Fuzzy Inference System In Predicting Unemployment Rate In City X Using Sugeno Method

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Abstrack

Unemployment in Indonesia is currently increasing. This can be seen from the number of unemployed and workers who are looking for job vacancies either directly or through applications. The problem in this study is the lack of understanding of job applicants about the terms or criteria for applying for a job so that they are not accepted in a company. There are five criteria that must be considered in applying for a job, namely, education, vacancies, age, opportunities and knowledge. The purpose of this study is to help job seekers to complete and understand the criteria that have been set. This study uses the Sugeno method with the final result in the form of linear or constant. The working process of the Sugeno method is fuzification, inference engine, application of implication and defuzzification functions to obtain results in accordance with the decision-making system.

Key words; Unemployment,FIS,Sugeno,Decision Making System

1. Introduction

Unemployment is the most serious problem, because with unemployment, people's productivity and income will decrease so that it can cause other social problems. The unemployment rate can be calculated by comparing the number of unemployed with the total labor force expressed in percent. The absence of income causes the unemployed to reduce their consumption expenditure which causes a decrease in the level of prosperity and welfare. Prolonged unemployment can also have a bad psychological effect on the unemployed and their families. The phenomenon of unemployment is also closely related to the occurrence of layoffs, which are caused, among others; a company that closes/reduces its line of business due to the economic crisis or unfavorable security; regulations that impede investment; obstacles in the export-import process, etc. The weakening of international markets due to the global economic crisis has impacted the real sector of Indonesia, especially export-oriented industries that absorb a lot of labor, such as the garment, shoe, electronics, timber, mining and crude palm oil industries. (GPO), and rubber. Today the national industrial sector is not only facing the problem of decreasing selling prices and demand, but also facing the problem of increasing raw material costs, especially imports due to the decline in the rupiah exchange rate, so that there is no choice for the national industry other than reducing production volumes which have an impact on reducing the workforce either by carrying out Lay off or lay off employees temporarily.

The first originator to find fuzzy logic, namely Prof. Lotfi A. Zadeh. Prof. Lotfi A. Zadeh discovered fuzzy logic in 1962. The basis of fuzzy logic is fuzzy set theory. In the fuzzy member function has a membership curve in the form of input mapping in the form of points with values of zero and one. Currently, fuzzy applications are highly developed, including a fuzzy inference system. (Fis) The rules that exist in fuzzy logic use the IF THEN system [1]. Prof. Lotfi A. Zadeh on the 95th birthday of Prof. Lotfi A. Zadeh
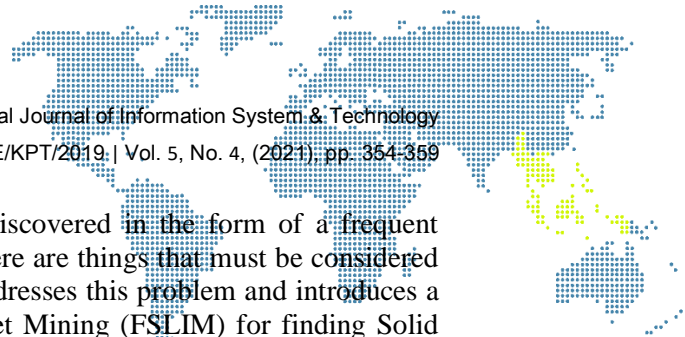
proposed announcing a new method he had just discovered in the form of a frequent itemsset using a quantitative transaction system. There are things that must be considered the data set that will be used. This paper directly addresses this problem and introduces a new algorithm called Fuzzy Solid Linguistic Itemset Mining (FSLIM) for finding Solid Linguistic Itemsets (SLIs) in quantitative datasets. SLI is a new concept introduced here as an important part of the solution presented in this paper. The proposed method consists of two stages. In the first phase, fuzzy set theory is used to transform each quantitative value into linguistic items; And in the second phase, all IDDs are extracted. Finally, the efficiency of FSLIM is compared in terms of execution time, scalability and number of frequent patterns with the two classic approaches to synthetic datasets. The proposed approach is also applied to the actual Urban Mashhad data set to illustrate FSLIM's ability to find hidden knowledge that cannot be extracted by traditional methods [2].

