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Online Banking System Using Fuzzy with AI

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Abstract: Online Banking system refers to manage the whole banking system through web. In banking system, it is necessary to retrieve important information of customers from their historical data to give them some opportunities, such as discount on loan interest. To do this it is very necessary to classify them. We have classified the customers based on classical logic and fuzzy logic. We have seen fuzzy classification provides better performance than classical classification. In the last decades, information systems have revolutionized the way information can be stored and processed. As a result, the information volume has significantly increased. It becomes difficult to analyse the large amounts of available data and to generate appropriate management decisions. In practice, Information systems mostly use relational databases in order to store these data collections. This paper makes a comparison between traditional or classical classification and fuzzy classification. Experimental results demonstrate that the proposed intelligent fuzzy query is more effective than the conventional query and it provides the user the flexibility to query the database using natural language. Traditional online banking system is not intelligent, because we can't retrieve the behaviour of customers through the system. Online Banking system refers to manage the whole banking system through web. It leads to the virtual office. Data mining is the most important research work in real world application. We can retrieve knowledge of employees and customers of any organization from their historical information through data mining. Online banking system with data mining is intelligent. In my research work, I include the most important data mining task classification and I have implemented the classical classification and fuzzy classification on online banking system. And finally, I have showed the comparisons between classical classification and fuzzy classification. Consequently, I have seen the fuzzy classification is better than classical classification due to the over and under estimation value closer to the boundary of the intervals

Keywords: Include at least 4 keywords or phrases

I. INTRODUCTION

Fuzzy Logic is a mathematical tool to represent the imprecise, uncertain and vague information. It is based on fuzzy set theory. It is multi-valued logic. It is a problem-solving control system methodology that lends itself to implementation in systems ranging from simple, small, embedded micro-controllers to large, networked, multi-channel PC or workstation-based data acquisition and control systems [1]. It can be implemented in hardware, software, or a combination of both. Fuzzy Logic(FL) provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information [2]. FL's approach to control problems mimics how a person would make decisions, only much faster.

There are two types of classification. One is classical classification and the other is fuzzy classification. Classical classification is based on classical set theory and fuzzy classification is based on fuzzy set theory. Difference between classical set theory and fuzzy set theory: The membership degree of each element in classical set is either 0 or 1.

For example, A= {(1,1),(2,0),(3,1),(4,1)}
The membership degree of each element in fuzzy set is in [0,1].
For example, A= {(1,0),(2,0.2),(3,0.5),(4,1)}
Difference between Classical classification and Fuzzy classification:

In classical classification a customer is classified into only one class, whereas in fuzzy classification a customer may be involved into different classes. Fuzzy Logic is based on fuzzy set theory. It is multi-valued logic. It is a problem-solving control system methodology. It can be implemented in hardware, software, or a combination of both. Fuzzy Logic (FL) provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information.

Types of classification:
1. Classical Classification.
2. Fuzzy Classification

- Classical classification is based on classical set theory.
- Fuzzy classification is based on fuzzy set theory.

Knowledge Discovery in Databases (KDD):
Frawley et al states that "Knowledge discovery is the nontrivial extraction of implicit, previously unknown, and potentially useful information from data." In order to get this information [3], we try to find patterns in the given data set. To know if a pattern is valuable, the assessment of its interestingness and certainty is crucial. Patterns that are interesting and certain enough according to the user's measures are called knowledge. The output of a program that discovers such useful patterns is called discovered knowledge.

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According toKDD exhibits four main characteristics:

- High-Level Language (HLL): The discovered knowledge is represented in a language that does not necessarily have to be directly used by humans, but its expression should be comprehensible [4].
- Accuracy: The measure of certainty implies whether the discovered patterns portray the contents of a database properly or not.
- Efficiency: Even for large Datasets, the running time of the algorithm is acceptable and predictable.

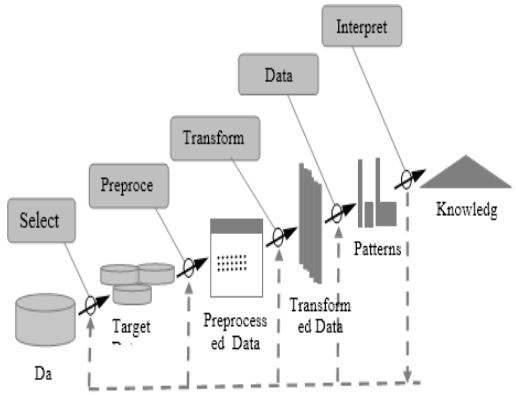

Fig-1: The KDD Process

Implementation

Fuzzy Classification is a well-established technique for discovering knowledge from data. We have seen that in classical classification a customer is classified into only one class, whereas in fuzzy classification a customer may be involved into different classes. The Classical Classification leads to the underestimation- or overestimation of values due to the hard boundary of the intervals. To overcome this problem the approach of Fuzzy Classification has been developed. In this chapter, firstly We will implement the Classical Classification and then Fuzzy Classification and finally We will compare between those two approaches.

