to win the election. But traditional nominee type of selection procedure

is sometimes biased and so much time consuming. So fuzzy rule based selection evaluator is better to select an appropriate candidate to win an election. Further it also decrease paper work and increase faith, cooperation and understanding among party members which positively increase the chances of winning of a party.

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