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Research Article

Performance Comparison of Clustering Kmeans and Fuzzy Logic Tsukamoto Method among Student Prospective Scholarship Receiversat Politeknik Pos Indonesia

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Abstract

Student, Alumni, and Cooperation Services are institutions under the Deputy Director III. This agency has a duty to provide academic services to students on the POS INDONESIA POLITEKNIK campus, and is responsible for providing information on campus activities and academic issues to students of POLITEKNIK POS INDONESIA. Currently, the field of Student Affairs, Alumni and Cooperation, POLITEKNIK POS INDONESIA does not yet have an application for a decision support system for scholarship selection using the Tsukamoto fuzzy logic method because it still uses manual methods to determine prospective scholarship recipients. A research and application development was carried out in order to improve the quality and support the activities of the Student Affairs, Alumni and POS INDONESIA POLITEKNIK Cooperation. The method currently used in this research is the Tsukamoto Fuzzy Logic method, which is a calculation method to determine the highest criterion value based on rules, the method before the development of this decision support system uses the K-Means Clustering method where this method determines cluster 1 and Cluster 2 and has tested the calculation results. The results of this study are that it can help the process of calculating student data for prospective scholarship recipients that can be used by Student Affairs staff through the system. With this application, it can help companies in lightening the work because they do not need to use the calculation process to determine prospective scholarship recipients manually. This research is expected to be useful for companies in order to assist companies in improving student academic services and in order to be more efficient.

Keywords: Fuzzy Logic, Tsukamoto Fuzzy Logic, Scholarship.

1. Introduction

1.1 Background

Student Services, Alumni, and Cooperation are institutions under Pudir III. This agency has the task of providing academic services to students on the POS INDONESIA POLYTECHNIC campus, and is responsible for providing information about campus activities and academic problems to POS INDONESIA POLYTECHNIC students. In an educational institution in the field of student affairs, alumni and cooperation every year always help / distribute information about the existence of scholarship assistance to all students [1]. This scholarship is a scholarship provided for underprivileged students who have achievements in both academic and non-academic fields [5] . Scholarships are held annually which are allocated to the Student Affairs, Alumni and POS INDONESIA POLYTECHNICAL collaborations aimed at improving and assisting students in the learning process as well as giving an appreciation to students who get achievements in all academic and non-academic fields by achieving national level achievements. / International [4]. From the

Tsukamoto fuzzy logic technique, it can help in classifying the data of students who are entitled to receive scholarships, students who are considered to receive and students who are not entitled to receive scholarships. In this study the author uses the Tsukamoto fuzzy logic algorithm to determine scholarship recipients by dividing student data into 2 clusters between received a scholarship and did not receive a scholarship[13]. However, the problem faced by the Student Affairs, Alumni and Cooperation Sector itself is that there is no system that helps accurately calculate the results of scholarship recipients because basically the calculation method has not been determined for selecting scholarship recipients, and especially the scholarship party cannot wait long to receive the list. data on scholarship recipients [12]. From this study, the two methods will be compared with the results of the previous calculation method, namely the Clustering K-Means method and developed with the Tsukamoto Fuzzy Logic method where the analysis of prospective recipients of 1 scholarship can run relevantly in determining a criterion, the criteria have been calculated through the system and determined based on the criteria with the highest value to obtain results that deserve a scholarship [7]. So that when the Tsukamoto fuzzy logic method is applied it will get more accurate results on who prospective students will get scholarships [12]. in this study to compare the results of the previous method used during Internship II using the Clustering K-Means method, but in this study the method that will be applied to the decision support system is Tsukamoto's fuzzy logic to determine who receives the scholarship so that it will be known from the attribute criteria. different values, and have cluster results that can be calculated accurately later (can be justified) and the results of the calculations are equated with the previous method [12]. The final result of the calculation from this study is the result of prospective student scholarship recipients so that a higher calculation result is obtained. By applying the Fuzzy Logic Tsukamoto method, it aims to assist the Student Affairs, Alumni and Cooperation Sector in optimizing the final calculation results determined based on the criteria with the highest score.

1.2 Problem Formulation

Based on the background above, the formulation of the problems identified are as follows:

1. How to compare the results of the implementation of Tsukamoto's Fuzzy Logic method and K-Means Clustering to determine prospective students who receive scholarships based on criteria.

2. How to implement Tsukamoto's Fuzzy Logic calculation method to compare with previous calculations using the K-Means Clustering method.

1.3 Problem Identification

Identification of problems in the Development of a Decision Support System for Scholarships for Pos Indonesia Polytechnic Students Using the Tsukamoto Fuzzy Logic Method are as follows: 1. how the calculation process is implemented using the Tsukamoto Fuzzy Logic method and the K-Means Clustering method.

2. How to build a decision support system application using the Fuzzy Logic Tsukamoto method to obtain the same results as the previous K-Means Clustering method.

