



## Fuzzification of College Adviser Proficiency Based on Specific Knowledge

Andysah Putera Utama Siahaan

Faculty of Computer Science, Universitas Pembangunan Panca Budi, Jl. Jend. Gatot Subroto Km. 4, 5 Sei Sikambang,  
20122, Medan, Sumatera Utara, Indonesia

---

**Abstract**— *Determination of the adviser is one of the academic obligations. Undesirable things always happen in getting optimal decisions in which faculty is assigned not the most appropriate to the topic of the thesis. This matter can affect the result and the quality of the thesis. The research process uses the input variable of lecturers criteria. The data will be treated by using the method of fuzzy logic to obtain the output consists of advisers. In this case, the students do not have to worry about the competence of the lectures since the lecturers who have been given to them are fully filtered.*

**Keywords**— *Fuzzy Logic, Membership Function*

---

### I. INTRODUCTION

The general issue to a adviser is to determine the development application of thesis. Fuzzy logic is a new promising chapter of formal logic[2][3]. It takes apart to identify and prepare lecturers who are assigned to test the adviser of a thesis. Preparation is carried out in the hope that the thesis tested by lecturers who have expertise in the theme of those tested. Implementation of fuzzy logic here is the calculation of the relationship between the lecturers skill. A lecturer can teach many subjects, but the weight of all subjects are not similar. The weight of each topic must be supported to calculate the result of the final test. The lecturer who obtains the highest score will be the chosen adviser.

### II. THEORIES

Fuzzy logic is a technique or method used to resolve the uncertain problem that has many answers. Fuzzy logic is the multivalued decision which able to define the state of values between the true or false, yes or no, white or black and others. Fuzzy Logic Reasoning provides a way to understand the performance of the system by assessing the input and output system. It also provides a way to describe any definitive conclusions from the information vague, ambiguous and imprecise. Fuzzy logic First developed by Lotfi A. Zadeh in 1965. He let us distinguish fuzzy logic in broad sense [4].

The reasons why fuzzy logic is used:

- The concept of fuzzy logic is easy to apply
- Fuzzy Logic flexible
- Fuzzy Logic can model complex nonlinear function
- Fuzzy logic can perform conventional control
- Fuzzy Logic tolerance for the right data
- Fuzzy logic is based on natural language
- Fuzzy Logic can develop the experiences of experts without the training process

#### A. Fuzzy Architecture

The concept of fuzzy logic then successfully applied to a controller by E.H. Mamdani. Since then the application of fuzzy growing more rapidly. In the 1980s Japan and countries in Europe are aggressively building a real product on the concept of fuzzy logic integrated into products such as household vacuum cleaner, a microwave oven, and a video camera. While entrepreneurs in the United States is not as fast as it includes this technology, fuzzy logic developed rapidly over the last few years. There are more than two thousand products on the market that use the concept of fuzzy logic, ranging from washing machines to high-speed trains. Each application must be aware of some of the advantages of fuzzy logic such as performance, simplicity, low cost, and productivity.

Figure 1 illustrates the fuzzy logic architecture. It explains the progress of input, process and output. There are three steps passed before obtaining the crisp value. The processes of fuzzy such as:

- Fuzzification is the process of transforming crisp input values into linguistic values[1] which is usually presented in the form of fuzzy associations with a membership function respectively.
- Inference System is as a reference for explaining the relationship between the variables of input and output variables which are processed and the resulting shaped fuzzy. To explain the relationship between inputs and outputs usually, use the "IF-THEN".
- Defuzzification is a process of changing the form of fuzzy variables into the data bound (crisp) that can be transmitted to the control equipment.

