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Optimizing the Fuzzy Membership Function in SAW to Detect Types of Psychopaths

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ABSTRACT

The use of a decision support system (DSS) can assist in making decisions quickly and precisely according to targets. Many problems that occur can be solved by using SPK, one of which is to determine psychological disorders, in this case to determine the type of psychopath where there are many psychopathic sufferers and difficult to detect. The algorithm that can be used in a decision support system is to use the Optimized Simple Additive Weighting (SAW) Algorithm with the Fuzzy membership function. In this paper, a case analysis is analyzed, namely determining psychological disorders by asking several questions so that the results of this study are a conclusion about psychological disorders, especially psychopaths, including: primary psychopath, secondary psychopath, distempered psychopath and charismatic psychopath which are obtained from the highest score of each. decision making process.

Keywords: DSS, Psychological Disorders, Types of Psychopaths, SAW, Fuzzy.

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1. INTRODUCTION

Decision making is basically choosing an alternative to solve a problem. The problems that often arise are complex with quite a lot of aspects or criteria taken (Lubis, Prayudani, & Al-Khowarizmi, 2020; Lubis, et al (2019). This complexity is also caused by the unclear structure of the problem, the uncertainty of the perception of decision makers, and the uncertainty of the availability of accurate or even non-existent statistical data (Al-Khowarizmi., et al (2020). Basically, every problem can be solved by looking at the problem as seen in an organized framework, which allows dependence between components and dependence between elements within a component. This framework allows decision makers to make effective decisions on these issues by simplifying, thereby accelerating the decision-making process (Fauzi, Al-Khowarizmi, & Muhathir, 2020).

The perceived and observed decision problems need to be taken as soon as possible, but the variations are complicated, so that the data cannot be recorded numerically, only qualitatively that can be measured, that is, based on perceived experience and intuition (Al-Khowarizmi, Syah, Nasution, & Elveny, 2021). One of them is psychological disorders in humans, psychological disorders are disorders in the way of thinking (cognitive), volition, emotions (affective), behavior (psychomotor) (Walther., et al 2019). From various studies it can be said that psychological disorders are a collection of conditions that are not normal, both physically and mentally (Caspi & Moffitt, 2018). In this case the researcher discusses one of the psychological disorders, namely psychopaths, psychopaths are symptoms of personality disorders that have long been considered dangerous and disturbing society. However, at first glance psychopaths have a kind and likeable nature but actually behind it all they are very detrimental to society, this sufferer is difficult to detect because as many as 80% more are hanging around than those who are languishing in prison or in mental hospitals. sufferers are also difficult to cure, so a decision support system is needed to determine psychological disorders because psychological disorders occur in almost all countries in the world. Statistical data

presented by WHO in 1990 states that, at any time, 1% of the world's population is in a state of needing help and treatment for a psychological disorder (Murley, 2004).

The most visible impact of the above problems is confusion in determining psychological disorders. In this study, the Simple Additive Weighting (SAW) algorithm will be used to process data from several desired criteria so that the optimization of the weight is applied with the Fuzzy membership function. Fuzzy logic is a logic that has a partial truth concept, where fuzzy logic allows membership values between 0 and 1. While classical logic states that everything can be expressed in a truth value of 0 or 1 (Anggraini & Sihotang, 2019). The fuzzy membership function is used to anticipate small changes to the value that is resulting in different categories, so that a slight change in value will not make a significant difference. And to make it easier to enter the desired criteria, the delivery of information is presented using a programming language (Puspa, 2019). In addition to providing information that can help provide various alternatives that can be taken in the decision-making process, decision support systems can provide decision support systems (Al-Khowarizmi, 2020).

The hallmark of a decision support system is that it uses a model whose function is to simplify the problem (Muhathir, Sibarani, & Al-Khowarizmi, 2020). The SAW algorithm is often also known as a weighted addition method. The basic concept of the SAW Algorithm is to find the weighted sum of the performance ratings for each alternative on all attributes. The SAW algorithm requires a decision matrix normalization process (X) to a scale that can be compared with all available alternative ratings.

2. METHODOLOGY

In order for the research to be structured and directed in accordance with the objectives, the authors established research methods, namely:

1. Literature study and literature study on fuzzy membership function and SAW algorithm by analyzing the SAW algorithm as a decision support system model to determine psychological disorders.
2. To collect data through questions asked to patients suffering from psychological disorders.
3. Implementation of the SAW algorithm in a decision-making process to determine psychological disorders in making applications.
4. Evaluating the optimization of the Fuzzy membership function in the SAW algorithm with applications that have been made to produce optimal decisions.