1.4 Goal

The objectives of the Development of a Decision Support System for Pos Indonesia Polytechnic Student Scholarships Using the Tsukamoto Fuzzy Logic Method are as follows:

1. Obtaining the results of prospective scholarship recipients properly and based on the scholarship criteria, calculating the Clustering K-Means method to compare the results with the Tsukamoto Fuzzy Logic method.

2. To find out how many received scholarships by calculating the process in the system using the Fuzzy Logic Tsukamoto method and comparing the results with the previous K-Means Clustering method.

3. To determine the accuracy of the comparison with the K-Means Clustering method and the Tsukamoto Fuzzy Logic method.

1.5 Benefits

The benefits of the Development of a Decision Support System for Pos Indonesia Polytechnic Student Scholarships Using the Tsukamoto Fuzzy Logic Method are as follows:

1. to determine the fastest calculation using the previous method, namely Clustering K-Means with the method currently used by Tsukamoto's Fuzzy Logic.

2. To further maximize the weighting of the criteria in the calculation process system for the selection of scholarship recipients using the Fuzzy Logic Tsukamoto method.

3. To facilitate the scholarship selection process based on predetermined criteria.

1.6 Scope

The scope of the Development of a Decision Support System for Pos Indonesia Polytechnic Student Scholarships Using the Tsukamoto Fuzzy Logic Method is as follows:

1. This scholarship data research took samples at the POS INDONESIA POLYTECHNIC campus in the student, alumni and cooperation fields during the internship I and II.

2. The calculation process of Tsukamoto's Fuzzy Logic method begins with manual calculations so that it is easier to implement into system calculations.

3. The process of calculating the application to the system using the Fuzzy Logic Tsukamoto method.

4. The application of Tsukamoto's Fuzzy Logic method in this application will be processed in a scholarship applicant submission data to determine the future scholarship recipients.

5. Match the results of the calculation of the Clustering K-means method used during the Internship I II with the Tsukamoto Fuzzy Logic method.

Theory Basıs

2.1 Description of the Same Topic

2.1.1 Fuzzy Method

Logic Figure II.1: fuzzy logic

Fuzzy Logic is used to express the operational laws of a system with language expressions, not with mathematical equations. Many systems are too complex to be modeled accurately, even with complex mathematical equations. In this kind of problem, the language expressions used in Fuzzy Logic can help define the operational characteristics of the system better. Language expressions for system characteristics are usually expressed in the form of logical implications for example, the IF-THEN rule [11]. In classical set theory, which is also known as crisp set (firm set), there are only two possibilities in its membership function, namely the possibility of including membership of the set (logic 1) or the possibility of being outside its membership (logic 0) [6]. However, in set theory Fuzzy Logic not only has two possibilities in determining the nature of its membership but has a membership degree whose value is between 0 and 1 [6]. The function that sets this value is called the membership function that is included in the fuzzy set. Fuzzy logic is a very flexible method, meaning that it is able to adapt to changes and uncertainties that accompany problems. The concept of fuzzy logic is easy to understand, because fuzzy logic uses the basis of set theory, the mathematical concepts that underlie fuzzy reasoning are quite easy to understand [6]. Fuzzy set is a group that represents a certain condition

in a fuzzy variable [6]. Fuzzy logic is a method used to overcome uncertainty in problems that have many answers. Basically, fuzzy logic is multi-valued logic that is able to define values between conventional states such as true or false, yes or no, white or black, and so on. Fuzzy has the term Fuzzy Inference System (FIS) which is the method of Mamdani and Sugeno. Where the Mamdani method is most often used for fuzzy logic control problems, because it covers a wide field and is in accordance with the human information input process. Determination of the inference model must be precise, Mamdani is usually suitable for problems that are intuitive, while Sugeno is for problems that deal with control. Fuzzy implementation at this stage will be assigned a value on each input variable and output variable using the Fuzzy implementation [6]. Suppose there are 1242 scholarship applicants, there are 3 variables. inputs include mathematical logical intelligence, spatial spatial intelligence, and the degree of compatibility. The input variables for logical mathematical intelligence and spatial intelligence have fuzzy sets including very low, low, sufficient, high and very high. The match level has fuzzy sets, namely low, medium, and high. The input variable of mathematical logical intelligence has a value range of 0 to 30, spatial intelligence has a range of values from 0 to 40 and the match level has a range of values from 0 to 3. In the output variable there are 2 fuzzy sets, namely pass and not pass with a range value of 1 to 40. Based on the range value that has been formed, it will be easier to assign parameter values to each fuzzy set [6]. System testing at the system testing stage is the stage where the system will perform testing. This test is needed to find out that the system can be run according to the purpose. The formulation of conclusions at this stage is carried out by formulating conclusions based on research that has been carried out whether the final results are in accordance with the expected goals. There are several reasons why people use Fuzzy Logic, including [6]:

1. Tsukamoto's Fuzzy Logic concept is easy to understand. The mathematical concepts underlying fuzzy reasoning are very simple and easy to understand.

