

Decision Support System For Selection Of The Best Doctors In Sari Mutiara Hospital Using Fuzzy Tsukamoto Method

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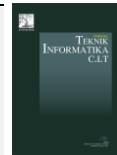
ABSTRACT

The doctor is one of the most important things that works to improve sick people. This research proposes to discuss and build a decision system for the selection of the best doctors that can help the selection of the best obgyn doctors using the Fuzzy Tsukamoto method by outlining the code of ethics for medicine, education, service systems, and years of service. The Tsukamoto method is a method that uses membership functions. With this method the optimal solution is sought from certain alternatives and suggestions. In this study, the study conducted research in the Sari Mutiara Lubuk Hospital so that it chose the best doctor on target.

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1. Introduction

Sari Mutiara Hospital is a privately owned business entity of the Sari Mutiara Medan Foundation located in Medan No. 17 Lubuk Pakam, Deli Serdang Regency, which is about 25 km from Medan city, North Sumatra Province and was established in 1988. Human resources at Sari Pearl Hospital are sufficient to improve the quality of service to the community. In providing services to patients, doctors and nurses work with sincerity and compassion, and as a tribute to the services that have been given, the Sari Pearl Hospital usually rewards employees, doctors, and nurses who are selected manually namely, by bringing the results of the evaluation into a meeting which is considered less effective. Doctors are medical personnel who are allowed to carry out medical practices without having to have specific specialization, and in pearl sari hospitals there are several specialized doctors, one of them is obgyn doctor who is a gynecologist and obstetrician who has an official title of Sp. OG. In choosing the best doctor, now it is not difficult anymore with the development of technology and information. Employees and patients in a hospital can choose their ideal specialist doctor well. Patients and the assessment team of the best doctors, generally have consideration or factors before making a decision, for example the code of ethics for medicine, education, service systems and years of service. In this research the method used is Fuzzy Tsumato which is an extension of monotonous reasoning. In the Tsukamoto method, each consequence of an IF-THEN rule must be represented by a fuzzy set with a monotonous membership function, as a result the inference output from each rule is given explicitly (crisp) based on the predicate (fire strength), the final result obtained by using a weighted average. With the selection of the best doctors, it is expected to be able to help patients, employees, and the assessment team in the Sari Mutiara Hospital in determining the best doctors honestly, fairly and prosperously so that they get satisfaction in the actual results.



2. Theory

2.1 Decision Support System

Apart from the definitions explained in the background, a Decision Support System (DSS) is a part of a computer-based information system (including knowledge-based (knowledge management)) that is used to support decision making in an organization or company [8].

Decision support system (DSS) is also defined as an integrated computer equipment that enables decision makers to integrate directly with computers in creating information that is useful in making decisions, both structured and unstructured[8].

2.2 Fuzzy Logic

The theory of cryptic sets of logic was developed by Prof. LoftiZadeh in 1962,Zadeh argues that the logic of right and wrong in conventional logic cannot overcome the gradation problem that is in the real world. To overcome this infinite gradation problem, Zadeh developed a fuzzy set.Unlike boolean logic, fuzzy logic has a continuous value. Vague is expressed in the degree of membership and the degree of truth. Therefore something can be said to be partly right and partly wrong at the same time[1].

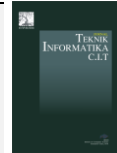
2.3 Tsukamoto Method

In the Tsukamoto method, each consequence of IF-THEN rules must be represented by a fuzzy set with a monotonous membership function (Figure 2.8). As a result, the output of inference results from each rule is given explicitly (crisp) based on α -predicate (fire strength). The end result is obtained using a weighted average. 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 divided into 2 sets B1 and B2, Var-3 are also divided into 2 sets, namely C1 and C2 [9].

