

## Credit Risk Prediction Decision Support System in Fuzzy Logic GUI

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*Abstract: this paper presents a Credit Risk Tool for reducing the risk while giving the Credit to any person or any Organization in the Industry. From the word "risk" means that can threaten the successful Credit. The risk in giving loan or Credit risk is normal in every sector of Industry i.e. banking, Insurance. Objective here is to detect the level of the risk while giving loan to the customers. So this is the Decision Support System that based on the various factors from which risk is calculated to give the loan to any Customer. This represents as the Decision Support System that financial institutes or banks can for reducing risk in giving credit to Customers.*

*Various Banks or Financial Institutes uses the different approach while giving loan or Credit to any Customer or any Organization. In this System there are 7 input variables (income, credit history, age, assets, liabilities, load period, guarantor) and one output that shows the risk status. Hence Different Banks or Financial Institutes stress on the different factors, some may give importance to the present income of the Customer and some may give importance to asset of the Customer. The Output variable have the values Very High, High, Low, Medium, Very Low. The System uses Mamdani inference method and simulation applied in MATLAB R2009b fuzzy logic toolbox.*

### I. INTRODUCTION

In recent year, Artificial Intelligence have largely been used by most of the Industries & Organizations in banking & Financial Sector. In banking and financial there are many system some of them are : Credit Rating, Prediction of Election Result, Software Quality Risk Analysis, Medical Report Analysis ,Credit Risk using Immune Learning which giving the Rating for the Credit on insufficiency of data. In Calculating the Risk for Credit giving to any customer is very vague and crisp therefore it is difficult to view the actual risk in Finance Sector. So in this research work, we propose a Risk Evaluator System using Fuzzy Logic.[1]Fuzzy Logic was introduced by the famous person Zadeh. The use of Fuzzy Logic was to purpose that system that has vague, imprecise and incomplete data. Hence the purpose for this FIS is to develop some that type of decision support System that help the financial organization at the time of giving loan. Every Bank or financial organization differs in their weightage given to every factor. Some Bank or financial organization give more weightage to the income of the customer as compare to the asset and credit history. But some gives more weightage to the Credit History as compare to the present salary of the customer. Hence this Decision

support System will help us to found the risk in the basis of survey that done finance expert.

### II. LITERATURE SURVEY

Fuzzy Logic have many applications and including weather Forecasting, marketing, Software Risk [2] Control, politics, economics, biology and medical Science. Hence in IT Industry there are many products available that are used to evaluate and for controlling the System that are vague and crisp. This act as Decision Support System.

*Expertise Consultancy:* For having the input in the Decision Support System that consider the survey from the Financial Institutes & Banks that give Credit to customers. So Expertise Survey gives the concrete information from which a correct decision can be made by the Simulation System. But if the information is not concrete then it will not lead to the correct output.

This survey was on the basis of the factors that was included as factors & parameters for measuring the risk at particular situation. Hence this data from the survey is vague and imprecise as weightage to the factors differ from bank to bank. So Fuzzy Logic Interference System is best suited in that situation. There are two most commonly fuzzy interference systems that are described by the Mamdani and Sugeno. In our purposed solution Mamdani is used to determine the results. There are three levels in the Fuzzy Interference, In the first level, the degree of membership for crisp input variables is determined. In the Second level evaluation of the fuzzy rules is done and output is produced for each rules. Then in the last defuzzification process is done. IN our FIS we take eight input factors and one output. We have made up 151 rules.

### III. PROPOSED SOLUTION

To give the proposed solution of the problem of having risk from any customer while giving loan or Credit, in this system firstly information is extracted from the survey papers that is in the vague form. Because in the survey paper there are different situation while giving Credit to any Customer or Organization.

This FIS use five membership function that are used to count the degree of the each factor. The formula that we use to calculating the risk as follows :

```
F=read ('lo3');  
risk=evalfis (arr, f);
```

$r = ((risk-5)*20);$   
 $r = round(r);$

'lo3' here is the filename in MATLAB. evalfis-is the evaluation of function interference system that calculate the risk over the 'arr' that is the array of inputs in the System. In the expression r firstly convert the risk into 1-10 range and after that we round off variable r using round function.

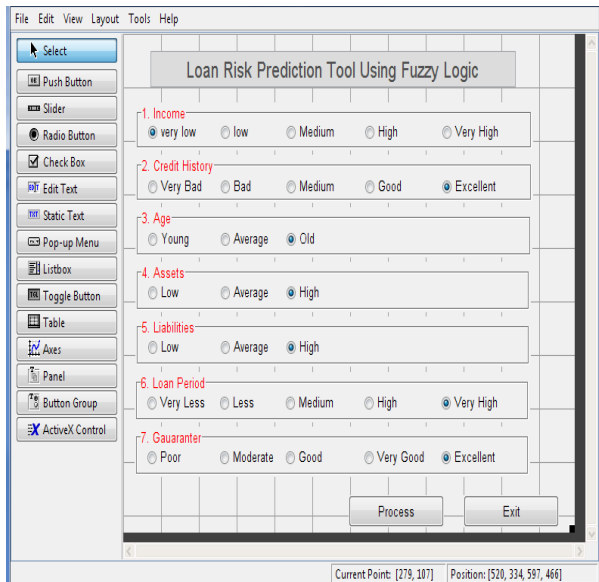


Fig. 1 A sample GUI for the Decision Support System that have 7 factors like Income, Credit History, Age, Assets, Liabilities, Load Period, Guranter

Hence the range of the risk is between -100 to 100 so the total risk is 200. Five membership function help to measure the degree of the factors are VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH. The formula is as simple is where we divide the total range by the number of fields.