2. Fuzzy Logic Tsukamoto is very flexible.

3. Fuzzy Logic Tsukamoto has tolerance for inaccurate data.

2.1.2 Advantages and Disadvantages of Fuzzy Logic

Fuzzy has several advantages, including the following: 1. The concept of fuzzy logic is easy to understand. The mathematical concepts underlying fuzzy logic reasoning are very simple and easy to understand. 2. Fuzzy logic is very flexible. 3. Fuzzy logic has tolerance for inaccurate data. 4. Fuzzy logic is able to model complex nonlinear functions. 5. Fuzzy logic can build and apply the experiences of experts directly without having to go through the training process. Fuzzy logic can work together with conventional control techniques [16].

6. Fuzzy logic is based on natural language. Meanwhile, in its application, fuzzy logic also has several advantages, including the following:

1. Its usability is considered to be better than any control technique that has ever existed.

2. Fuzzy controllers are renowned for their reliability.

3. Easy to repair.

4. Fuzzy controller provides excellent control compared to other techniques

5. The effort and funds required are small. [16] In addition, fuzzy logic also has drawbacks, especially in its application. These shortcomings include:

1. Many previous and present generations of engineers and scientists are not familiar with fuzzy control theory, even though they have practical technical experience to use existing control technologies and tools [16].

2. There are not many courses/education centers and textbooks that reach every level of education (undergraduate, postgraduate, and on site training)

3. Until now there is no standard and uniform systematic knowledge about solving control problems using fuzzy controllers [16].

4. There is no general method for developing and implementing fuzzy controllers [16].

2.1.3 Tsukamoto's Fuzzy Rules

In building a fuzzy system, several reasons are known, including: the Tsukamoto method, the Mamdani method and the Sugeno method. In the Tsukamoto method, every consequence of the current IF-THEN rule is represented by a fuzzy set with a monotonic method function [8]. As a result, the inference output of each rule is given strictly based on the fire strength predicate. The final result is obtained using 8 weighted averages. For example, there are 2 input variables, var-1(x) and var-2(y) and 1 output variable var-3(z), where var-1 is divided into 2 sets, namely A1 and A2 and var-2 is divided into B1 sets. and B2. While var-3 is also divided into 2 sets, namely C1 and C2 [8].

[R1] IF (x is A1) and (y is B2) THEN (z is C1)

[R2] IF (x is A2) and (y is B1) THEN (z is C2)

Figure II: Fuzzy Logic Rules.

Descrıptıon Of Study Objects

3.1 Scholarship Selection System Scholarship selection system for Indonesian Postal Polytechnic students

still has a problem that is still using manual calculations to do a selection of prospective scholarship recipients. Then, the admin staff knows how to solve the problem and find a solution by making a calculation process system that is poured through the calculation of the Fuzzy Logic Tsukamoto method [2]. What the company currently needs is how the system that will be made can run according to the calculations that have been determined based on the criteria. And requires an application for admin staff in order to help the scholarship selection process by calculating the system with the Fuzzy Logic Tsukamoto method [1].

3.2 Data Source

3.2.1 Primary Data

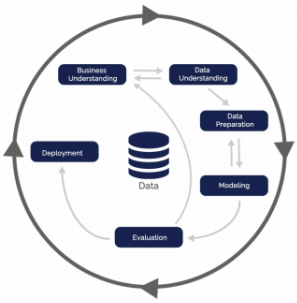
Primary data, data obtained and collected directly from the source. Primary data sources were obtained from interviews and data provided by Deputy Director III. Primary data here is used to find problems that exist in the Field of Student Affairs, Alumni and Indonesian Postal Polytechnic Cooperation. Primary data includes data for scholarship selection.

3.2.2 Interview

Interview is an activity carried out to obtain information about an object. Interviews were conducted through a question and answer process with the Deputy Director III for Student Affairs, Alumni and POS INDONESIA POLYTECHNICAL Cooperation to find out information about the flow and process of selecting scholarships. In conducting a research, supporting data is needed and must be collected to find out the problems that occur so that later the problem can be solved. In identifying research problems the method used is the interview method. In conducting this interview, there were problems in system design, here the researchers conducted interviews with related parties, namely: Resource Person: Mr. Hilman Setiadi, S.E., S.Pd., M.T Interviewer : Diki Wahyu Nugraha Place : Ruang. Deputy Director III POS INDONESIA POLYTECHNIC. Theme: Scholarship Selection 3.2.3 Secondary Data Secondary data, data obtained by researchers from existing sources. Secondary data sources were obtained from books, research journals and for making the results of prospective scholarship recipients using the Tsukamoto Fuzzy Logic method.

