





## Development of individualized education system with artificial intelligence fuzzy logic method

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### Keywords

Composite materials  
Artificial intelligence  
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Nano technology

### Abstract

The importance of artificial intelligence is indisputable today. With the development of artificial intelligence, computers, smartphones and other electronic devices have become indispensable to human life. With the fuzzy logic method under the heading of artificial intelligence, many mathematical problems can be easily solved. Artificial intelligence is briefly a computer science. Artificial intelligence can be explained as the ability to exhibit human-like behavior. The aim of this study is to develop an individualized teaching practice in which each student can improve himself/herself by using the fuzzy logic principle. Thanks to this designed educational technology, each student will see questions about their own level of success and move their learning level up as much as possible. For the fuzzy logic application, the inputs are determined as the time to solve the question and the accuracy rate, and the output is determined as the difficulty of the problem.

### Introduction

Within the scope of this study, it is planned to develop an individualized teaching system with the fuzzy logic method, which is the sub-branch of artificial intelligence. In general, mamdani inference was used in the study, and AND and OR rules were determined to cover each different condition. In the light of these rules, it is aimed that the program will show difficult questions to students who solve the questions they have shown before quickly and with a high accuracy rate, and reduce the difficulty of the question as they go to higher times and low accuracy rates. In this context, graphs were created for each input and output and the blur degrees of the inputs and outputs were calculated. Calculations were made with 6 randomly selected samples using graphs and determined AND and OR rules. As a result of these calculations, the program has given the expected level of difficulty for the expected students. It has been determined that a functional individualized training program can be made using the fuzzy logic principle. Studies on the progress of composite material materials and derivatives with artificial intelligence.

### Artificial Intelligence (AI)

Artificial intelligence is very important nowadays. Coordinated studies in health, law and other departments, especially in the field of artificial intelligence and mechanics, are academicians by continuing. The topics discussed around artificial intelligence, the components are artificial neural networks, expert systems, fuzzy logic, genetic algorithms. There are many disciplines that adopt artificial intelligence. Some of them are computer engineering, philosophy, cognitive science, electronic sciences [1]. By giving importance to the study of intelligence automation with computers, the foundations of artificial intelligence were laid. In the 1950s and 1960s, when the definition of

intelligence and artificial intelligence was discussed, artificial intelligence gained usability in every field in the society we live in [2-3]. Artificial intelligence is the process by which the human brain, non-organic systems (computer, program, robot, etc.) Based on its functions. In short, artificial intelligence is a set of systems that think like a human, perceive like a human, interpret like a human, analyze like a human and make decisions like a human after all these stages. Scientists have defined artificial intelligence differently. For example, artificial intelligence is the science of computer programs that simulate intelligent behavior, and artificial intelligence is the science of converting things into machines that require intelligence when done by humans [4-5]. When the literature is scanned, it is possible to come across different studies with artificial intelligence and sub-branches. For example, in a study conducted; Student academic performance estimation was made by artificial intelligence using machine learning algorithms of students. At the end of the study; the decision tree algorithm gives the best accuracy rate with a maximum depth value of 2 for 649 student data. The random forest algorithm gives the best accuracy with 649 student data. The logistic regression algorithm was found to give the best accuracy with 395 student data [6]. In different studies, the importance of the development of artificial intelligence in the field of food, epidemics and pandemics and its applicability in the field of health have been investigated. The literature findings were shared in the results section [7-9].

### Fuzzy Logic

In 1965, Prof. Fuzzy logic was mentioned in the work by Lotfi Askar Zadeh [10]. The concepts of fuzzy logic and fuzzy sets were first introduced in 1965 by Lotfi A. It is set out in an article published by Zadeh. Later, in his notes published in 1973, Zadeh proposed the idea that fuzzy set theory has a structure that can be modeled on the human decision-making system with the best approximation [11]. In classical logic, the limitations are certain, an element is either a member of a set or it is not. There is a logic of 0 and 1 in classical sets. In fuzzy logic, on the other hand, there is partial membership. In this way, it can operate in vague and approximate situations similar to human logic. Fuzzy logic is currently used in many fields such as the automotive industry, electronic control systems, and home electronics. Especially with the use of electrical appliances, energy has been saved and such tools have been smartened up [12]. An example fuzzy logic diagram is shown in Figure 1.