Hence from the output we have the rank of risk for any Customer according to different parameters that are inputted into the Decision System.

#### IV. DESIGN METHODOLOGY

All the Input variable affect the output of the system as risk. Figure 1 shows the 8 input factors and one output as risk. At last on the basis of survey from finance expert, there are 151 rules in the system.

Some of the rules are as follows:

- 1). If the Income is VERY LOW & Credit History is VERY BAD & Age is OLD & Assets are LOW & Liabilities are HIGH & Loan Period is VERY LESS & Guarantor is POOR then Risk is 0.9
- 2). If the Income is LOW & Credit History is BAD & Age is OLD & Assets are LOW & Liabilities are HIGH & Loan Period is LESS & Guarantor is POOR then Risk is 0.75
- 3). If the Income is MEDIUM & Credit History is MEDIUM & Age is AVERAGE & Assets are AVERAGE & Liabilities are AVERAGE & Loan Period is MEDIUM & Guarantor is MODERATE then Risk is 0.7
- 4). If the Income is MEDIUM & Credit History is MEDIUM & Age is YOUNG & Assets are AVERAGE & Liabilities are AVERAGE & Loan Period is MEDIUM & Guarantor is MODERATE then Risk is 0.1

3). If the Income is MEDIUM & Credit History is MEDIUM & Age is AVERAGE & Assets are AVERAGE & Liabilities are AVERAGE & Loan Period is MEDIUM & Guarantor is MODERATE then Risk is 0.7

4). If the Income is MEDIUM & Credit History is MEDIUM & Age is YOUNG & Assets are AVERAGE & Liabilities are AVERAGE & Loan Period is MEDIUM & Guarantor is MODERATE then Risk is 0.1

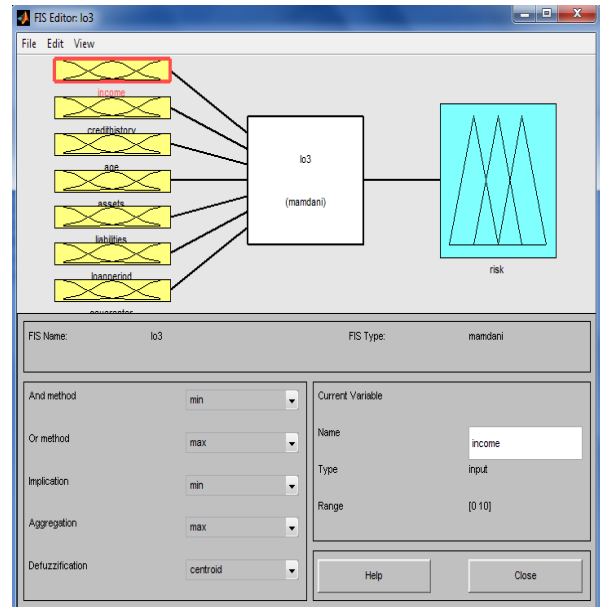


Fig. 2 Eight Factors & one Output as risk

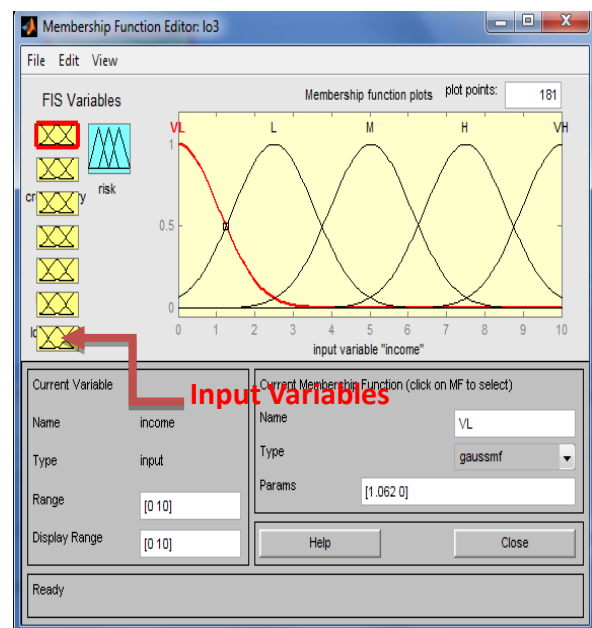


Fig. 2 FIS Variables & with intersection of Membership Functions

A. *Input Membership Function:* In this System there are input variables (Income, Credit History, Age, Asset, Liabilities, Loan Period, and Guarantor)

For example income has five Membership Function to represent VL(Very Low), L(Low), H(High), VH(Very High) as shown in Figure-3. Here Gaussian Curve based built in membership function is used to define the variable Very Low. Hence Z based built in Function is used to represent variable M(Medium). S shaped built in membership function here is used to define for High.