C1: Very very committed customer
C2: Very committed customer
C3: Committed customer
C4: Non-committed customer

We offer discounts 5%, 4%, 3% and 0% on loan interest for C1, C2, C3 and C4 classes respectively.

Customer Name	No of Loan payment per year	No of Transaction per year
Kalam	7	4
Jamal	12	11
Rahim	7	8
Karim	5	9
Shohag	12	12
Rafique	10	3
Sumon	0	0

Table 1: Processed Database for Classical Classification

According to classical classification approach, we know that the membership degree of a customer in regular payer and regular customer is either 0 or 1.

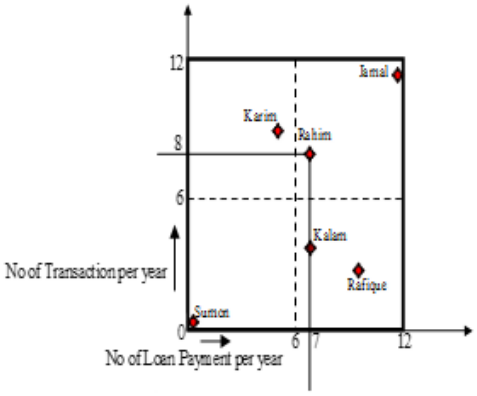

Fig 2: Customers over

In fig 2, we have seen Jamal belongs to Class C_1 and Rahim belongs to Class C_1, i.e in C_1 the membership degree of Jamal and Rahim is 1 and in other classes the membership degree for Jamal and Rahim is 0. This is one of the problems in Classical Classification. Here we have seen that the number of loan payment for Jamal and Rahim are not same, but they belong to same classes with same membership degree. That is the main drawback of classical classification. After computing the membership degree of each customer, I have got the database, which is shown in table 2.

Customer Name	No of Loan Payment Per Year	No of Transaction Per Year	Values In different classes
Kalam	7	4	C1:0 , C2:1, C3:0, C4:0
Jamal	12	11	C1: 1, C2:0, C3:0, C4:0
Rahim	7	8	C1: 1, C2:0, C3:0, C4:0
Karim	5	9	C1: 0, C2:0, C3:1, C4:0
Shohag	12	12	C1: 1, C2:0, C3:0, C4:0
Rafique	10	3	C1:0 , C2:1, C3:0, C4:0
Sumon	0	0	C1:0 , C2:0, C3:0, C4:1

Calculation the amount of discount for classical classification

In our research work, main goal is to provide some discount on loan interest based on their status. Since the discount over classes C_1, C_2, C_3 and C_4 are 5%, 4%, 3% and 0% respectively, the general expression to calculate the total discount of a customer is shown in equation (1).

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Discount(customer_name)=C1*5+C2*4+C3*3+C4*0…… …. (1)

For example, the membership degrees in C1, C2, C3 and C4 classes for Kalam customer are respectively 0, 1, 0 and 0. So the overall discount on loan interest of kalam will be by using equation (1).

Discount(Kalam)= 0 * 5 + 1 * 4 + 0 * 3 + 0 * 0 = 4%
In the same way, after computing the discount on loan interest for all customer of processed database I have got the table 3.

Table 3: Experimental result for Classical Classification

Customer Name	No of Loan Payment Per Year	No of Transaction Per Year	Values In different classes	Discount (%)
Kalam	7	4	C1:0 , C2:1, C3:0, C4:0	4
Jamal	12	11	C1: 1, C2:0, C3:0, C4:0	5
Rahim	7	8	C1: 1, C2:0, C3:0, C4:0	5
Karim	5	9	C1: 0, C2:0, C3:1, C4:0	3
Shohag	12	12	C1: 1, C2:0, C3:0, C4:0	5

II. FUZZY DATABASE

The database in which the membership degree of any numerical attribute is included is called fuzzy database. In our research work, we have applied fuzzy membership degree on number of loan payment and the number of transactions. Weused S-shaped and Z-shaped membership functions that match with this data. The used membership function for Regular Loan Payer and Regular Customer is S-shaped membership function, which is shown in fig-3.