3. Research Method

The method used in this study is:

- a. Identifying the problem, the stage of problem identification needs to be done to facilitate the writer in conducting research because in carrying out the selection of the best doctor candidates the assessment team often faces problems in determining the best doctor candidates where the results decided are ineffective in deliberations and the selection is still done manually so that takes a long time.
- b. Analyzing the Problem, this stage needs to be done because the author observes the selection of the best doctor candidates where the selection is still done manually and the results decided in a deliberative meeting are not effective so that it requires a computerized system for the selection of the best doctors conducted next at the pearl extract hospital so provide more effective results and gain satisfaction for each individual.
- c. Collecting Data and Information, at this stage the authors collect the data needed in research needs, including by means of observations made by the author directly at the research site and get accurate information from the delivery room (verlos kamer) as well as data collection at the theoretical foundation uses national journals, international journals, and other books.
- d. Applying the Tsukamoto Method, at this stage after the authors collect data and information, the authors apply the Tsukamoto method in the research of selecting the best doctor candidates where each consequent physician variable on IF-THEN rules must be represented by the Fuzzy set whose membership function is valued $[0, 1]$ so that menggunakan operasi himpunan fuzzy irisan (intersection), gabungan (union), dan komplemen (complement).
- e. Analysis and Design, at this stage how to analyze the system that is built includes user system analysis, system requirements analysis and fuzzy variable analysis used by the system. At the system design stage the design of program functions is discussed, the design of Data Flow Diagrams (DFD), the design of flowcharts and the design of interfaces and the user must determine the desired selection criteria of each specification variable presented on the system.
- f. Testing the Results, this stage is a step that is shown to evaluate whether the system has been made in accordance with established procedures. And the output in this research is Software where the final test results using Visual Basic 2010 and Mysql Databas
- g. Conclusions and Recommendations, at this stage contains conclusions from the research conducted and suggestions for development system for further research.



4. Results

The criteria used when selecting the best doctor are:

- Code of Conduct Value = μ Code of Ethics
- Education = μ Education
- Working Period = μ Master Service
- Service Value = μ Service

The following is an example of the case for calculating the degree of membership for input variables and output variables in the selection of the best doctor.

Research case examples:

Table 1
Doctor's Rating

Code	Name Doctor	Value			
		Code Ethics	Educational	Years of Service	Service
D1	dr. Ronny Ajartha, SPOG,M.kes	9	8	6	8
D2	dr. Robert Simamora, SPOG	8	7	7	6
D3	dr. JeksonLubis, SPOG	6	5	6	5
D4	dr. JhonTambunan, SPOG	7	4	6	4

a. Code Ethics

$$\begin{aligned}
 D1 &= \mu_{KodeEtikKurangBagus}[9] &&= x \geq 4 \\
 &&&= 9 \geq 4 = 0 \\
 \mu_{KodeEtikCukupBagus}[9] &&&= x \geq 7 \\
 &&&= 9 \geq 7 = 0 \\
 \mu_{KodeEtikSangatBagus}[9] &&&= \frac{6}{10 - 6} \\
 &&&= \frac{9 - 6}{10 - 6} \\
 &&&= \frac{3}{4} = 0.75 \\
 D2 &= \mu_{KodeEtikKurangBagus}[8] &&= x \geq 4 \\
 &&&= 8 \geq 4 = 0 \\
 \mu_{KodeEtikCukupBagus}[8] &&&= x \geq 7 \\
 &&&= 8 \geq 7 = 0 \\
 \mu_{KodeEtikSangatBagus}[8] &&&= \frac{x - 6}{10 - 6} \\
 &&&= \frac{8 - 6}{10 - 6} \\
 &&&= \frac{2}{4} = 0.5 \\
 D3 &= \mu_{KodeEtikKurangBagus}[6] &&= x \geq 4 \\
 &&&= 6 \geq 4 = 0 \\
 \mu_{KodeEtikCukupBagus}[6] &&&= \frac{7 - x}{7 - 5} \\
 &&&= \frac{7 - 6}{7 - 5} \\
 &&&= \frac{1}{2} = 0.5 \\
 \mu_{KodeEtikSangatBagus}[6] &&&= x \leq 6 \\
 &&&= 6 \leq 6 = 0 \\
 D4 &= \mu_{KodeEtikKurangBagus}[7] &&= x \geq 4 \\
 &&&= 7 \geq 4 = 0 \\
 \mu_{KodeEtikCukupBagus}[7] &&&= x \geq 7 \\
 &&&= 7 \geq 7 = 0
 \end{aligned}$$

b. Educational

$$\begin{aligned}
 D1 &= \mu_{PendidikanStandar}[8] &&= x \geq \\
 &&&= 8 \geq 4 = 0 \\
 \mu_{PendidikanCukupTinggi}[8] &&&= x \geq 6 \\
 &&&= 8 \geq 6 = 0 \\
 \mu_{PendidikanTinggi}[8] &&&= x \geq 8 = 0
 \end{aligned}$$



