

Application of Fuzzy Logic to Classify Community Welfare Levels

Aditra*, Sumijan, Rini Sovia

Universitas Putra Indonesia YPTK Padang, Jl. Raya Lubuk Begalung Padang, Sumatera Barat – 25221, Indonesia

* aditra1818@gmail.com

Abstract

Information regarding family welfare does not only affect family members, but also influences the success of government, including village government. Therefore, information regarding the level of family welfare is needed to monitor the progress of development programs that have been carried out. The fuzzy logic of the Tahani model is one method that can be applied to classify things. The aim of this research is to classify the level of welfare of families as potential recipients of assistance based on population data held by the Mentawai Social Service & P3A. This research was processed using Fuzzy Tahani logic. Fuzzy Tahani is an optimization algorithm that can be used to support decisions by utilizing relational databases. Based on the research results obtained, fuzzy logic with the Tahani model can be used to process family data in accordance with indicators of family welfare levels by providing output in the form of family classification. It's just that the application of the Tahani model should be done on a single rule search function, not to process all the rules using a Tahani query to produce a family classification.

Keywords: Fuzzy Logic, Tahani Model, Classification, Family, Social Assistance.

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1. Introduction

The background of general welfare in Indonesia can be described based on the level of poverty. Poverty arises when a person or group of people is unable to meet the level of prosperity that is considered a basic need for a certain standard of living[1]

According to Minister of Home Affairs Regulation No. 39 of 2012, social assistance is the provision of selective and non-continuous assistance in the form of money/goods to the community whose aim is to improve community welfare. As a provider of social assistance to the community, the government has an obligation to account for social assistance according to its portion based on applicable regulations[2][3]

The problem of poverty is not just the number and percentage of poor people. Another dimension that needs to be considered is the depth and severity of poverty. Apart from efforts to reduce the number of poor people, poverty reduction policies are also related to how to reduce the depth and severity of poverty [4]

The family data object used as research material is family data obtained from the Social Service & P3A of Mentawai Islands Regency, West Sumatra. The family data obtained has not been classified because it refers to family data held by the Mentawai Social Service. Generally, the problem that occurs in the distribution of

aid funds is that there is no system that can simplify the process of classifying family data that will be submitted as potential aid recipients, so that the selection process only uses the mind and there are no precise calculations at the time of selection. At the Social Services office P3A Mentawai Islands Regency collects community data and the classification of community welfare levels is still manual. So sometimes people protest because people are supposed to get financial assistance but they don't get financial assistance, and vice versa, so a system is needed that can support decisions to make them more precise. The method implemented to classify family data based on their level of welfare uses Fuzzy Tahani.

The concept of Decision Support Systems (DSS) was first expressed in the early 1970s by Michael S. Scott Morton with the term Management Decision System. The term SPK refers to a system that utilizes computer support in the decision making process [5][6][7]. A Decision Support System is a system intended to support managerial decision makers in semi-structured decision situations. The DSS is intended to be a tool for decision makers to expand their capabilities, but not to replace their judgment [8]

Basically, a decision support system is a system that is used to assist users in the decision-making process, by utilizing data and modeling systems that are formed to

meet the needs of users in solving existing problems. [9]

Decision Support Systems are designed to assist decision makers in solving semi-structured or unstructured problems by adding human wisdom and computerized information. In the processing process, the decision support system combines the use of analytical models with conventional data entry techniques and information search/interrogation functions. Decision Support Systems are designed in such a way that they can be used or operated easily. Decision Support Systems are designed with emphasis on aspects of flexibility and high adaptability [10] [11]

Fuzzy logic is a methodology for expressing the operational laws of a system using language or linguistic expressions, not through mathematical equations.[12] The Tahani model's fuzzy database still uses standard relations, only this model uses fuzzy set theory to obtain information in its queries. Most standard databases are defined based on how the data is perceived by users [13][14]

Fuzzy Tahani is an optimization algorithm that can be used to support decisions by utilizing relational databases. This fuzzy algorithm uses fuzzy set theory to obtain information from the database using database queries [15][16].

The aim or objective of conducting this research is to classify the level of family welfare based on family data held by the Mentawai P3A Social Service from an economic perspective including disadvantaged families, underprivileged families and prosperous families. It is hoped that the information on classifying the level of family welfare can be used as supporting information for the Mentawai Social Service in selecting families to be proposed as potential recipients of government social assistance.