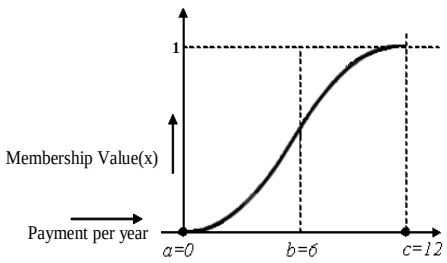

Figure 3: S-Shaped

The Mathematical expression of S-Shaped function is:

$$\mu(x:a,b,c) = \begin{cases} 0 & if\ x <= a \\ (x-a)^2/((b-a)*(c-a)) & if\ a < x <= b \\ 1-((x-c)^2/((c-b)*(c-a))) & if\ b < x <= c \\ 1 & if\ x > c \end{cases}$$

For Non_Regular Loan Payer and for Non_Regular Customer I have used Z-shaped membership function.

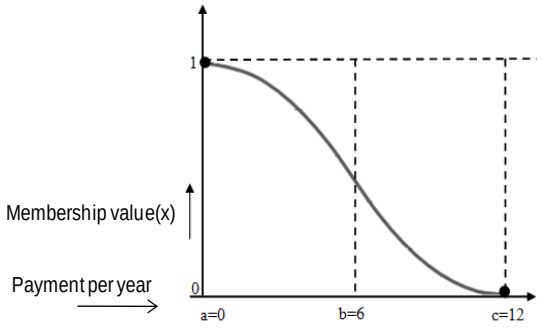

Fig 4: Z-Shaped

Mathematical expression of Z-Shaped function

$$\mu(x:a,b,c) = \begin{cases} 1 & if \quad x <= a \\ 1-2\left(\frac{x-a}{c-a}\right)^2 & if \quad a <= x <= b \\ 2\left(\frac{x-c}{c-a}\right)^2 & if \quad b <= x <= c \\ 0 & if \quad x >= c \end{cases}$$

According to fuzzy classification approach, we know that the membership degree of a customer in Regular Payer and Regular Customer is in [0,1][5]. The scenario of each customer of processed database with their membership degree is shown in Fig 5.

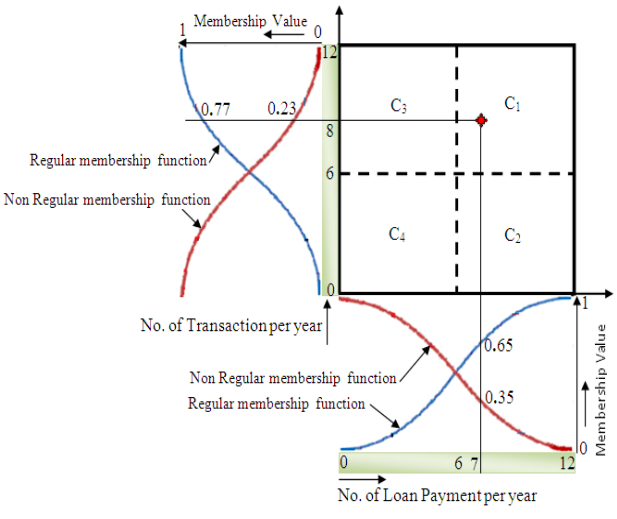

Fig-5: Classes with different membership values

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Table 5 : Transformed database (Fuzzy database)

Customer Name	No. of Loan Payment Per Year	Fuzzy Membership Value In regular loan payer	No. of Transaction on Per Year	Fuzzy Membership Value In regular customer
Kalam	7	0.652	4	0.222
Jamal	12	1	11	0.980
Rahim	7	0.652	8	0.777
Karim	5	0.347	9	0.875
Shohag	12	1	12	1
Rafique	10	0.944	3	0.125
Sumon	0	0	0	0

Calculation of membership degree of customers over different classes

$$\mu(x_i) = \left(\prod_{i=1}^{m} \mu_i\right)^{(1-\gamma)} * \left(1 - \prod_{i=1}^{m}(1-\mu_i)\right)^{\gamma}, \quad \gamma \in [0,1]$$

Gamma operation is defined in terms of fuzzy algebraic sum by Gamma (γ) is a parameter chosen the range from 0 to 1 I have used γ=0.5

For example, the number of loan payment for Rahim is 7 and the number of transaction for Rahim is 8, the membership degree of Rahim in C_1, C_2, C_3 and C_4 is shown below by using eq.

$$\left.\begin{aligned} &Final\ (Rhim\ |C_1) = \mu(Rhim\ |C_1)\ /\ Card\ (Rhim\ |C_i) = 0.406 \\ &Final\ (Rhim\ |C_2) = \mu(Rhim\ |C_2)\ /\ Card\ (Rhim\ |C_i) = 0.193 \\ &Final\ (Rhim\ |C_3) = \mu(Rhim\ |C_3)\ /\ Card\ (Rhim\ |C_i) = 0.285 \\ &Final\ (Rhim\ |C_4) = \mu(Rhim\ |C_4)\ /\ Card\ (Rhim\ |C_i) = 0.115 \end{aligned}\right\} = 1$$

$$\mu_{combinatio\ n} = (fuzzy\ \ a\lg ebraic\ \ product)^{((1-\gamma)} * (fuzzy\ \ a\lg ebraic\ \ sum)^{\gamma}$$

0.406, 0.193, 0.285 and 0.115 respectively.