Research Methodology

4.1 Research Methodology Flowchart



Gambar IV.1: *Cross-Industry Process for Data Mining CRIPS-DM*

4.2 Tahapan-Tahapan Alur Metodologi Penelitian

1. Pengumpulan Data

Tahap ini dilakukan pengumpulan data yang berkaitan dengan metode Fuzzy Logic Tsukamoto yaitu merupakan salah satu aspek yang berperan dalam kelancaran dan keberhasilan dalam suatu penelitian. Dalam penelitian ini pengumpulan data, diantaranya :

2. Observasi

Observasi merupakan pengamatan dan pencatatan secara sistematik terhadap unsur-unsur yang tampak dalam suatu gejala-gejala pada obyek penelitian. Dalam penelitian ini, penulis melakukan observasi pada :

NO	CRITERIA
1	GPA
2	Parents Salary
3	Dependent
4	Performance

Table IV. 1: Scholarship Selection Criteria

Time: March 3, 2019 to August 25, 2019

Place: Pos Indonesia Polytechnic, Deputy Director's Room III.

Address: Jln.Sari Asih No.54 Sarijadi, Bandung 40151

3. Interview

The interview was conducted with Mr. Hilman Setiadi., S.E.,S.Pd.,M.T s on July 25, 2019 at 16.00 as Deputy Director III at POLITEKNIK POS INDONESIA. 4. Questionnaire Questionnaire is a data collection technique which is done by giving a set of written statements to respondents to answer. Provide questionnaires to employees to find out respondents' responses to the statements that have been provided.

4.2.1 Business Understanding

In this study, researchers will analyze the effect of the calculation of scholarship selection based on criteria. The scholarship selection process is determined based on the eligibility criteria for passing the GPA, one of which is then the criteria for students with achievements, academic and non-academic achievements. One of the selected scholarship recipients is a student who excels in all aspects of education. Basically, the scholarship

itself will later be given to students who are entitled to be determined by a high criterion value and then selected if they have similarities in GPA scores, they will be compared with other criteria, including achievement or parental salary, which will be selected based on a comparison of criteria values.

4.2.2 Data Understanding

In obtaining accurate data, the researchers collected data obtained from various sources. Because data is an important element used for the research process. The source of data used by researchers in this study is to use secondary data.

4.2.3 Preparation of data (Data Preparation)

By using these 15 data, the researcher will conduct a test using manual calculations using Microsoft Excel tools and WEKA tools. For manual calculations, it will be explained in the data calculation subsection. WEKA is a tool that can be used to perform statistical analysis. This program has a fairly high analytical ability, besides that this program also has a data management system. Using the program is also simple with various descriptive menus and dialog boxes. WEKA is widely used in various marketing research, quality control/repair, as well as various research related to calculations. The use of these tools in research conducted by researchers is to find the results of the analysis of this research. The methods used in analyzing the data are as follows:

1. Descriptive Statistics This method will provide an overview of the research in the form of an overview of the data based on the average value, maximum and minimum values, and data distribution.

2. Classical Assumption Test This test will measure the normality test, multicollinearity test, and autorelation test. This test will follow the provisions of the WEKA program 3. Hypothesis Testing In this test the hypothesis will be tested based on the test results of calculations based on criteria.

4.2.4 Descriptive Analysis of Data

with a number of fifteen (15) data used as samples in this study is scholarship data.

4.3 Analysis

Analysis is a process to determine the form of application requirements both in the form of requirements at the time of development and at the time of implementation. Analysis is a stage of understanding an information system that has been created.

4.3.1 Ongoing analysis

The steps needed in making a program are analyzing existing systems, where system analysis is the process of studying a system by describing the system into the elements that make it up.

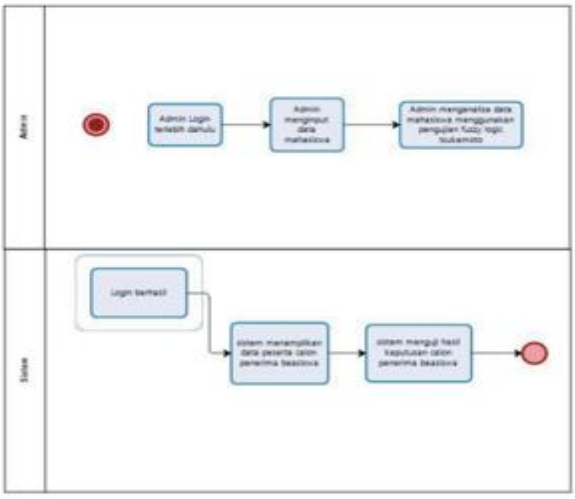


Figure III: Ongoing Analysis

4.3.2 Determination of Value

Membership Goal : Get membership value. Input: GPA Criteria, Parents Salary, Parents Dependents, and Achievement Methods: Data collection. Output : Calculation accuracy value. At this stage, namely taking or selecting data generated from secondary data which has the final result of calculating the prospective scholarship recipient.

4.3.3 Analysis and Comparison of Algorithms

Objective: To analyze, find functions and implement formulas using the Clustering K-Means and Fuzzy Logic Tsukamoto methods. Input: Criteria for GPA, Parents Salary, Parents Dependents, and Achievements. Method : K-Means Clustering and Fuzzy Logic Tsukamoto method. Output: Final Results of Scholarship Recipients.