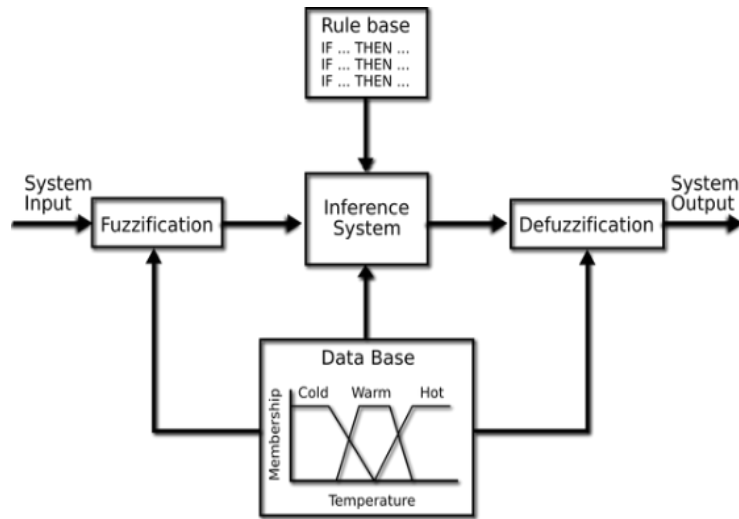


Fig.1 Fuzzy Logic Architecture

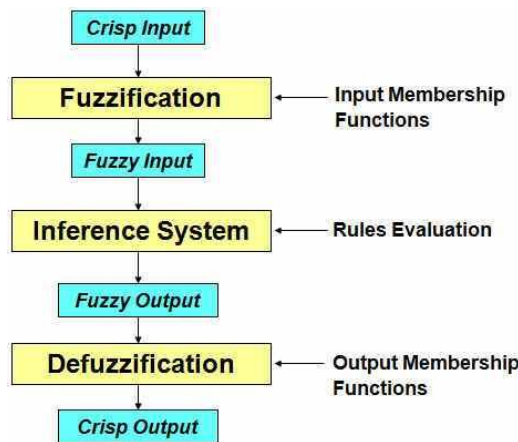


Fig. 2 Step of fuzzy logic

In Figure 2, the step by step of the fuzzy logic process. The raw input is a crisp. Then it is handled by Fuzzification. It produces the fuzzy value which then calculated by the membership function and later it is converted back to the crisp value by defuzzification method.

**B. Inference System**

Fuzzy membership functions can be formulated based on expert knowledge approach [5]. For example, the fan generator has a speed controller to adjust the heat value. The fuzzy logic can give the appropriate voltage to the dynamo.

- IF temperature is very cold THEN stop fan
- IF temperature is cold THEN turn down fan
- IF temperature is normal THEN maintain level
- IF temperature is hot THEN speed up fan

There are four rules applied to control the fan. Once the sensor detects the temperature is cold, the fuzzy controller stops the fan from operating while if the temperature is boiling, the fan will speed up.

The AND, OR, and NOT operators are also available in fuzzy logic. It defines as the minimum, maximum, and complement; when they are defined this way, they are called the Zadeh operators. The fuzzy variables x and y is

$$\begin{aligned} \text{NOT } x &= (1 - \text{truth}(x)) \\ x \text{ AND } y &= \text{minimum}(\text{truth}(x), \text{truth}(y)) \\ x \text{ OR } y &= \text{maximum}(\text{truth}(x), \text{truth}(y)) \end{aligned}$$

**III. DESIGN AND IMPLEMENTATION**

In this section, this research discusses about the design of variables, fuzzy set and membership functions.

**A. Input**

The appraisal is categorized into five items. These items will be inserted into the fuzzy system as input parameters. The specifications are:

- Algorithm & Programming (AP)
- Computer Network (CN)
- Mobile Programming (MP)

- Artificial Intelligence (AI)
- Soft Computing (SC)

Every lecturer will be given the weight from 0 to 100, where 0 is the lowest value and 100 is the highest one. Table 1 shows the skills obtained based on survey.

Table I Lecturers Skill

No.	Name	AP	CN	MP	AI	SC
1	Andie Siahaan	90	90	90	90	90
2	Michael Bolton	90	80	80	70	70
3	Van Damme	80	90	70	60	50
4	Tom Cruise	90	60	70	80	70
5	Chun Li	60	60	60	50	40

**B. Output**

The output takes the form of an adviser list and examiners thesis are ready to assist students in completing their scientific works. There are four lecturers with the highest weight by the specification requirements designated thesis.

Below is the list of specific skill:

- Grade 1 : Adviser 1
- Grade 2 : Adviser2
- Grade 3 : Adviser3 (backup)
- Grade 4 : Adviser4 (backup)

**C. Fuzzy Process**

The data those have been entered will be processed to produce the optimal output. At this stage, each weight specification will be matched with the needs of the material by the specifications of each thesis. The weight of lecturer will be divided into three fuzzy sets. There are LOW, MID, and HIGH. If the result is in HIGH section, this is the high priority to the lecturer who can assist the student to complete the thesis.

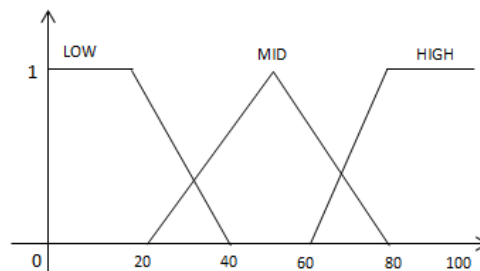


Fig. 3Lecture Membership Function

Figure 3 describes the membership function of the lecturer’s grade. The value 100 is the highest value. The LOW = (0;20;40), MID = (20;50;80) and HIGH = (60;80;100). Afterward, the weight of each skill must be calculated.