By using equation (1), the discount of loan interest of Rahim will be: Discount (Rahim)= 0.406 * 5 +0.193 * 4 + 0.285 * 3 + 0.115 * 0 = 3.658%

Table 6: Experimental result for Fuzzy Classification

Customer Name	No. of Loan Payment Per Year	Fuzzy Membership Value	No. of Transaction Per Year	Fuzzy Membership Value	Membership value in different classes	Discount (%)
Kalam	7	0.652	4	0.222	C1:0.193, C2:0.406, C3:0.115, C4:0.285	2.93
Jamal	12	1	11	0.980	C1:0.893, C2:0.106, C3:0, C4:0	4.89
Rahim	7	0.652	8	0.777	C1:0.406, C2:0.193, C3:0.285, C4:0.115	3.65
Karim	5	0.347	9	0.875	C1:0.321, C2:0.083, C3:0.450, C4:0.145	3.29

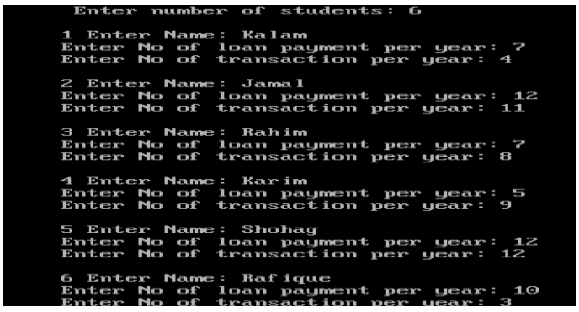

Figure 5 & 6: Screenshot of all output

III.AI

Artificial intelligence (AI) is intelligence exhibited by machines. In computer science, an ideal "intelligent" machine is a flexible rational agent that perceives its environment and takes actions that maximize its chance of success at some goal. Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving". As machines become increasingly capable, facilities once thought to require intelligence are removed from the definition. For example, optical character recognition is no longer perceived as an exemplar of "artificial intelligence" having become a routine technology. Capabilities still classified as AI include advanced Chess and Go systems and self-driving cars. AI research is divided into subfields that focus on specific problems or on specific approaches or on the use of a particular tool or towards satisfying

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particular applications. The central problems (or goals) of AI research include reasoning, knowledge, planning, learning, natural language processing (communication), perception and the ability to move and manipulate objects. General intelligence is among the field's long-term goals. Approaches include statistical methods, computational intelligence, soft computing (e.g. machine learning), and traditional symbolic AI. Many tools are used in AI, including versions of search and mathematical optimization, logic, methods based on probability and economics. The AI field draws upon computer science, mathematics, psychology, linguistics, philosophy, neuroscience and artificial psychology.

The field was founded on the claim that human intelligence "can be so precisely described that a machine can be made to simulate it." This raises philosophical arguments about the nature of the mind and the ethics of creating artificial beings endowed with human-like intelligence, issues which have been explored by myth, fiction and philosophy since antiquity. Attempts to create artificial intelligence has experienced many setbacks, including the ALPAC report of 1966, the abandonment of perceptron's in 1970, the Light hill Report of 1973 and the collapse of the Lisp machine market in 1987. In the twenty-first century AI techniques became an essential part of the technology industry, helping to solve many challenging problems in computer science.

IV. CONCLUSION

The most frequent activities conducted online were checking account balances and viewing or paying bills. These features should be easily accessible upon login and include clear and simple terminology, feedback information, and ability to easily identify/fix mistakes. By using this project, one can classify customers by using classical and fuzzy approaches. I have used only classification in the data mining task. One can extend my work by including other tasks of data mining, such as Association rules, Regression, Deviation Detection etc.One can extend our work by using fuzzy modifier, such as very very regular, extremely regular, more or less regular etc.

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BIOGRAPHY

Tasnuva Tehrin has completed her B.Sc. from American International University Bangladesh under the department of Computer Science and Software Engineering. Her core research area is Human Computer Interaction and Artificial Intelligence based algorithms.