2. Research Methodology

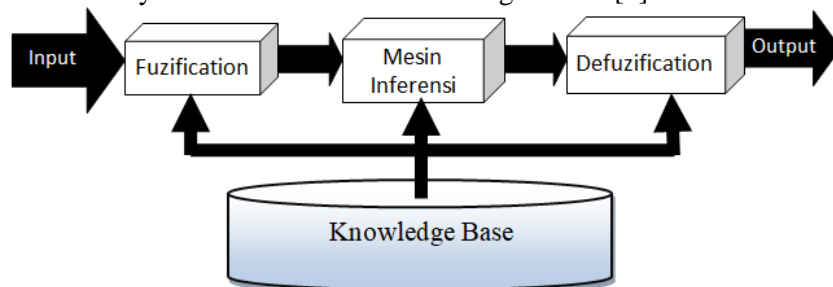To find out how fuzzy works can be seen in the image below [3]:


Figure 1. Fuzzy System

Information:
   a) Knowlge Base: Grouping of existing facts;
   b) Fuzzyfication: Is the input value into a firm value;
   c) Inference Engine: Rules that use the IF and THEN system;
   d) Defuzzification: change the output value and produce the output value.

In making a bus decision using a fuzzy inference system or called fuzzy logic. Fuzzy logic is a form of logic that has input and produces output, and has a continuous value. Fuzzy has a degree of membership of truth [4]. The fuzzy inference system has four methods, namely methods in solving problems. The methods include mamdani, sugeno, tsukamoto and holdi. The uni process uses the mamdani method which uses a low value to a high value by finding the lowest value with each existing rule. According to [5]. Some of the reasons why people use fuzzy logic, among others:
   a) Fuzzy logic is easy to understand by the middle and lower classes;
   b) The fuzzy system is very flexible;
   c) Have a tolerance for data;
   d) Fuzzy logic based on expert experience;
   e) Fuzzy logic uses natural language;
   f) Using low-level language [6].

The Fuzzy Inference System originated from the Fuzzy Set theory proposed by Lofti Zadeh around 1965. With the Fuzzy Set, it can be represented and handled with various uncertain parameters, meaning that there are no clear results, and partial truth [7]. The processes that run in the Fuzzy Inference System consist of fuzzyfication, inference, and defuzzyfication. Defuzzyfication in this study using the Weight Average method. To determine the membership function limit, the FCM algorithm is used according [8] Things that must be discussed in the fuzzy system are: (1) Fuzzy Variables It is an indicator that will be reviewed on fuzzy, (2) Fuzzy set Is a scope that represents something in an indicator, (3) The universe of talk All values that have been discussed in
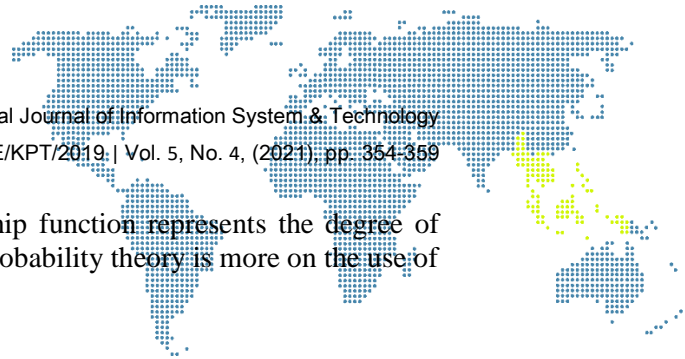
the fuzzYset used, and (4) Domain. The membership function represents the degree of proximity of an object to a certain attribute. While probability theory is more on the use of relative frequency [9-11].

3. Results and Discussion

System analysis and design in the case of discussion of unemployment prediction using the Sugeno method. Where the ultimate goal of this research has been to collect data and the results of interviews with companies and job seekers, at the company. One of them is the data used for unemployment prediction. Fuzzy analysis begins with unemployment prediction data using the Comparison of the Sugeno method to determine variables, then the formation of fuzzy sets, after the variables are set and fuzzy sets have been formed, the next step is to enter data into the application. In determining the system design, there are 5 input variables and 1 output variable. Which input variables consist of Education, Vacancies, Age, Opportunity and Company The output variable is decision, or decision. this can be seen in the Figure 2.
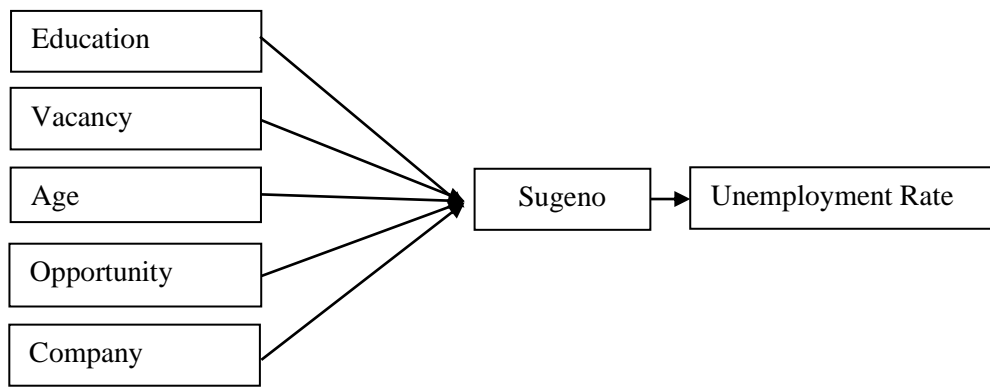

Figure 2. Sugeno's Fuzzy Analysis Process

In this study, there are five input variables, namely, Education, Vacancies, Age, Opportunity and Company and as an output in the form of decisions. The explanation is in Table 1.

