

The Use of Fuzzy Logic to Predict Business Opportunities by Consumer Behaviour

Aryanti Aryanti ^a, Ikhtison mekongga ^b

^aTelecommunication engineering, ^bComputer engineering, State Polytechnic of Sriwijaya
(Aryanti@polsri.ac.id, Mekongga@polsri.ac.id)

*corresponding author Email: Aryanti@polsri.ac.id

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ABSTRACT

Nowadays, the development of information technology has resulted in intelligent systems. A lot of applications of intelligent systems can be used for predicting. One of them is fuzzy logic which can be used for uncertain reasoning and have been widely used in modern industrial and consumer product control systems. This research was aimed for predicting how success a business run and would run. A business run and was able to compete in tough market competition if the company counted on consumers' satisfactory. Consumers' behaviour depended on product characteristics like the appearance, style, quality and price. This research built regression model among level of education, income, and purchasing capability using fuzzy logic. This regression model was for predicting business opportunities that would run based on the correlation among level of education, income and purchasing capability. The result of research showed that area inhabited by large number of university students and income of one million, the decision to buy products was 94,7 meaning that consumers were able to spent 9.47% of their income for buying products.

Keywords: Prediction, Business, Consumers, Behaviour, Fuzzy logic.

1. Introduction

Conventional forecasting methods generally used is regression analysis. Nowadays, with the development of information technology has spawned intelligent systems, methods of forecasting are also getting better, especially on the data interval. One method of intelligent systems that can be used for forecasting is using fuzzy logic ¹. Regression analysis is conventionally only capable of forecasting for data - data input and output are already fixed. But if the data input and output is then the interval data for forecasting, better use of regression analysis with fuzzy logic ².

A business will be able to run and able to survive in an era of intense competition if the company is able to pay attention to customer satisfaction or consumers. One form of attention in this regard, that the company has to know the factors that cause consumers to make purchases. Consumer behavior is inseparable from the characteristics of a good product on the appearance, style, quality and price of these products. Pricing by sellers will influence the buying behavior of consumers, because prices can be accessed by consumers will tend to make consumers make purchases of these products ^{3,4}. Instead characteristics seller will influence buying decisions. In this case the consumer would rate the seller, either about the service, easy to acquire products and friendly attitude of the seller.

There are three factors that influence consumer decision-making, namely: (1) individual factors include consumer education and consumer income; (2) the influence of the environment; (3) marketing strategy ^{3,4}. Socioeconomic changes influence consumer behavior in buying, both for primary and secondary. Socioeconomic changes include the income and educational levels that are characteristic of the buyer. There is a direct correlation between the level of education, income and ability to buy someone. Education is directly related to the ability to buy because there is a strong correlation between education and income. Education affects consumers in making decisions, consumers higher education has a different view of the alternative brands and consumer prices compared with lower educated.

In this paper the regression models are built by using fuzzy logic between the level of education, income and ability to buy someone. The regression model is expected to predict the success of the business to be or is being done.

2. Experimental Details

On the theory of fuzzy sets, membership function (MF) is a curve that shows the mapping of points of input data into membership values (often called the degree of membership) which has the interval between 0 and 1⁵. One of the ways that can be used to obtain membership is through the value function approach.

In this paper, the application of fuzzy operator is assumed there are 9 pieces of fuzzy rules, namely.^{5,6} 1) If the lower entrance X1 and X2 small then Y minimum. 2) If a lower entry X1 and X2 average then Y minimum. 3) If the low entry X1 and X2 larger then need Y normal. 4) If X1 and X2 standard sign small then need Y minimum. 5) If the standard entry X1 and X2 on average it is necessary Y minimum. 6) If X1 and X2 standard sign big it is necessary to maximum Y. 7) If X1 and X2 high entry smaller than need Y normal. 8) If the high entry X1 and X2 average maximum Y it is necessary. 9) If X1 and X2 high entry smaller than need maximum Y.

In this study, the research stage are: 1) Sulose Equation Model. In fuzzy logic a representation of the membership functions of the independent variables X1, X2, X3, ..., Xn as an input as well as the representation of the membership functions of independent variables and dependent variable Y as an output⁷. 2) Determine the Needs Analysis. In order to reach the end of constructing a good system, the necessary arrangement needs analysis procedure that includes: a) Needs Input, input is required in the type of membership function input X1, X2, X3, ..., Xn and the necessary parameters. The same is done for the dependent variable Y. The same input X1, X2 and Y to determine forecasting with multiple regression. Input X1, X2 and Y are the simulation will be shown on the outcome of the discussion. b) Needs Process. The programming procedure is: 1) Determine the input and output to be used in building the fuzzy logic, which makes in the Editor FIS input X1 and X2 as well as the output Y. 2) Determine the input variable membership function X1. 3) Determine the membership function input variable X2. 4) Determine the output variable membership function Y. 5) Develop a fuzzy rule. 6) Defuzzification Mamdani rules on the composition, which in this case using the centroid method. 7) Calculating forecasting Centroid Y using the method. c) Needs output. In accordance with the principle of building the system, then the output is also an important role. In this example the output is generated if it had been entered input values. d) Needs Software and Hardware. The system is built with the computer hardware with the software used to build the system is Matlab that works on Windows XP operating system. 3) Creation of a System Design. Have previously performed the design, such as the purpose of membership functions, fuzzy rules design, design procedures and design of the display (interface). 4) Build a Computer Program, a computer program utilized to construct this system is a software Matlab on the footing that the Matlab technical computing language that is really popular and very gentle to apply and also easy to see the construction of the language. 5) Testing Program. Once the system is built, it must be examined whether the system can work well and easy to operate. Tests carried out in detail presented in the results and discussion that follows.