2. Research methodology

In this research, in order to get the desired results, a research framework is needed. The research framework is the concept or stages that will be carried out in the research. So that the steps taken by the author in this design do not deviate from the main discussion and are easier to understand, the sequence of research steps will be made systematically so that it can be used as a clear

and easy guide for solving existing problems.

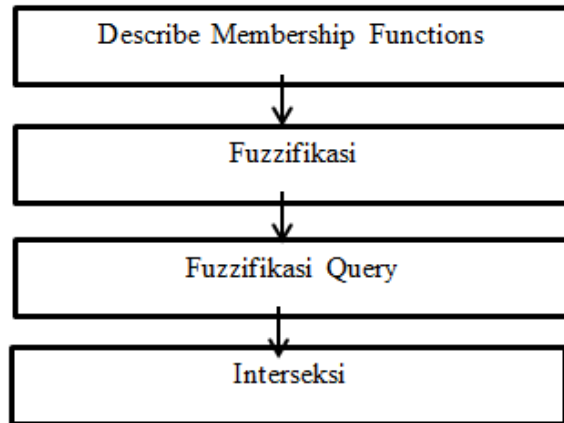


Figure 1. Research Framework

The steps in the fuzzy Tahani method are as follows:

1. Describes the membership function for each fuzzy criterion or variable, namely a curve that shows the mapping of input data points into their membership values (degree of membership) which has an interval between 0 to 1. One way that can be used is the function approach, the membership function approach takes the form triangle.
2. Fuzzification is the first phase of fuzzy calculations, namely changing firm values to fuzzy values. Where each fuzzy variable is calculated for the degree of membership in each fuzzy set
3. Query Fuzzification is assumed to be a conventional (nonfuzzy) DBMS query which will try to create and implement a basic system of fuzzy query logic or also known as query formation using basic relations.

3. Results and Discussion

From the tests that have been carried out it will be go out The results will be used to carry out evaluations at a time recommend system Which new Which can overcome any deficiencies detected on system Which has designed.

3.1 Planning Domain Fuzzy

Results from interview, so obtained limit from set fuzzy For every variable set. Domain For each set fuzzy on study This Can seen on table 1.

Table 1. Formation Domain Fuzzy

No	Variable	Set	Domain
1	Income	Low	100,000-2,000,000
		Currently	1,500,000-2,500,000-3,500,000
		Tall	3,000,000-4,500,000
2	Dependents	A little	0-5
		Lots	3-8
3	Age	Young	25-35
		Parubaya	30-40-50

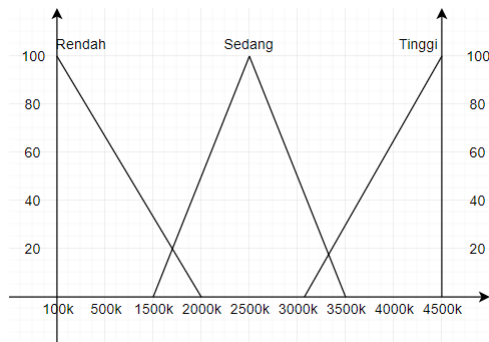
No	Variable	Set	Domain
4	Years of service	Old	45-60
		New	0-30
		Long	20-50

Then based on these fuzzy constraints , then function membership from every variable can represented in form curve representation linear And triangle Which is mapping from input to the degree of membership depicted as a line straight. There is two set states fuzzy linear, namely a linear representation of rising and falling. Whereas representation triangle on basically is combined between two linear line going up and down

3.2 Planning Representation Fuzzy

1. Function Membership Variable Income

Variables income divided into three set fuzzy, that is tall, medium and low. Representation from variables visible income on picture 2.



Picture 2. Representation Variable Income

Function membership from representation variable income on, then it can be formulated in formula as following This.

$$\mu(x) = Rendah = \left\{ \frac{2000000 - x}{2000000 - 100000} \right\} = 100000 < x < 2000000$$

$$1; x \leq 100000 \quad 0; x \geq 2000000$$

$$\mu(x)_{sedang} = \left\{ \begin{array}{l} \frac{x - 1500000}{2500000 - 1500000} \\ \frac{3500000 - x}{3500000 - 2500000} \end{array} \right\}$$