Table 1. Blurred Set

Fungsion	Variable Name	Universe of Conversation
Input	Education	[0 100]
	vacancy	[0 100]
	Age	[0 100]
	opportunity	[0 100]
	company	[0 100]
Output	Unemployment Prediction	[0 100]

Below will be explained an example of implementing fuzzy into Matlab software and using linear equations. Opportunity is a job opportunity for applicants to get a job, in every applicant trying to find opportunities to get the job they want.

Universe of talk	Fuzzy set name	MF Model models	Parameter	Domain
0-100	Lots	Trapmf	[55 70 100]	55 100
0-100	Not much	Trimf	[40 55 70]	40-70
0-100	Not many	Trapmf	[0 0 40 50	0-50

The membership function diagram for the Opportunity variable can be seen in the Figure 3
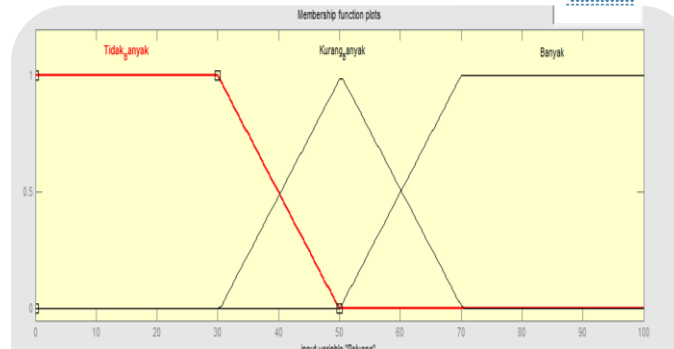
Figure 3. Membership Function for Sugeno

On the Opportunity variable the data owned can be divided into fuzzy sets, namely: Not Many, Less Many, Many. membership is not many, fuzzy set is not many will have a domain [0-75 with a degree of membership not many. Many less fuzzy sets will have domains [60-90]. The fuzzy fuzzy set will have a domain [75-100]. The form of manual down payment calculation is as follows:

$$\mu\text{Not Many} = \begin{cases} 1; & x \leq 30 \\ (50-x)/(50-30) & 30 \leq x \leq 50 \\ 0; & \leq x50 \end{cases}$$

$$\mu\text{Not much} = \begin{cases} 0; & x \leq 30 \ x \geq 70 \\ (x-30)/(50-30); & 30 \leq x \leq 50 \\ (70-x)/(70-50); & 50 \leq x \leq 70 \end{cases}$$

$$\mu\text{ Lots} = \begin{cases} 1; & x \leq 50 \\ (50-x)/(70-50) & 50 \leq x \leq 70 \\ 0; & \leq x70 \end{cases}$$

From the results of fuzzification, it produces 3 fuzzy inputs, namely:
   a)   Education = Very High (0) and High (0);
   b)   Vacancies = Very Many (0.5) and Many (0.5);
   c)   Age = Very Large (0.7) and Large (0.2);
   d)   Probability = Very Much (0.17) and Many (0.75);
   e)   Jobs = Decent (0.5) and Many (0.5).