4.3.3.1 K-Means . Clustering Method Analysis

The K-Means Clustering method is implemented on scholarship data based on criteria that have been given weighted distances and weighted points of interest. The implementation of the K-Means Clustering Method is carried out for cluster 1 and cluster 2. The results obtained from the implementation of the K-Means Clustering Method are looking for the results of clusters of prospective scholarship recipients. The results of this implementation will be used by the application to show the results of cluster 1 and cluster 2.

4.3.3.2 Tsukamoto Fuzzy Logic Method Analysis

Next is the Tsukamoto Fuzzy Logic Method, this method is one solution for determining the search for solutions to prospective scholarship recipients. Tsukamoto's Fuzzy Logic method is one of the variants of dynamic programming, which is a method that performs problem solving based on Rules criteria by viewing the solution to be obtained as an interrelated decision. This means that these solutions are formed from the solutions that come from the previous stage and there is the possibility of more than one solution. At this stage of the method, the analysis is carried out first, then the prospective scholarship recipients are generated which then the formulas and analytical methods that are calculated will produce a decision that will be implemented into a web-based system.

4.3.4 Comparison of Method Results

Objective : To compare the results of K-Means Clustering and Tsukamoto's Fuzzy Logic Method. Input: Results of Analysis of the K-Means Clustering Method and Tsukamoto's Fuzzy Logic Method. Method : Comparison or Comparison of K-Means Clustering Method and Tsukamoto's Fuzzy Logic Method. Output : Method comparison table. Next is the stage of determining the scholarship recipients, namely determining the Defuzzification value for Fuzzy and the Cluster value for K-Means, based on some available data, where there is only one destination point. Calculates the centroid distance by finding the distance between existing values. And determine the fastest decision results after processing data using the K-Means Clustering Method and the Tsukamoto Fuzzy Logic Method [3].

4.3.5 Testing Method

Objective : To test and find solutions from the KMeans Clustering Method and the Tsukamoto Fuzzy Logic Method. Input: Analysis of the K-Means Clustering Method and Tsukamoto's Fuzzy Logic Method. Methods: K-Means Clustering Method and Tsukamoto Fuzzy Logic Method. Output: Results of Determination of Scholarship Recipients. System implementation is the stage of implementing a system that has been designed or designed, so that the system that has been created can be operated and used optimally according to needs. In addition to the implementation phase, testing of the new system will be carried out and will see the shortcomings of the new application for further system development. The implementation of the system carried out at this stage is to implement a decision support system for prospective scholarship recipients from the K-

Means Clustering method and the Tsukamoto Fuzzy Logic Method then testing the system which will display the accuracy results of the scholarship recipients.

4.3.6 Evaluation of Results

Objective: To evaluate the accuracy of the K-Means Clustering method and the Tsukamoto Fuzzy Logic Method. Input: Results of Passed and Failed Scholarship Recipients. Methods: K-Means Clustering and Tsukamoto's Fuzzy Logic Method. Output : The method used. The method that will be used with accurate results is the Fuzzy Logic Tsukamoto method because based on the calculation decision the result system that receives more scholarships is using the Fuzzy Logic Tsukamoto method compared to the Clustering K-Means method.

Experiment And Result

5.1 EXPERIMENT

5.1.1 Implementation of the K-Means Clustering Method

5.1.2 Data Collection

	A	B	C	D	E	F	G
1	Nama	IPK	Gaji Orang Tua	Jumlah Tanggungan	Prestasi	LULUS	TIDAK LULUS
2	A	2,33	9000	5	0		TIDAK LULUS
3	B	2	1500	4	0		TIDAK LULUS
4	C	3,3	1460	4	1	LULUS	
5	D	2,92	1500	4	0		TIDAK LULUS
6	E	3,37	2400	2	1	LULUS	
7	F	3,35	2500	4	1	LULUS	
8	G	3,32	4000	5	1	LULUS	
9	H	2,90	5000	3	0		TIDAK LULUS
10	I	2,43	4000	5	0		TIDAK LULUS
11	J	2,85	5000	5	0		TIDAK LULUS
12	K	3,5	3500	4	1	LULUS	
13	L	3,82	4000	5	1	LULUS	
14	M	2,68	5200	3	0		TIDAK LULUS
15	N	3,48	5000	1	1	LULUS	
16	O	2,9	3200	3	0		TIDAK LULUS
17	P	3,12	3000	4	0	LULUS	
18	Q	3,35	3000	4	0	LULUS	
19	R	3,66	1500	5	0	LULUS	
20	S	3,53	3000	3	0	LULUS	

