Fuzzy Logic Application with MATLAB: Estimating Egg Consumption

Introduction

Fuzzy logic , first proposed by Zadeh according to whom fuzzy logic produces more statements between 0 and 1 than the 0 and 1 statements of classical logic. The definition of fuzzy sets differs from the classical concept of member or non-member of a set. In Zadeh's definition , nothing in fuzzy logic and fuzzy set theory is absolutely certain. In mathematical terms, all change on the boundary between 0 and 1.

In the concept of a fuzzy set, each element of the set is defined as an element up to a certain point. According to this definition, the "fuzzy cluster" is a cluster with elements of different levels of membership . Fuzzy sets can be expressed by classifying the elements of the set according to their degree of membership and mathematically defining the membership function.

Using fuzzy logic, an inference structure with applicable knowledge-based approximation capability is provided. Fuzzy set theory has provided mathematical power containing uncertainties combined with human cognitive processes such as reasoning.

MATLAB is software used in many fields around the world for numerical and symbolic computing, data analysis, advanced programming, engineering and scientific applications etc . It is recognized as the most advanced technical and scientific problem-solving and application development tool of the digital world with its numerous sub-modules called toolboxes, which cover many mathematical and engineering areas

For example, it is used in geophysics to construct a soil description system, electromyographic wavelet transform, to construct a land assessment model, and in healthcare sector. The aim of this study is to estimate egg consumption with a fuzzy logic application by creating input functions and output functions using Matlab program.

Description

The study population included people living in Bingöl, Turkey and neighboring provinces. A sample population was surveyed in February 2020 mainly in Bingöl, Turkey (Van Diyarbakır and Malatya) and neighboring provinces, and the survey was conducted among 220 people. The survey was excluded and the remaining 220 surveys were analyzed.

Fuzzy logic is a method in which logic-based fuzzy statements are examined by passing them through a logical filter. Membership functions determine whether an object is a member of a set. With the inference methods of fuzzy logic we try to interpret the events. From this it can be concluded that fuzzy sets are subjective and not objective.

An object's degree of membership ranges from 0 to 1. Here, a value of 1 indicates complete membership and a value close to 0 indicates that the object's membership in the fuzzy set is weak. That is, the object with value 0 is not a member of the fuzzy set. Triangle membership functions are one of the commonly used membership functions in fuzzy logic terminology . Membership functions can be defined in different ways depending on the problem to be solved with fuzzy Logic.

These are input/data definition, fuzzification, fuzzy rule base, fuzzy inference, defuzzification and outputs. In this model, which estimates egg consumption based on fuzzy logic, inputs were defined as monthly income and food expenditure, and outputs were defined as the number of eggs (Table 1). The structure of the system is shown in Figure 1.

Fuzzy sets and expressions were formed according to the data here. The fuzzy sets constructed for each of the input data were formed in the low, middle and high ranges. The input variable income was defined in the range 2,000 to 8,000, the variable food expenditure was defined in the range 500 to 3,500 and the number of eggs was defined in the range 0 to 135.

Levels were defined in the system by value ranges to define membership functions. Three levels (low, medium, high) were defined for income input data, three levels (low, medium, high) for food expenditure, and three levels (low, medium, high) for output data of eggs. The membership functions used in the system are shown in Figure 2. The analysis of the fuzzy logic application was performed with Matlab Fuzzy-Toolbox.

In the study on egg consumption, it was found that 91.9% of 345 university students consumed eggs, the average number of eggs consumed was 3.4 per week, and 91.2% ate eggs for breakfast became. In another study, a questionnaire was presented to 384 consumers in Uşak province in Turkey and ChiSquare analyzed between some variables and income levels.

The amount of eggs consumed in Uşak province was below the Turkish average and the egg weight was between 53 and 72 g.

Conclusion

In this study, a fuzzy logic model was developed to estimate egg consumption using information about income and food expenditure. Income and food expenditure were used as input variables in the model, while the number of eggs was used as output variable.

To understand the relationship between input and output variables, a fuzzy rule base was created. Mamdani type was used as the inference mechanism. The centroid method was used for defuzzification. The system was modeled in MATLAB.

In this study, a model was built to calculate the number estimate monthly number of eggs consumed by individuals using fuzzy logic. The maximum number of eggs consumed by individuals per month was estimated at 117 with income of 8,000 TL and food expenditure of 3,500 TL . It has been observed that the fuzzy logic model.