$$1500000 \leq x \leq 2500000 \quad 2500000 \leq x \leq 3000000$$

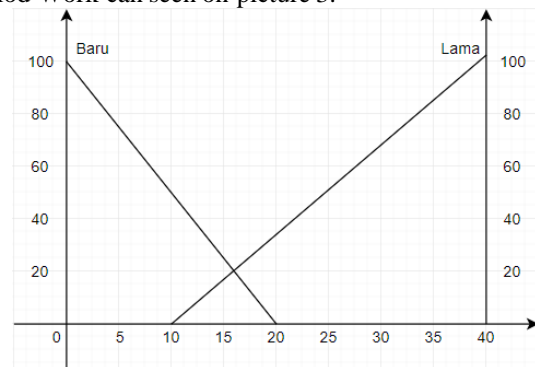
$$1; x = 2500000 \quad 0; x \leq 1500000 \text{ atau } x \geq 3500000$$

$$\mu(x) = tinggi = \left\{ \frac{x - 3000000}{4500000 - 3000000} \right\} = 3000000 \leq x \leq 4500000$$

$$1; x = 4500000 \quad 0; x \leq 3000000 \text{ a}$$

2. Function Membership Variable Period Work

Variables period Work divided into two set Fuzzy, that is: new And long. Representation of variables period Work can seen on picture 3.



Picture 3. Representation Variable Period Work

Function membership from representation variable wide land above, it can be formulated in the formula as following This.

$$\mu(x)_{Baru} = \left\{ \frac{20 - x}{20 - 0} \right\} \quad 0 \leq x \leq 2$$

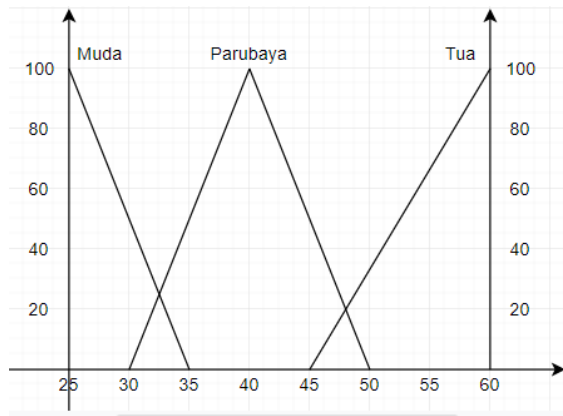
$$1; x \leq 0 \quad 0: x \geq 2$$

$$\mu(x)_{Lama} = \left\{ \frac{x - 10}{40 - 10} \right\} \quad 10 \leq x \leq 40$$

$$1; x \geq 40 \quad 0: x \leq 10$$

3. Function Membership Variable Age

Variable age divided becomes three set fuzzy, that is old, middle age And young. Representation of variable age seen on picture 4.



Picture 4. Representation Variable Age

Membership function from the representation of the age variable in on, so can formulated in formula following This.

$$\mu(x)Muda = \begin{cases} \frac{35 - x}{35 - 25} & 25 \leq x \leq 35 \\ 0 & x > 35 \end{cases}$$

$$1: x \leq 25 \qquad 0: x \geq 35$$

$$\mu(x)Parubaya = \begin{cases} \frac{x - 30}{40 - 30} & 30 \leq x \leq 40 \\ \frac{50 - x}{50 - 40} & 40 \leq x \leq 50 \\ 0 & x < 30 \text{ atau } x \geq 50 \end{cases}$$

$$30 \leq x \leq 40 \qquad 40 \leq x \leq 50$$

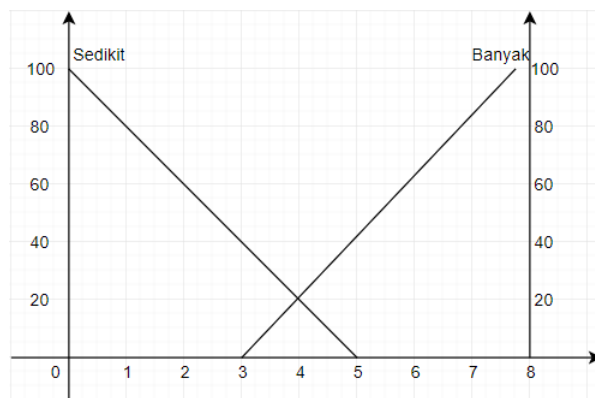
$$1: x = 40 \qquad 0: x \leq 30 \text{ atau } x \geq 50$$

$$\mu(x)Tua = \begin{cases} \frac{x - 45}{60 - 45} & 45 \leq x \leq 60 \\ 0 & x < 45 \end{cases}$$

$$1: x \leq 60 \qquad 0: x \geq 45$$

4. Function Membership Variable Dependents

Dependent variables divided into two set fuzzy , that is many and A little. Representation of variable dependents seen on picture 5.



