Fuzzy Application In Decision Support System In The Senior High School Selection In Bandar Lampung

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ABSTRACT

Determining the best and the best school is not easy. we should look for information in the schools we attend, then compare them and choose which schools fit the criteria.One expert system design to predict the right school using the Fuzzy Inference System Tsukamoto method which includes 3 variables: academic value, parent income, and school. As a result, the inference output of each rule is given explicitly (crisp) based on the α-predicate (fire strength). The final result is obtained by using weighted average. Fuzzy inference system with Tsukamoto process is used to solve an unstructured problem simply. so by applying the method, can get the right school choice statement.

Keywords: Fuzzy Inference System, Tsukamoto.

1. Introduction.

In Indonesia have known four levels of education, covering the level of early childhood education, primary education, secondary education, and higher education.All residents are required to attend a nine-year compulsory education program, six years in primary school, and three years in junior high school.But in line with the demands of the world of work, nowadays people tend to pursue education up to senior high school or vocational high school level, although not close the possibility of continuing to higher education.

For people who are studying at elementary, junior and senior high school, they are faced with many school choices. Choosing the right school is very important in life, because the school chosen will affect education and the future. The accuracy of choosing a school will have a major impact when it comes to continuing higher education or entering the workforce.

Recognizing the importance of choosing the right schools, it is necessary to design a mechanism that can help with the selection of schools. Fuzzy Inference System is a computer-based system that can determine a statement.Fuzzy Inferece System using the Tsukamoto method is used because of the method that has tolerance on the datan and is very flexible. So by applying the method, it is expected to help the decision of the school election appropriately.

2. Research Method.

a. Decision Support System

Decision Support System is one software product developed specifically to assist in decision making process. As the name implies, the purpose of the use of this system is as "second opinion" or "information sources" which can be used as consideration before deciding a particular policy. Decision support system is an approach to support decision making. The decision support system uses data, provides an easy user interface, and can incorporate decision-making thinking [1].

b. School

School is a tiered and continuous education unit to organize teaching and learning activities [2]. Schools can also be defined as institutions consisting of teachers, students, and administrative staff who have their respective duties in program surfing.

From the definition, the school is an institution or organization authorized to organize learning activities. It aims to produce graduates who have good academic, attitude, and mental competence, so they can continue their education to a higher level or work according to their expertise.

c. Tsukamoto Method

Tsukamoto's method is an extension of monotonous reasoning. In the Tsukamoto method, every consequence of the If-Then rule must be represented by a fuzzy set with a monotonous membership function. As a result, the inference output of each rule is given explicitly (crisp) based on the α-predicate (fire strength). The final result is obtained by using weighted average [3].

The steps to complete the tsukamoto method are as follows:

1. Fuzzy set input

In designing this system using input from the value of inputted by admin. These values are the variables used in the calculations to find the fuzzy value.

2. Determine the degree of fuzzy set membership

Each system variable in the fuzzy set specifies the degree of membership (α). Where the degree of membership becomes a value in the fuzzy set.

3. Calculating predicate rules (α)

Variables that have been included in the fuzzy set, formed rules obtained by combining each variable with one variable with linguistic attributes respectively. The rules that have been obtained will be calculated the value of predicate rules with the implication process.

In tsukamoto method the implication process is done by Min operation. The predicate rule is obtained by taking the minimum value of the membership degree of one variable with another variable, which has been combined in predefined rules.

4. Defuzification

In this defuzification stage we calculate the average (Weight Average/WA) of each predicate on each variable using the following equation:

$$WA = \frac{\alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \ldots + \alpha_n Z_n}{\alpha_1 + \alpha_2 + \alpha_3 + \ldots + \alpha_n}$$

Description αn = predicate value of rule n

Zn = index of the nth output value

The application of fuzzy logic with Tsukamoto method is used to change the inputs in the form of academic value and income of the parents into the output in the form of public or private schools. There are several steps used in the implementation of Fuzzy Inference System (FIS) Tsukamoto, namely:

1. Determining the Fuzzy Foundation Membership Degrees

In the Tsukamoto Method, both input and output variables are divided into one or more fuzzy sets. The determination of school input variables is divided into two namely Academic Value and Parent Income. And one variable output, namely the School variables. Here is the design of the fuzzy set on the school's determination.

Table 1. Variable Data Range Table

Variabel	The Fuzzy set	Value Range
Academic Value	Low	0 – 400
	High	200 – 400
Parent Income	Low	0 – 1500
	High	500 – 1500
School	Private	≤500
	Country	≥501

The fuzzy set and the membership function of the academic value variable, parent income, and school are represented as follows:

a. The Fuzzy Assemblies of Variable Academic Values

Table 2. Table of Academic Values

Nilai Akademik	
The Fuzzy set	Fuzzy Numbers
Low	0 – 400
High	200 – 400

The Academic Value variable contains two fuzzy sets, ie low and high. The linear form goes down to represent the lower fuzzy set and the linear form rises for the high fuzzy set.

b. The Fuzzy Set of Parent Income Variables.

Table 3. Parent Income Table

Parent Income	
The Fuzzy set	Fuzzy Numbers
Low	0 – 1500
High	500 – 1500

In the parent income variable is defined into two fuzzy set that is, low and high. The shape of the linear curve descends to represent the lower fuzzy set and the linear curve form rises to represent the high fuzzy set.

c. Fuzzy School Variable Set
School Table

Table 4. Fuzzy School Table

School	
The Fuzzy set	Fuzzy Numbers
Private	0 – 1000
Country	200 – 1000

In the school variable is defined two fuzzy set, namely private and domestic. The shape of the linear curve falls to represent the private fuzzy set, and the linear curve form rises for the fuzzy set of the country.