$$\begin{aligned}\mu_{\text{PendidikanSangatTinggi}}[8] &= (10 - x) / (10 - 8) \\ &= (10 - 8) / (10 - 8) \\ &= 2 / 2 = 1\end{aligned}$$

$$\begin{aligned}D2 = \mu_{\text{PendidikanStandar}}[7] &= x \geq 4 = 7 \geq 4 = 0 \\ \mu_{\text{PendidikanCukupTinggi}}[7] &= x \geq 6 = 7 \geq 6 = 0 \\ \mu_{\text{PendidikanTinggi}}[7] &= (8 - x) / (8 - 6) \\ &= (8 - 7) / (8 - 6) \\ &= 1 / 2 = 0.5\end{aligned}$$

$$\begin{aligned}\mu_{\text{PendidikanSangatTinggi}}[7] &= x \geq 7 \\ &= 7 \geq 7 = 0\end{aligned}$$

$$\begin{aligned}D3 = \mu_{\text{PendidikanStandar}}[5] &= x \geq 4 \\ &= 5 \geq 4 = 0 \\ \mu_{\text{PendidikanCukupTinggi}}[5] &= (6 - x) / (6 - 4) \\ &= (6 - 5) / (6 - 4) \\ &= 1 / 2 = 0.5\end{aligned}$$

$$\begin{aligned}\mu_{\text{PendidikanTinggi}}[5] &= x \leq 5 \\ &= x \leq 5 = 0\end{aligned}$$

$$\begin{aligned}\mu_{\text{PendidikanSangatTinggi}}[5] &= x \leq 7 \\ &= 5 \leq 7 = 0\end{aligned}$$

$$\begin{aligned}D4 = \mu_{\text{PendidikanStandar}}[4] &= x \geq 4 \\ &= 4 \geq 4 = 0 \\ \mu_{\text{PendidikanCukupTinggi}}[4] &= (x - 3) / (4 - 3) \\ &= (4 - 3) / (4 - 3) \\ &= 1 / 1 = 1\end{aligned}$$

$$\begin{aligned}\mu_{\text{PendidikanTinggi}}[4] &= x \leq 5 \\ &= 4 \leq 5 = 0\end{aligned}$$

$$\begin{aligned}\mu_{\text{PendidikanSangatTinggi}}[4] &= x \leq 7 \\ &= 4 \leq 7 = 0\end{aligned}$$

$$\begin{aligned}\mu_{\text{KodeEtikSangatBagus}}[7] &= (x - 6) / (10 - 6) \\ &= (7 - 6) / (10 - 6) \\ &= 1 / 4 = 0.25\end{aligned}$$

c. Years of Service

$$\begin{aligned}D1 = \mu_{\text{MasaKerja} < 5}[6] &= x \geq 4 \\ &= 6 \geq 4 = 0 \\ \mu_{\text{MasaKerja} > 5 < 10}[6] &= (7 - x) / (7 - 5) \\ &= (7 - 6) / (7 - 5) \\ &= 1 / 2 = 0.5 \\ \mu_{\text{MasaKerja} > 10}[6] &= (x - 6) / (10 - 6) \\ &= (6 - 6) / (10 - 6) \\ &= 0 / 4 = 0\end{aligned}$$

$$\begin{aligned}D2 = \mu_{\text{MasaKerja} < 5}[7] &= x \geq 4 \\ &= 5 \geq 4 = 0 \\ \mu_{\text{MasaKerja} > 5 < 10}[7] &= (7 - x) / (7 - 5) \\ &= (7 - 7) / (7 - 5) = 0 \\ \mu_{\text{MasaKerja} > 10}[7] &= (x - 6) / (10 - 6) \\ &= (7 - 6) / (10 - 6) \\ &= 1 / 4 = 0.25\end{aligned}$$

$$\begin{aligned}D3 = \mu_{\text{MasaKerja} < 5}[6] &= x \geq 4 = 6 \geq 4 = 0 \\ \mu_{\text{MasaKerja} > 5 < 10}[6] &= (7 - x) / (7 - 5) \\ &= (7 - 6) / (7 - 5)\end{aligned}$$