3. Results and Discussion

Free variable (X) are the factors that influence consumer behavior in purchasing, broken down into two variables include: 1) The education factor (X1) is an assessment of the education of the respondents, which indicator is the last formal education they have. Kindergarten-Elementary-junior category of low education. High school education standard category D1-D3. Education D4-S1-S2-S3 ff high category. 2) Factor income (X2) is a monthly net income obtained by the respondent or personal income for those who still own (flunky / girl) in rupiah, then grouped as follows: Less than Rp 1 million small category. Between Rp 1.000.000- Rp 1,200,000 average category. More than US \$ 1.2 million major categories. The average consumer's decision to purchase (y), it is usurped in the group: a) Minimum, if the consumer is only able to spend <5% of the revenue to buy the product. b) Normally, if a consumer is able to spend 5% or <10% of the revenue to buy the product, and c) Maximum if consumers were able to spend > 10% of the revenue to purchase the merchandise.

In the build input data parameters X1 given input like the following model to examine the production of output produced in the universe of discourse or X1 range between 1-10, The X1 variable curve is illustrated in Figure 1. X1 lower The lower limit (a): 1, The upper bound (b): 4. For X1 Standard The lower limit (a): 3, Limit the middle (b): 6, The upper limit (c): 8 and X1 High The lower limit (a): 7, The upper limit (c): 10. Of the values of the limit values entered by the user, will the limits of these values are utilized to estimate the level of membership of each representation curve used is for variable low use linear curve down, the default variable used curves triangles, and for high variable use linear curve rose.

In the build input data parameter limits variable X2, an example is given, input as below to test the output generated output. In the creation of discourse or X2 range between 9-13. The variable X2 curve is illustrated in Figure 2. Small X2 The lower limit (a): 9, The upper limit (b): 10:25, and X2 Average The lower limit (a): 9.75, The middle Limit (b): 11, The upper limit (c): 12:25. Large X2, The lower limit (a): 11.75, and The upper limit (c): 13. Of the values above are entered by the user, will the limits of these values are used to calculate the degree of membership of each representation curve used is for variable little use linear curve down, variable averaging curve triangles, and for variable big using a linear curve rose. The variable Y curve is illustrated in Figure 3. Of the limit values entered by the user, will the limits of these values are used to calculate the degree of membership of each representation curve used is for variable minimum use linear curve down, variable normal use curves triangles, and for variable maximum use of the curve linear rise.

By using fuzzy rules as written on the basis of theory, data from the education and income levels that exist can be solved with a fuzzy logic program with Matlab toolbox. Fuzzy rules can be viewed in Figure 4. Figure 5 show the final step is the affirmation (defuzzyfication). The affirmation is performed with the aid of software toolbox fuzzy. The test results with the centroid method with the input level of education are students or fuzzy value = 5 and an income of about Rp 1,100,000 or fuzzy value = 11 produces output fuzzy purchasing decisions with a value of 94.7. This fuzzy reasoning using centroid method.

4. Conclusion

In conclusion, this study shows that in order to determine the purchase decision or purchasing power of consumers, one factor that attention can be concern a that the level of income and education level of consumers in the area. In this study showed that if the majority of a region inhabited by the student's education and income levels of around Rp 1 million, it can be expected that a decision will purchase the product at 76.3 or consumers will be able to release funds amounting to 7.63% of their income to buy the product Suggestion. This forecasting techniques are well suited to the data in the form of intervals and fluctuate. For the study should consider the high degree of homogeneity in the selected respondents to be more accurate forecasting techniques.

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Figure captions

Figure 1. The curve variable X1.

Figure 2. The curve X2 variable.

Figure 3. The curve variable Y.

Figure 4. Rule buying power

Figure 5. The curve variable Y centroid method

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Figure 1.

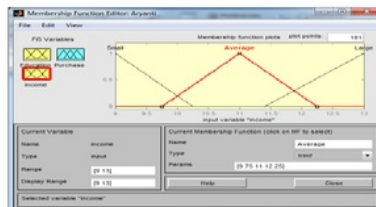


Figure 2.

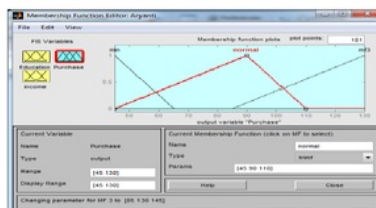


Figure 3.

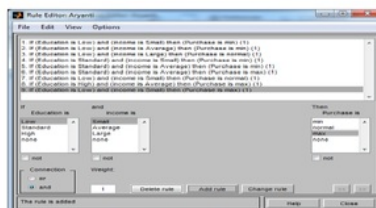


Figure 4.

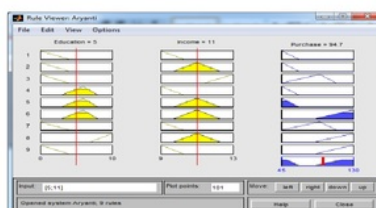


Figure 5.

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