Figure IV 4: Raw Data

5.1.3 Data Preprocessing

5.1.4 Initial Centroid

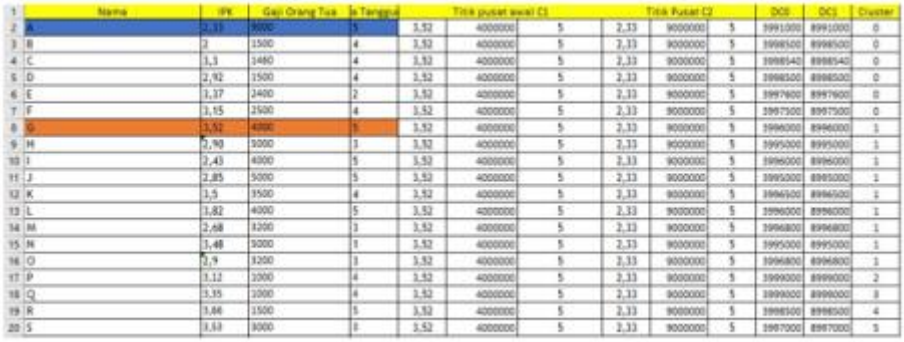
Initial Centroid search is done using the WEKA tool, and determines the initial centroid as below:

	A	B	C
C0	2,845	3060	3,83333
C1	2,47556	4100	3,77778

Figure V 5 : Cluster 1 And Cluster 2

5.1.5 Calculating data distance with centroid

5.1.6 Initial and Final Results Data distance with Centroid



	Nama	IPK	Gaji Orang Tua	Jk Tanggung	Titik pusat awal C1			Titik Pusat C2			DC0	DC1	Cluster
2	A	3,33	5000	5	3,52	4000000	5	2,33	9000000	5	3991000	8991000	0
3	B	2	1500	4	3,52	4000000	5	2,33	9000000	5	3998500	8998500	0
4	C	1,3	1460	4	3,52	4000000	5	2,33	9000000	5	3998540	8998540	0
5	D	2,92	1500	4	3,52	4000000	5	2,33	9000000	5	3998500	8998500	0
6	E	1,37	2400	2	3,52	4000000	5	2,33	9000000	5	3997600	8997600	0
7	F	1,15	2500	4	3,52	4000000	5	2,33	9000000	5	3997500	8997500	0
8	G	3,52	4000	5	3,52	4000000	5	2,33	9000000	5	3996000	8996000	1
9	H	2,90	5000	3	3,52	4000000	5	2,33	9000000	5	3995000	8995000	1
10	I	2,43	4000	5	3,52	4000000	5	2,33	9000000	5	3996000	8996000	1
11	J	2,85	5000	5	3,52	4000000	5	2,33	9000000	5	3995000	8995000	1
12	K	3,5	3500	4	3,52	4000000	5	2,33	9000000	5	3996500	8996500	1
13	L	1,82	4000	5	3,52	4000000	5	2,33	9000000	5	3996000	8996000	1
14	M	2,68	3200	3	3,52	4000000	5	2,33	9000000	5	3996800	8996800	1
15	N	1,48	5000	1	3,52	4000000	5	2,33	9000000	5	3995000	8995000	1
16	O	2,9	3200	1	3,52	4000000	5	2,33	9000000	5	3996800	8996800	1
17	P	3,12	1000	4	3,52	4000000	5	2,33	9000000	5	3999000	8999000	2
18	Q	3,35	1000	4	3,52	4000000	5	2,33	9000000	5	3999000	8999000	2
19	R	3,66	1500	5	3,52	4000000	5	2,33	9000000	5	3998500	8998500	4
20	S	3,53	3000	3	3,52	4000000	5	2,33	9000000	5	3997000	8997000	5

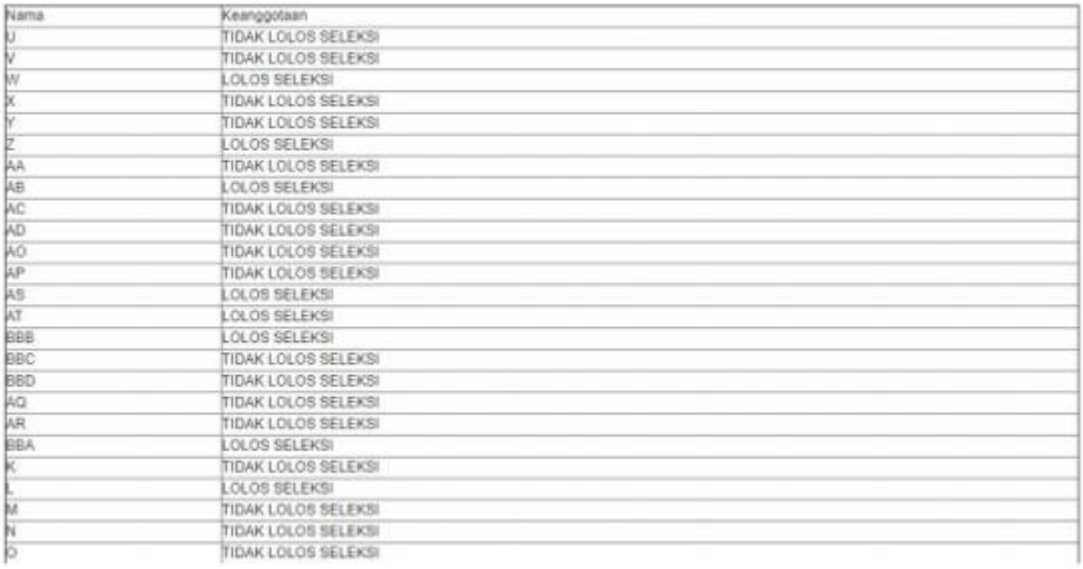
Figure VI 6 : Initial Results Of Cluster Distance Data