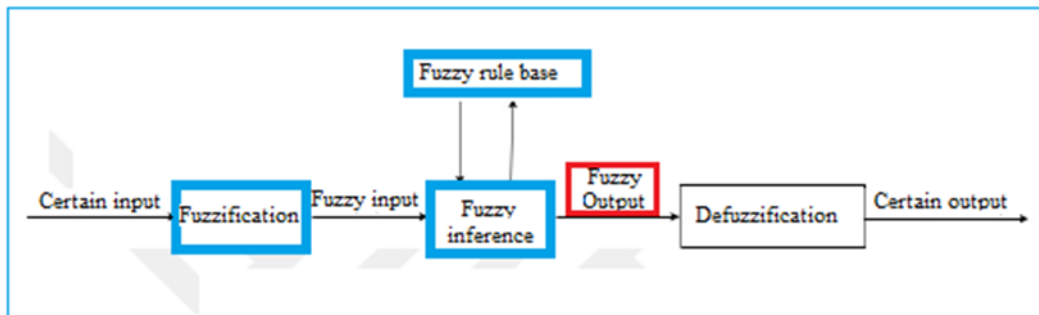


Figure 1. Operation of the fuzzy system fuzzy logic system [13]

### Method

The difficulty level of each problem in the study will be calculated by fuzzy logic. Two different inputs will be subjected to the rules and the difficulty level of the problem will give the output. Mamdani inference will be used in the study. When the student starts using the system, he will be shown 10 leveling questions, which are shown to everyone. These questions will be selected by educators and will consist of different difficulties. It is very important to have selective questions. According to the percentage of wrong / right that arise as a result of these questions and the time spent per question on these questions, the questions will begin to be shown to him according to his academic level. With each question it solves, the time and accuracy will be updated according to previous calculations. In this way, it is aimed to gradually increase the student's learning level by increasing the difficulty level.

### Results

The inputs were defined as the time to solve the questions and the accuracy rate of the questions. In the question solving time graph, the Y-axis shows the membership status, while the X-axis gives the time to solve the question

in seconds.: The graph of the students' question solving speed is given in Figure 2.

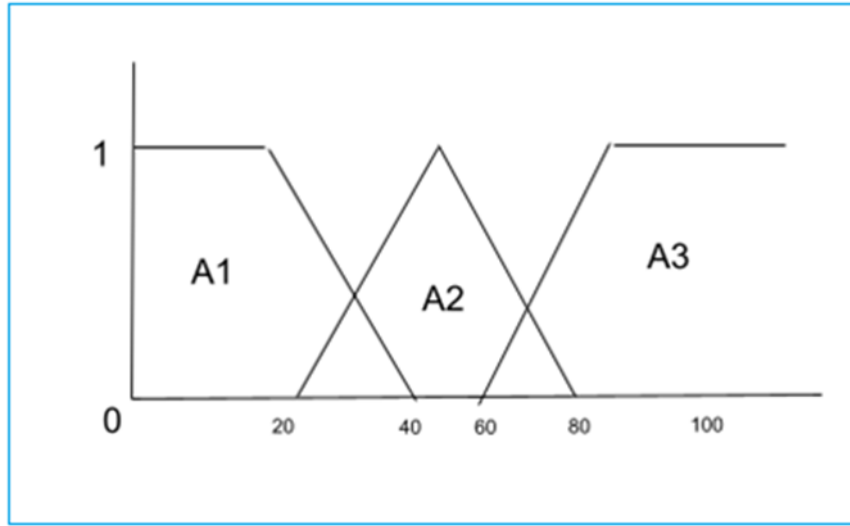


Figure 2. Students' question solving speed graph

## Conclusion

In this study, the aim of this study, which I started on the idea of adjusting the question difficulty while studying, is to create an individualized education system by applying the fuzzy logic principle in order for students to get maximum efficiency. As a result of the literature review, it was found that the two important factors that indicate that a student is academically successful in a subject and that he has completely learned that subject are the accuracy rate in the questions and the time to solve the questions. Rules have been created with fuzzy logic and these rules have been poured into graphs and output has been provided. The principle of operation of this program is illustrated by example cases. It has been determined that the program works as desired.

## Recommendations

- This system is also recommended to be used in classrooms, especially for students preparing for high school and university exams.
- By designing this system in the form of a mobile application, it can also be ensured that it works better on tablets and phones, thus increasing mobility.
- If the study wants to be more detailed, new parameters can be added to the entries.

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