**B. Output Membership Function:** Here is the formula for the Output Membership Function.

Formula = (Total Range/No. Of Fields) => 200/5 = 40

-100 TO -60 THEN RISK IS VERY LOW

-60 TO -20 THEN RISK IS LOW

-20 TO 20 THEN RISK IS MEDIUM

20 TO 60 THEN RISK IS HIGH

60 TO 100 THEN RISK IS VERY HIGH

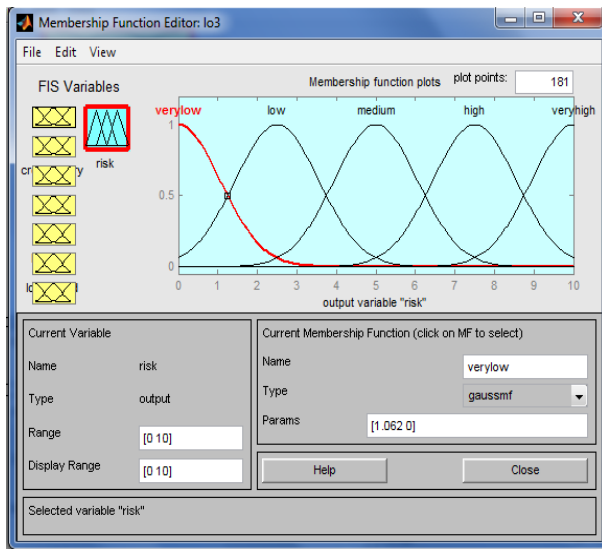


Fig. 4. Output variable stating about the risk

### V. RESULT ANALYSIS

Sr. No.	Income	Credit history	Age	Assert	Liabilities	Loan period	Guaranter	Risk	Risk %
1.	Low	Very bad	young	High	High	Very less	Poor	6.9132	38 %
2.	Very low	Bad	Old	Low	Low	Very high	Good	6.8001	36%
3.	High	Excellent	Old	High	High	High	Moderate	6.0983	22%
4.	High	Excellent	Average	Low	High	Medium	Moderate	6.7419	35%
5.	Medium	Good	Young	High	High	Very high	Excellent	6.8347	37%
6.	Very high	Very bad	Old	Low	High	Very less	Poor	8.2602	65%
7.	Very low	Good	Young	Low	Low	Medium	Poor	6.9146	38%
8.	Very high	Bad	Young	High	Average	High	Poor	7.9489	59%
9.	Low	Medium	Average	Average	Average	Very high	Excellent	8.1425	63%
10.	High	Medium	Average	Average	Average	Very high	Very good	7.7970	56%
11.	Medium	Very bad	Young	High	Low	Very less	Excellent	3.0397	-39%
12.	Medium	Excellent	Average	Average	Average	High	Very good	3.0297	-39%
13.	Low	Good	Average	High	Low	Medium	Good	3.8354	-23%
14.	Very high	Good	Old	Low	Low	Very less	Poor	3.9297	-21%
15.	High	Bad	Average	Low	Low	Less	Moderate	2.1860	-56%
16.	Very low	Excellent	Old	High	High	Very high	Very good	1.8332	-63%
17.	Very high	Very bad	Old	Low	High	Medium	Poor	2.1818	-56%
18.	Medium	Very bad	Old	High	High	High	Poor	1.9604	-61%
19.	Low	Very bad	Young	Low	High	Very high	Excellent	5.0000	0%
20.	High	Very bad	Young	High	Low	Very high	Excellent	4.2717	-15%
21.	Very high	Medium	Young	Low	High	Very less	Poor	5.3559	7%
22.	Very low	Medium	Average	Average	High	Less	Poor	5.1204	2%

In this Decision Support System to calculate the risk of any customer we take the different scenarios. These Scenarios were in the Survey paper that held with financial institutions and banks. Following is the report of all the scenarios as input by the user in the system.

### VI. CONCLUSIONS

This paper evaluates the risk of the Customer by the different factors. Hence many banks and finance centre have different terms and conditions in giving Loan to their Customer. Hence this problem is solved by the evaluation of this Fuzzy Inference System that is developed in MATLAB. This takes all the factors that affect the risk in giving Credit to the Customer. These are defined by the membership function and have 151 rules based on “if-then” conditions. Hence by the survey we take different scenarios to develop rules and from these rules we use to calculate the value of the risk.

Hence now with this purposed solution when different Customers having different financial conditions will be judged by the system for giving loan to them. If the risk is Less than it means Customer have good financial conditions and chances of returning loan instalments are high

### VII. REFERENCES

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