Mecine Inference
1)   [R1] IF (Education is Not High) AND (Not Many Vacancies) AND (Age is not Very Big) AND (Opportunity is Not Much) AND (Small Company) Then (Decision is Rejected).
2)   [R2] IF (Education is Not High) AND (Not Many Vacancies) AND (Age is Not Very Big) AND (Opportunity Not Much) AND (Medium Company) Then (Decision is Rejected).
3)   [R3] IF (Education is Not High) AND (Not Many Vacancies) AND (Age is not Very Big) AND (Opportunity is Not Much) AND (Large Company) Then (Decision is Rejected).
4)   [R4] IF (Education is Not High) AND (Not Many Vacancies) AND (Age is Not Very Big) AND (Less Opportunity) AND (Small Company) Then (Decision is Rejected).
5)   [R5] IF (Education is Not High) AND (Not Many Vacancies) AND (Age is not Very Big) AND (Many Opportunities) AND (Small Company) Then (Decision is Rejected).
6)   [R145] IF (High Education) AND (Many Vacancies) AND (Very Large Age) AND (Many Opportunities) AND (Medium Firm) Then (Decision is Accepted).
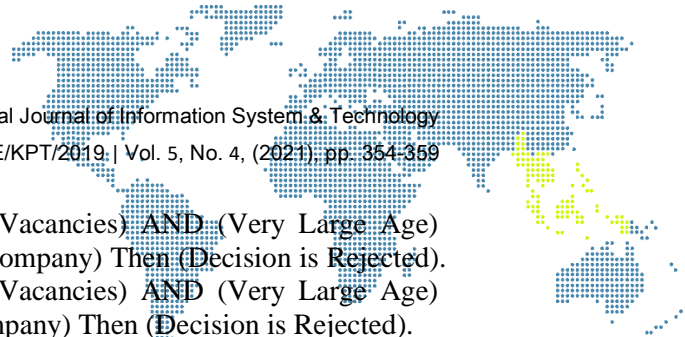
7) [R146] IF (High Education) AND (Sufficient Vacancies) AND (Very Large Age) AND (Sufficient Opportunity) AND (Medium Company) Then (Decision is Rejected).

8) [R147] IF (High Education) AND (Sufficient Vacancies) AND (Very Large Age) AND (Many Opportunities) AND (Medium Company) Then (Decision is Rejected).

9) [R148] IF (Education is Very High) AND (Sufficient Vacancies) AND (Age is Very Large) AND (Sufficient Opportunity) AND (Company is Medium) Then (Decision is Rejected).

10) [R149] IF (High Education) AND (Sufficient Vacancies) AND (Very Large Age) AND (Sufficient Opportunity) AND (Medium Company) Then (Decision is Rejected).

By using the defuzzy weighted average method, the credit disbursement is as follows:

$$Z* = \frac{(0,*80)+(0,5*65)+(0,7*60)+(0,8*80)+(65*0,17)}{0+0,5+0,7+0,8+0,17} +$$

$$Z* = \frac{149.55}{2.17}$$

$$Z* = 68.91$$

Based on the results of the above equation, the result of the defuzzification = 71.77 is included in the accepted table range.
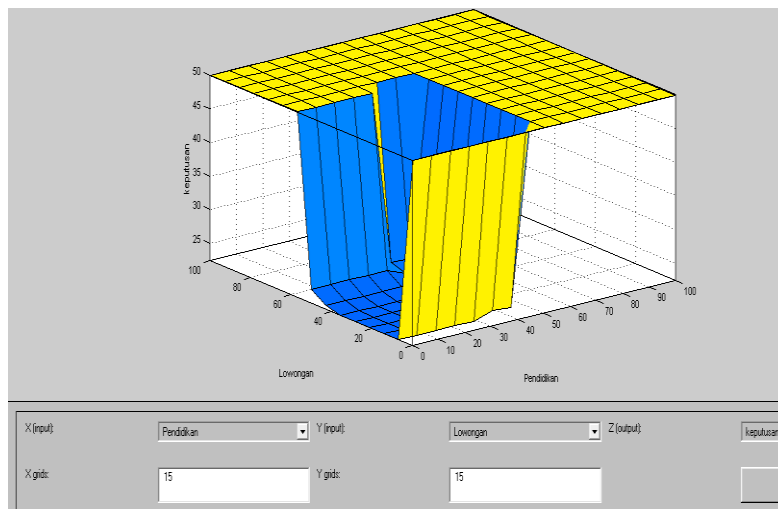

Figure 4. Surface Viewer

This viewer is useful for viewing the flow of fuzzy reasoning in the system, including mapping the input given to each input variable, operator application and implication functions, composition (aggregation) of rules, to the determination of firm output on the defuzzification method. This viewer can be called by selecting view – view rules. Based on Figure 4.10, it can be seen that the output value of Job Vacancies Prediction is 6891. That value lies in the accepted fuzzy set. In addition to the rule viewer, you can also display the surface rule (surface viewer) of job vacancies, display the surface rule of Job Vacancies Prediction

4. Conclusion

Based on the results that have been obtained, it can be said that this research is:

a) Unemployment predictions in City X can be seen from the input variables which consist of five parts, namely education, age, vacancies, companies and opportunities so as to produce a decision support system.

b) The sugeno method is able to complete touch-level prediction stories with fuzification, machine inference, application and defuzzification processes to obtain output results.

c) This research can be used as a reference for researchers who want to develop the Sugeno method. And can be used to develop other applications.

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