Picture 5. Representation Variable Dependents

Function membership from representation variable responsibilities above, then it can be formulated in formula as following This

$$\mu(x)Sedikit = \begin{cases} \frac{5 - x}{5 - 0} & 0 \leq x \leq 5 \\ 0 & x > 5 \end{cases}$$

$$1: x \leq 0 \qquad 0: x \geq 5$$

$$\mu(x)Banyak = \begin{cases} \frac{x - 3}{8 - 3} & 3 \leq x \leq 8 \\ 0 & x < 3 \text{ atau } x > 8 \end{cases}$$

$$1: x \geq 0 \qquad 0: x \leq 5$$

3.3 Inversion Rules

On researcher determine rules from logic fuzzy with the aim of stating the relationship between variables input t And output, with use operator zاده . Rules Which formed as much 36 as following :

No	Rules
1.	IF income = low AND dependents = few AND age = young AND years of service = new THEN underprivileged
2	IF income = low AND dependents = few AND age young AND period Work = long THEN underprivileged
3	IF income = low AND dependents = few AND age = middle age AND period Work = new THEN underprivileged
4	IF income = low AND dependents = little AND age = middle age AND period Work = long THEN underprivileged
5	IF dependent = low AND dependent = small AND age = old AND period Work = new THEN family No capable
6	IF income = low AND dependents = little AND age = old AND period Work = long THEN family No capable
7	IF income = low AND dependents = many AND age = young AND years of service = new THEN underprivileged
8	IF income = low AND dependents = a lot AND age = young AND years of service = long THEN underprivileged
9	IF income = low AND dependents = many AND age = middle age AND period Work = new THEN family No capable
10	IF income = low AND dependents = many AND age = middle age AND period Work = long THEN family No capable
11	IF income = low AND dependents = many AND age = old AND period Work = new THEN family No capable
12	IF income = low AND dependents = many AND age = old AND period Work = long THEN family No capable
13	IF income = currently AND dependents = A little AND age = young AND period Work = new THEN Underprivileged
14	IF income = moderate AND dependents = few AND age = young AND years of service = long THEN poor
15	IF income = moderate AND dependents = few AND

No	Rules
	age = middle age AND years of service = new THEN underprivileged
16	IF income = moderate AND dependents = few AND age = middle age AND years of service = long THEN underprivileged
17	IF income = little AND dependents = little AND age = old AND years of work = new THEN underprivileged
18	IF income = moderate AND dependents = few AND age = old AND years of service = long THEN poor
19	IF income = medium AND dependents = many AND age = young AND years of service = new THEN underprivileged
20	IF income = medium AND dependents = many AND age = young AND years of service = long THEN poor
21	IF income = moderate AND dependents = many AND age = middle age AND years of service = new THEN the family can't afford it
22	IF income = moderate AND dependents = many AND age = middle age AND years of service = long THEN the family can't afford it
23	IF income = moderate AND dependents = many AND age = old AND years of service = new THEN family can't afford it
24	IF income = moderate AND dependents = many AND age = old AND years of service = long THEN family can't afford it
25	IF income = high AND dependents = few AND age = young AND years of service = then prosperous
26	IF income = high AND dependents = few AND age = young AND years of service = long THEN prosperous
27	IF income = high AND dependents = few AND age = middle age AND years of service = then THEN prosperous
28	IF income = high AND dependents = few AND age = middle age AND years of service = long THEN prosperous
29	IF income = high AND dependents = little AND age = old AND years of service = new THEN prosperous
30	IF income = high AND dependents = few AND age = old AND years of service = long THEN prosperous
31	IF income = high AND dependents = many AND age = young AND years of service = then THEN prosperous
32	IF income = high AND dependents = many AND age = young AND years of service = long THEN prosperous
33	IF income = high AND dependents = many AND age = middle age AND years of service = new THEN underprivileged
34	IF income = high AND dependents = many AND age = middle age AND years of service = long THEN underprivileged
35	IF income = high AND dependents = many AND age = old AND years of service = new THEN underprivileged
36	IF income = high AND dependents = many AND age = old AND years of service = long THEN poor

4. Conclusion

The implemented Decision Support System with Fuzzy Logic, the Tahani model, can help users to classify the level of community welfare as a reference for receiving government funding assistance more easily, quickly and accurately compared to a manual calculation system. In the calculation process that has been carried out, the results of the decisions that have been determined are obtained. The researcher obtains classification results from the fuzzification process of the data where the system can produce output, namely guidelines for a list of recommended names of prospective families who are eligible to be registered as potential recipients of social funding assistance from the government. The report document resulting from this decision can be saved in the form of a PDF file and can be used as printed media.

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