Nama	IPK	Gaji Orang Tua	Jk Tanggung	Titik pusat awal C1			Titik Pusat C2			DC0	DC1	Cluster
A	3,33	5000	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2159284	4695283	0
B	2	1500	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2166784	4702783	0
C	1,3	1460	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2166804	4702823	0
D	2,92	1500	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2166784	4702783	0
E	1,37	2400	2	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2165884	4701885	0
F	1,15	2500	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2165784	4701783	0
G	3,52	4000	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2164284	4700283	1
H	2,90	5000	3	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2163284	4699283	1
I	2,43	4000	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2164284	4700283	1
J	2,85	5000	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2163284	4699283	1
K	3,5	3500	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2164784	4700783	1
L	1,82	4000	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2164284	4700285	0
M	2,68	3200	3	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2165084	4701083	1
N	1,48	5000	1	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2163284	4699283	0
O	2,9	3200	1	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2165084	4701083	1
P	3,12	1000	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2167284	4703283	0
Q	3,35	1000	4	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2167284	4703283	1
R	3,66	1500	5	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2166784	4702783	1
S	3,53	3000	3	2,84286	2168264,286	3,42857	2,2425	4704283,4	4,125	2165284	4701285	0

Figure VII 7 : The Final Result Of Cluster Distance Data

5.1.7 Final Centroid

The 4th iteration has been carried out and the results of iterations 3 and 4 are the same as below:

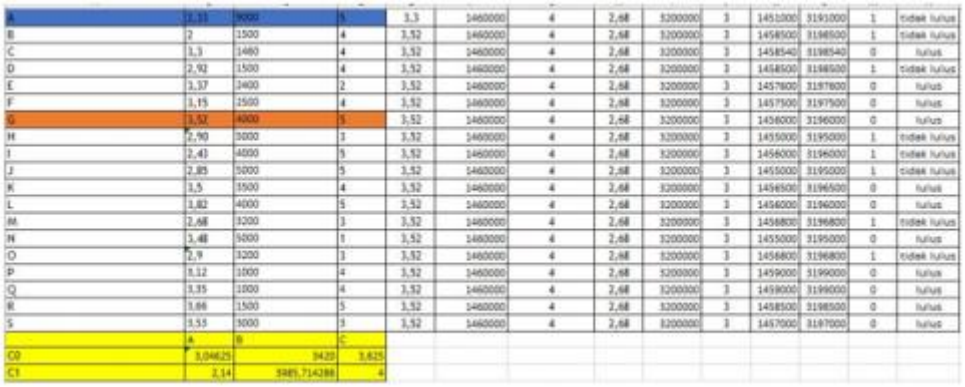


Nama	Keanggotaan
U	TIDAK LOLOS SELEKSI
V	TIDAK LOLOS SELEKSI
W	LOLOS SELEKSI
X	TIDAK LOLOS SELEKSI
Y	TIDAK LOLOS SELEKSI
Z	LOLOS SELEKSI
AA	TIDAK LOLOS SELEKSI
AB	LOLOS SELEKSI
AC	TIDAK LOLOS SELEKSI
AD	TIDAK LOLOS SELEKSI
AO	TIDAK LOLOS SELEKSI
AP	TIDAK LOLOS SELEKSI
AS	LOLOS SELEKSI
AT	LOLOS SELEKSI
BBB	LOLOS SELEKSI
BBC	TIDAK LOLOS SELEKSI
BBD	TIDAK LOLOS SELEKSI
AQ	TIDAK LOLOS SELEKSI
AR	TIDAK LOLOS SELEKSI
BBA	LOLOS SELEKSI
K	TIDAK LOLOS SELEKSI
L	LOLOS SELEKSI
M	TIDAK LOLOS SELEKSI
N	TIDAK LOLOS SELEKSI
O	TIDAK LOLOS SELEKSI

Figure VIII 8 : Final Centroid

5.1.8 RESULT

The following is the final result of grouping scholarship data using the K-Means Clustering method :