2. Application Function Implications

Application of the implication function, in which the user of MIN Function as the method of implication in determining the minimum α-predicate of each defined rule, means that some of the IF statements are taken α-predicate or the smallest degree of membership value and the implication value 0 is omitted. So we get fuzzy area in school variable for each rule. However, before calculating the rule predicate (α), it must be known in advance that the rules are useful in determining the decision as the output of the system. These rules are the basis of knowledge gained from experts. Here are the rules of the relationship of input variables with output variables based on data obtained by the author.

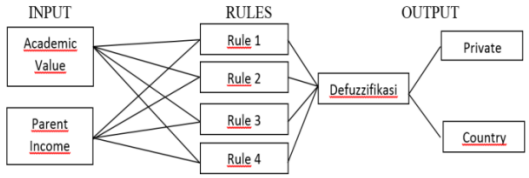
The rules in determining the school

No	Academic Value and Parent Income			School
1	IF	LOW academic value and LOW parent income	THEN	Private
2	IF	LOW academic value and HIGH parent income	THEN	Private
3	IF	HIGH academic grades and LOW parent income	THEN	Country
4	IF	HIGH academic grades and HIGH parent income	THEN	Country

The above data determine the solving case study using Fuzzy Inference System (FIS) method tsukamoto need to specify the input and output criteria. Because to analyze the best schools using some criteria input, then it is in accordance with the approach method of Tsukamoto.

3. Designing the structure of Tsukamoto's fuzzy method

Based on the nine fuzzy rules will be determined min value for each rule.



FIS Structure Tsukamoto
Information :
Input is an erratic score number according to the assessment

3. Discussion.

The Decision Support System for Selection of Senior Secondary Schools in Bandar Lampung is displayed by running the Web. Program runs well, such as the discussion on the program display above, if it can not connect then there is interference in the

internet connection.

This decision support system is implemented in the form of an application program that can support the selection process of secondary schools in Bandar Lampung using Tsukamoto method. The results of this system are given in the form of a description report which is displayed after inputting the data and being processed.

A. Fuzzy Tsukamoto calculations

1. Academic Value = 315
2. Elderly Income = 800 (Thousand Units)

Finding Fuzzy Value:

3. Academic Value Variable (315): Low academic score = (400-315) / (400-200) = 85/200 = 0.43
   High academic score = (315-200) / (400-200) = 115/200 = 0.58
4. Parent income variable (800):

Parent income Low = (1500-800) / (1500-500) = 700/1000 = 0.7
High Parent income = (800-500) / (1500-500) = 300/1000 = 0.3
The rule used is the MIN rule on its implication function:
[R1] IF Academic Value Low and Income of Lower Parent Then Private School

Academic Value (Low)	Parent income (Low)	Min (α)	Valu e(z)
0,43	0,7	0,43	660

[R2] IF Low Academic Value and High Parent Income Then Private School

Academic Value (Low)	Parent Income (High)	Min (α)	Nilai (z)
0,43	0,3	0,3	760

[R3] IF High Academic Value and Low Income of Parents Then State School

Academic Value(High)	Parent Income (Low)	Min (α)	Nilai (z)
0,58	0,7	0,58	660

[R4] IF High Academic Value and High Parent Income Then Public School

Academic Value (High)	Parent Income (High)	Min (α)	Nilai (z)
0,58	0,3	0,3	440

In the Tsukamoto method, to determine the output firmly use the centralized mean defuzzification, namely:

$$Z = \frac{(\alpha 1z1 + \alpha 2z2 + \cdots + \alpha nzn)}{\alpha 1 + \alpha 2 + \cdots + \alpha n}$$

For the 4 fuzzy rules then the centralized average formula becomes:

$$Z = \frac{(\alpha 1z1 + \alpha 2z2 + \alpha 3z3 + \alpha 4z4)}{\alpha 1 + \alpha 2 + z3 + z4}$$

Firm values can be obtained using the centered average formula for the above 4 fuzzy rules.

$$Z = \frac{((0{,}43 * 660) + (0{,}3 * 760) + (0{,}58 * 660) + (0{,}3 * 440))}{0{,}43 + 0.3 + 0{,}58 + 0{,}3}$$

$$Z = \frac{1020}{1{,}6} = 637{,}5$$

$$\text{Curve Down} = \frac{1000 - 637{,}5}{1000 - 200} = 0{,}45$$

$$\text{Curve Up} = \frac{637{,}5 - 200}{1000 - 200} = 0{,}55$$

B. Results

Based on the design of interfaces that have been made, the following will be explained about the application program that will be used as a decision support system of high school selection in Bandar Lampung. The results of the program display is described in the form of a program display that has been run (Running). The appearance of this program is as follows.

Figure 1. Implementation Fuzzy of System

4. Conclusion.

Based on research conducted by researchers through the analysis done in the previous chapters, it can be concluded several things as follows, namely:

1. The system of high school selection with the method of Fuzzy Inference System Tsukamoto has been done computerized and run through the website.
2. The high school selection system with the Tsukamoto Fuzzy Inference System method helps to make it easier for parents to choose high schools in Bandar Lampung.
3. This decision support system program uses the school's academic value, parental income, and achievement based on certificates that are developed and constructed using the SDLC method that includes the Planning, Analysis, Design, Coding, and Implementation steps.
4. Based on the system that has been tested,

it produces high school selection based on predetermined variables and will result in the numbers converted into selected schools.

Suggestion

Based on the results of the research, the researchers suggested some things about the selection of high schools in Lampung city so that prospective students / students can go to the right school:

1. This system only provides a simple view, for those who will develop this program further expected to be equipped and refined appearance and can provide additional other variables.
2. The decision support system of high school selection in the city of Lampung is a program that is still very simple, and do not rule out the future there will be a new application development that can be coordinated with a better data processing system.

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