Table II Weight of Algorithm and Programming

No.	Name	AP	LOW	MID	HIGH
1	Andie Siahaan	90	0	0	1
2	Michael Bolton	90	0	0	1
3	Van Damme	80	0	0	1
4	Tom Cruise	90	0	0	1
5	Chun Li	60	0	0.667	0

In Table 2, the name “Andie Siahaan” to “Tom Cruise” are in HIGH area. It happens since the values are bigger than 80. The MID area is limited to 80. As in number 3 “Van Damme” is in both MID and HIGH areas where MID produce 0 and HIGH produce 1. For example, the last name. “Chun Li” has got 60 in her value. It is between 20 and 80 in MID area. The MID peak value is 50. Let’s do some calculations.

$$\begin{aligned}
 \text{LOW} &= 0 \\
 \text{MID} &= \frac{80-60}{80-50} \\
 &= \frac{20}{30}
 \end{aligned}$$

HIGH = 0.667  
 = 0

Table III Weight of Computer Network

No.	Name	CN	LOW	MID	HIGH
1	Andie Siahaan	90	0	0	1
2	Michael Bolton	80	0	0	1
3	Van Damme	90	0	0	1
4	Tom Cruise	60	0	0.667	0
5	Chun Li	60	0	0.667	0

Table IV Weight of Mobile Programming

No	Name	MP	LOW	MID	HIGH
1	Andie Siahaan	90	0	0	1
2	Michael Bolton	80	0	0	1
3	Van Damme	70	0	0.333	0.5
4	Tom Cruise	70	0	0.333	0.5
5	Chun Li	60	0	0.667	0

Table V Weight of Artificial Intelligent

No	Name	AI	LOW	MID	HIGH
1	Andie Siahaan	90	0	0	1
2	Michael Bolton	70	0	0.333	0.5
3	Van Damme	60	0	0.667	0
4	Tom Cruise	80	0	0	1
5	Chun Li	50	0	1	0

Table VI Weight of soft computing

No	Name	SC	LOW	MID	HIGH
1	Andie Siahaan	90	0	0	1
2	Michael Bolton	70	0	0.333	0.5
3	Van Damme	50	0	1	0
4	Tom Cruise	70	0	0.333	0.5
5	Chun Li	40	0	0.667	0

Table 3 to Table 6 are the membership functions of all knowledge. The values resulted depends on the range of the input. For example, in Table 6 number 4 “Tom Cruise” has two ranges, MID, and HIGH. The value is 70. It is between 20 and 80 in the MID area and between 60 and 100 in the HIGH area. “Tom Cruise” values are AP=(0;0;1), CN=(0;0.667;0), MP=(0;0.333;0.5); AI=(0;0;1) and SC=(0;0.333;0.5). The best knowledge that he has are “Algorithm & Programming” and “Artificial Intelligent”.

#### IV. FURTHER SCOPE

The skills required will be calculated; then the weight is mapped in the form of classification so that lecturers who deserve to be the adviser is found. The next stage, each lecturer, will be sorted in descending order by weight which has been obtained, in which the lecturer who has the highest weight is at the top of the list and vice versa. Afterward, each chosen lecturer is marked and given a counter that stores the total number of students he has handled. Every lecturer can only lead six students per semester. If the counter exceeds, the lecturer can no longer get the student.

#### V. CONCLUSION

Applications built using the concept of fuzzy logic can easily determine the competence of a lecturer. So the research produced keeps perfect. The process of determining the thesis adviser is similar to the conventional process. It occurs since the algorithm comes from the natural way of human reasoning. Fuzzification can adjust the lecturer's knowledge level, so the given topic is not to deviate from the background of the problem. However, using this application, the academic authorities will get more consistent without having the burden to analyze which specification is the most appropriate.

## REFERENCES

- [1] B. C. Arabacioglu, "Using Fuzzy Inference System For Architectural Space Analysis," *Applied Soft Computing*, vol. 10, p. 926–937, 2010.
- [2] L. Biacino and G. Gerla, "Fuzzy Logic, Continuity and Effectiveness," *Mathematical Logic*, vol. 41, p. 643–667, 2002.
- [3] G. Gerla, "Effectiveness and Multivalued Logics," *The Journal of Symbolic Logic*, vol. 71, pp. 137-162, 2006.
- [4] P. Hájek, "Fuzzy Logic and Arithmetical Hierarchy," *Fuzzy Sets and Systems*, vol. 73, pp. 359-363, 1994.
- [5] S. S. Jamsandekar and R. R. Mudholkar, "Fuzzy Classification System by Self Generated Membership Function Using Clustering," *International Journal of Information Technology*, vol. 6, no. 1, pp. 697-704, 2014.

## ABOUT AUTHOR



**Andysah Putera Utama Siahaan** was born in Medan, Indonesia, in 1980. He received the S.Kom. degree in computer science from Universitas Pembangunan Panca Budi, Medan, Indonesia, in 2010, and the M.Kom. in computer science as well from the University of Sumatera Utara, Medan, Indonesia, in 2012. In 2010, he joined the Department of Engineering, Universitas Pembangunan Panca Budi, as a Lecturer, and in 2012 became a researcher. He is applying for his Ph.D. degree in 2016. He has written several international journals. He is now active in writing papers and joining conferences.