3. RESULT AND DISCUSSION

The application of the fuzzy membership function to determine psychological disorders, the authors took several steps to obtain valid data in its preparation. This is done to get the optimal value to be able to obtain the weight that will be entered into the SAW algorithm. In determining the values of the criteria, we need weighting for the criteria value, in this study to determine the criteria value is taken from the results of the answers to the questions that represent each criterion. There are 12 questions that are given, consisting of 3 questions each from Primary Psychopath, Secondary Psychopath, Distempered Psychopath and Charismatic Psychopath. The questions are as follows:

1. If I have a headache, I should take headache medicine rather than rest or sleep.
2. If I can fight someone, that person deserves it.
3. I am very angry when I get blamed for anything.
4. I am good at persuading and have a special ability to make people want to do what I want.
5. It is normal to lie for my own sake.
6. I am suited for dangerous tasks because I am capable of making very quick decisions.
7. I rarely plan because I prefer everything to be spontaneous and sudden.
8. Seeing animals injured or in pain doesn't bother me one bit.
9. If someone owes me a debt, I don't care to collect it.
10. Cheating on your partner is fine as long as you don't get caught.
11. If suddenly there is something better then there is nothing wrong with canceling the previous opportunity.
12. Driving at high speed, riding roller coasters and skydiving really appeal to me.

The answers received from the questions above are optimized with the fuzzy membership function where the fuzzy membership function is described as follows:

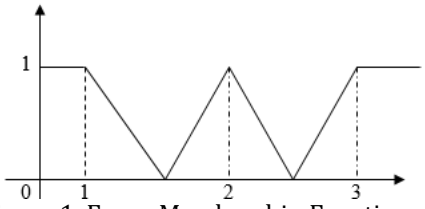

Figure 1. Fuzzy Membership Function

After obtaining the value of the fuzzy membership function, the value will become a weight and the weight will be calculated using the SAW algorithm to determine psychological disorders, which in this case is the type of psychopath that is suffered. The criteria used to determine psychological disorders of the SAW algorithm are primary psychopath (PP), secondary psychopath (SP), distempered psychopath (DP) and charismatic psychopath (CP) with the understanding whether a person who has been detected with a psychopathic disorder has the type of psychopath that has been analyzed in this study.

In analyzing a problem that can lead to decisions, the SAW method is often known as the weighted addition method. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes. The SAW method requires a decision matrix normalization process (X) to a scale that can be compared with all available alternative ratings. The result of this research is an alternative that has the highest value compared to other alternatives. The alternative value is obtained from the results of the assessment of each criterion. The data needed for decision making is obtained from the results of questions that have been solved by optimizing the value of the fuzzy membership function regarding the assessment of the criteria that are the reference for the assessment in determining psychological disorders, which in this case is a psychopath. In this study, there are weights and criteria used to determine psychological disorders as follows.

Table 1. Criteria

No	Criteria	**Noted**
1.	C1	Primary Psychopath
2.	C2	Secondary Psychopath
3.	C3	Distempered Psychopath
4.	C4	Charismatic Psychopath

Determination of the weight of the assessment has been carried out based on predetermined criteria based on the results of the study, however this can be made in line with the demands of the needs. That the system in the assessment process refers to the fulfillment of predetermined criteria and refers to several cases that have occurred, so that it truly has a good benchmark. After optimizing the fuzzy membership function of the questions given then proceed with the SAW algorithm, a suitability rating is obtained, the data taken from table 1 above will be made in the form of a matrix X, the following decisions:

$$X = \begin{bmatrix} 3 & 2 & 3 \\ 1 & 2 & 2 \\ 2 & 3 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

Next, determine which criteria are the criteria for benefit or cost . The results of the transformation of the matrix X are then normalized. All the criteria that have been determined are classified into the benefit attribute, then the calculation to determine the normalized matrix R uses the benefit attribute. The criteria that are classified as benefit attributes are as follows:

$$r1.1 = \frac{3}{\text{Max } (3; 1; 2; 1)} = \frac{3}{3} = 1{,}00$$

$$r1.2 = \frac{1}{\text{Max } (3; 1; 2; 1)} = \frac{1}{3} = 0{,}33$$
$$r1.3 = \frac{2}{\text{Max } (3; 1; 2; 1)} = \frac{2}{3} = 0{,}67$$
$$r1.4 = \frac{1}{\text{Max } (3; 1; 2; 1)} = \frac{1}{3} = 0{,}33$$
$$r2.1 = \frac{2}{\text{Max } (2; 2; 3; 1)} = \frac{2}{3} = 0{,}67$$
$$r2.2 = \frac{2}{\text{Max } (2; 2; 3; 1)} = \frac{2}{3} = 0{,}67$$
$$r2.3 = \frac{3}{\text{Max } (2; 2; 3; 1)} = \frac{3}{3} = 1{,}00$$
$$r2.4 = \frac{1}{\text{Max } (2; 2; 3; 1)} = \frac{1}{3} = 0{,}33$$
$$r3.1 = \frac{3}{\text{Max } (3; 2; 2; 1)} = \frac{3}{3} = 1{,}00$$
$$r3.2 = \frac{2}{\text{Max } (3; 2; 2; 1)} = \frac{2}{3} = 0{,}67$$
$$r3.3 = \frac{2}{\text{Max } (3; 2; 2; 1)} = \frac{2}{3} = 0{,}67$$
$$r3.4 = \frac{1}{\text{Max } (3; 2; 2; 1)} = \frac{1}{3} = 0{,}33$$

The results of normalizing Matrix X to Matrix R are as follows:

$$R = \begin{bmatrix} 1{,}00 & 0{,}67 & 1{,}00 \\ 0{,}33 & 0{,}67 & 0{,}67 \\ 0{,}67 & 1{,}00 & 0{,}67 \\ 0{,}33 & 0{,}33 & 0{,}33 \end{bmatrix}$$

Determining the ranking of each alternative, then first determining the importance weight of each criterion (Wj). The determination of the importance weight of each criterion (Wj) is formed in the questions of each criterion while the questions consist of basic, medium and high questions which are presented in the following table:

Table 2. Determination of the Weight of Importance of Criteria (Wj)

Criteria	Fuzzy	Value
Basic Question	Very important	0.33
Midle Question	Very important	0.33
Hogh Question	Very important	0.33

From table 2 above, the weight value (Wj) is obtained with the data W = [0.33, 0.33, 0.33] Then the ranking process is carried out using the Simple Additive Weighting method.

$$V_i - \sum_{J-1}^{N} W_j r_{ij}$$

Information:
Vi = ranking for each alternative
Wj = weight value of each criterion
rij = normalized rating value

So that the final result in the SAW algorithm in determining the alternative preference for the chosen decision is as follows.

V1 = (1,00 * 0,33) + (0,67 * 0,33) + (1,00 * 0,33)
= 0,8811
V2 = (0,33 * 0,33) + (0,67 * 0,33) + (0,67 * 0,33)
= 0,5511
V3 = (0,67 * 0,33) + (1,00 * 0,33) + (0,67 * 0,33)
= 0,7722
V4 = (0,33 * 0,33) + (0,33 * 0,33) + (0,33 * 0,33)
= 0,3267

The results of the alternative preferences are organized into table 3 below:

Table 3. Preference values for each alternative

Alternatif	Preference value
A1	0,8811
A2	0,5511
A3	0,7722
A4	0,3267

The alternatives are ranked based on the preference value of each alternative, from table 3 the preference value above can be ranked as follows:

Table 4. Ranking Results Based on Preference Value

Rank	Alternative	Preference value
1	A1	0,8811
2	A3	0,7722
3	A2	0,5511
4	A4	0,3267

From the table above, it can be seen that the greatest value is in V1 so that the alternative A1 or Primary Psychopath is a psychological disorder, in this case it is a psychopath suffered by the data source above.

4. CONCLUSSION

Based on the results and discussion on the optimization of the fuzzy membership function in the SAW algorithm on the DSS to determine psychological disorders, the conclusion is that the fuzzy membership function is used in optimizing the answers to the questions given and used as a weight for calculations with the SAW algorithm in supporting decisions to determine psychological disorders. which in this study is the type of psychopathic sufferers. The SAW algorithm, which is one of the DSS methods in solving various multicriteria decision-making problems, can also be used in DSS to determine psychological disorders, especially psychopaths. The criteria needed to determine psychological disorders in determining the type of psychopath are Primary Psychopath, Secondary Psychopath, Distempered Psychopath and Charismatic Psychopath. In this study, in determining the psychological disorders from the fuzzy membership function then the data is reprocessed using the SAW algorithm, the user is given the conclusion that they are classified as Primary Psychopath because they have the highest superior value, namely 0.8811. The DSS application for determining psychological disorders using the SAW algorithm can be used as a supporting tool for psychologists while remaining based on a decision support system but not to replace assessments and not emphasize making or making decisions.

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