$$\begin{aligned}
 \mu_{\text{MasaKerja} > 10} [6] &= 1 / 2 = 0.5 \\
 &= (x - 6) / (10 - 6) \\
 &= (6 - 6) / (10 - 6) \\
 &= 0 / 4 = 0 \\
 D4 = \mu_{\text{MasaKerja} < 5} [6] &= x \geq 4 \\
 &= 6 \geq 4 = 0 \\
 \mu_{\text{MasaKerja} 5 > x < 10} [6] &= (7 - x) / (7 - 5) \\
 &= (7 - 6) / (7 - 5) \\
 &= 1 / 2 = 0.5 \\
 \mu_{\text{MasaKerja} > 10} [6] &= (x - 6) / (10 - 6) \\
 &= (6 - 6) / (10 - 6) \\
 &= 0 / 4 = 0
 \end{aligned}$$

d. Service

$$\begin{aligned}
 D1 = \mu_{\text{PelayananKurangBagus}} [8] &= x \geq 4 \\
 &= 8 \geq 4 = 0 \\
 \mu_{\text{PelayananCukupBagus}} [8] &= x \geq 7 \\
 &= 8 \geq 7 = 0 \\
 \mu_{\text{PelayananSangatBagus}} [8] &= (x - 6) / (10 - 6) \\
 &= (8 - 6) / (10 - 6) \\
 &= 2 / 4 = 0.5 \\
 D2 = \mu_{\text{PelayananKurangBagus}} [6] &= x \geq 4 \\
 &= 6 \geq 4 = 0 \\
 \mu_{\text{PelayananCukupBagus}} [6] &= (7 - x) / (7 - 5) \\
 &= (7 - 6) / (7 - 5) \\
 &= 1 / 2 = 0.5 \\
 \mu_{\text{PelayananSangatBagus}} [6] &= (x - 6) / (10 - 6) \\
 &= (6 - 6) / (10 - 6) \\
 &= 0 / 4 = 0 \\
 D3 = \mu_{\text{PelayananKurangBagus}} [5] &= x \geq 4 \\
 &= 5 \geq 4 = 0 \\
 \mu_{\text{PelayananKurangBagus}} [5] &= x \geq 4 [5] \\
 &= (x - 3) / (5 - 3) \\
 &= (5 - 3) / (5 - 3) \\
 &= 2 / 2 = 1 \\
 \mu_{\text{PelayananSangatBagus}} [5] &= (x \leq 6) \\
 &= x \leq 6 = 0 \\
 D4 = \mu_{\text{PelayananKurangBagus}} [4] &= x \geq 4 \\
 &= 4 \geq 4 = 0 \\
 \mu_{\text{PelayananCukupBagus}} [4] &= (x - 3) / (5 - 3) \\
 &= (4 - 3) / (5 - 3) \\
 &= 1 / 2 = 0.5 \\
 &= 6 \leq 0
 \end{aligned}$$

Here are the results of overall defuzzification (Z) on the best doctor's decision-making selection assessment system:

$$\begin{aligned}
 Z &= ((\alpha_1 * z_1) + (\alpha_2 * z_2) + (\alpha_3 * z_3) + (\alpha_4 * z_4)) / (\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4) \\
 &= ((0.5 * 7.5) + (0.25 * 6.25) + (0.5 * 7.25) + (0.25 * 6.15)) / (0.5 + 0.25 + 0.5 + 0.25) \\
 &= (3.75 + 1.5625 + 3.625 + 1.5375) / (1.4) \\
 &= 10.5625 / 1.4 \\
 &= 7.583 \Rightarrow 7
 \end{aligned}$$

Then the Fuzzy value of the calculation of Evaluation Evaluation is 7.5 with the name of Dr. Ronny Ajatha, SPOG, M.kes. Based on these values, it can be seen the results of the evaluation of the best doctors as follows.



5. Conclusion

Based on the discussion regarding the Selection of the Best Doctors in Sari Mutiara Hospital with the Fuzzy Tsukamoto Method, it can be concluded:

- a. Decision support system with fuzzy logic method with Tsukamoto inference system is able to analyze and determine the best doctor in Sari mutiara Lubuk Pakam Hospital.
- b. The Selection System for the Best Doctors at Sari Mutiara Hospital can perform fuzzyfication and defauzzyfication according to the rules in the Tsukamoto method.
- c. The Selection System for the Best Doctors in Sari Mutiara Hospital with the Fuzzy.
- d. Tsukamoto Method can be used as one of the solutions to solve the problems in determining the best doctor and make it easier for the house to choose the best doctor.

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