A	1,33	9000	5	3,3	1460000	4	2,68	3200000	3	1451000	3191000	1	tidak lulus
B	2	1500	4	3,32	1460000	4	2,68	3200000	3	1458500	3198500	1	tidak lulus
C	1,3	1460	4	3,32	1460000	4	2,68	3200000	3	1458540	3198540	0	lulus
D	2,92	1500	4	3,32	1460000	4	2,68	3200000	3	1458500	3198500	1	tidak lulus
E	1,37	2400	2	3,32	1460000	4	2,68	3200000	3	1457600	3197600	0	lulus
F	1,15	2500	4	3,32	1460000	4	2,68	3200000	3	1457500	3197500	0	lulus
G	1,52	4000	5	3,32	1460000	4	2,68	3200000	3	1456000	3196000	0	lulus
H	2,90	3000	3	3,32	1460000	4	2,68	3200000	3	1455000	3195000	1	tidak lulus
I	2,41	4000	5	3,32	1460000	4	2,68	3200000	3	1456000	3196000	1	tidak lulus
J	2,85	5000	5	3,32	1460000	4	2,68	3200000	3	1455000	3195000	1	tidak lulus
K	1,5	3500	4	3,32	1460000	4	2,68	3200000	3	1456500	3196500	0	lulus
L	1,82	4000	5	3,32	1460000	4	2,68	3200000	3	1456000	3196000	0	lulus
M	2,68	3200	3	3,32	1460000	4	2,68	3200000	3	1456800	3196800	1	tidak lulus
N	1,48	5000	1	3,32	1460000	4	2,68	3200000	3	1455000	3195000	0	lulus
O	2,9	3200	3	3,32	1460000	4	2,68	3200000	3	1456800	3196800	1	tidak lulus
P	1,12	1000	4	3,32	1460000	4	2,68	3200000	3	1459000	3199000	0	lulus
Q	1,35	1000	4	3,32	1460000	4	2,68	3200000	3	1459000	3199000	0	lulus
R	1,66	1500	5	3,32	1460000	4	2,68	3200000	3	1458500	3198500	0	lulus
S	1,55	3000	3	3,32	1460000	4	2,68	3200000	3	1457000	3197000	0	lulus
	A	B	C										
C0	1,046,25	3420	3,625										
C1	2,14	3985,714286	4										

Figure VIII 8 : Final Result Of Calculation

Conclusıon

6.1 Problem Conclusion

The conclusions that can be drawn from the application of the decision support system for prospective scholarship recipients for POLITEKNIK POS INDONESIA students using the Fuzzy Logic Tsukamoto method are as follows:

1. The implementation of the application in the previous research compared the results of the calculation of the K-Means Clustering method and the Tsukamoto Fuzzy Logic method and decided with the same calculation results that have been tested through the system created.

2. The implementation of Tsukamoto's Fuzzy Logic in the application of a decision support system can provide the results of the decision of prospective scholarship recipients based on predetermined value criteria. Based on the data processing of the assessment of the scholarship recipients, the final implementation results were obtained with selection assisted by the Fuzzy Logic Tsukamoto method.

6.2 Conclusion From Method

1. Fuzzy Logic Tsukamoto is a data calculation method that performs the IF-THEN-ELSE rule. Where in this study the rules are determined based on the criteria.

2. The calculation results generated from Tsukamoto's Fuzzy Logic method itself are very pure according to the method used without any additions and subtractions from calculations outside the calculation method itself.

6.3 System Test Conclusion

Based on the results of the application for developing a decision support system for prospective scholarship recipients, POLITEKNIK POS INDONESIA students concluded that the system that had been made was running well and could be used in this study, and in testing the results of calculations using Tsukamoto's Fuzzy Logic, validation tests had been carried out using the Weka and Tsukamoto tools. PHP Native programming language

Dıscussıon

7.1 Discussion

After doing research on the decision support system for prospective scholarship recipients at POLYTEKNIK POS INDONESIA using the Fuzzy Logic Tsukamoto method, suggestions for a better direction are needed. The following is a statement that the author will give related to the research that has been carried out:

1. Based on system testing using the Clustering K-Means and Fuzzy Logic Tsukamoto methods, the final results of the graduation of prospective scholarship recipients are more feasible using the Fuzzy Logic Tsukamoto method.

2. The application design in previous research compared the results of the calculation of the K-Means Clustering method and decided to develop it using the Tsukamoto Fuzzy Logic method and decided with the same calculation results and has been tested through the system created [9].

3. Based on testing the higher accuracy system and deserves to be prioritized is the Fuzzy Logic Tsukamoto method because it determines the acquisition of the final results of the scholarship recipients [9].

7.2 Recommendations

The recommendations to be conveyed for the development of a decision support system for prospective scholarship recipients for POLITEKNIK POS INDONESIA students using the Fuzzy Logic Tsukamoto method in this study are as follows:

1. For the development of the Fuzzy Logic Tsukamoto application, further criteria can be added which can be developed in the application of a decision support system for prospective scholarship recipients.

2. This research can be developed using other calculation methods, or using a programming language other than Php Native [22].

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