

Design Learning Modules Application of Fuzzy Logic Method in the Matlab Application of Artificial Intelligence Courses

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Abstract

In the research entitled "Designing Learning Modules Application of Fuzzy Logic Method in Matlab Application of Artificial Intelligence Courses" aims to design and create learning modules in the application of fuzzy logic methods using the Matlab application in artificial intelligence courses. In artificial intelligence courses there are several methods in soft computing that are useful in relation to "problem solving" one of which is the fuzzy Logic (Fuzzy Logic Method) method. The application used in this study is using Matlab software with a fuzzy toolbox. This research produces a learning module that can be useful in supporting learning activities in the classroom. With the learning module the application of the fuzzy logic method in the Matlab application can help lecturers in conducting lectures especially in the practice of Artificial intelligence courses. While for students, it can be useful as a guide in practical activities on the material application of Soft computing methods, especially the fuzzy logic method.

Keywords: *Learning Module, Fuzzy Logic Method, Matlab Application, Artificial Intelligence*

1. Background

At the university level the lecture process can be seen from the process of initial activities to the end of the lecture and the results achieved. Efforts to improve the quality of the quality of learning continue to be made. One effort to achieve an increase in the quality of learning is in terms of the implementation of teaching and learning activities. The process of teaching and learning activities is an important part to produce quality graduates, this is because the teaching and learning process is one of the efforts in the context of transferring knowledge so that the creation of expected behavioral changes in accordance with the objectives of the educational process in an effort to improve the quality of human resources through education.

The success of a curriculum in producing productive, creative and innovative people is largely determined by various factors which are the key to success. The keys to success include the creativity of educators, student activities, a conducive academic environment and the provision of educational facilities and infrastructure (Mulyasa, 2013: 39). Related to facilities and infrastructure, in higher education continues to strive to be improved in order to support the creation of quality learning. Another key to success is the creativity of educators in designing learning in the classroom. One way to increase learning creativity is to design supporting learning resources, especially learning modules that are adequate for the learning needs of students, in addition to the use of existing learning resources

Modules fall into one of the categories of visual teaching materials. Learning materials arranged in modules must be able to be studied by students independently because the

module is a stand-alone unit and consists of a series of learning that is integrated, to help students achieve a number of goals that have been formulated (Daryanto, 2014: 178) .

The application of learning modules as supporting learning resources can condition learning activities that are better planned, independent, complete and with clear outputs (Daryanto, 2014: 186)

The Artificial Intelligence course is one of the courses in the informatics engineering study program. In teaching and learning activities in the lecture hall, sometimes the delivery of lecture material with standard methods is sometimes ineffective. This is mainly related to practical lecture material. In the course of Artificial intelligence, there are several materials that are applied by practical methods. In practice materials needed a guide that can help lecturers in the learning process to take place efficiently and effectively. To overcome these problems, we need a learning module that can be written guidelines / guidelines in practical activities. With the module, students can easily learn it and understand the material taught by the lecturer in the time provided, in addition to the existence of the learning module can help lecturers in providing understanding of students given the ability of each student to receive material is not the same.

2. Methods

This type of research is development research. The product of this research is the Learning Module Application of Fuzzy Logic Method in the Application of Artificial Intelligence Subjects. This research uses an R&D approach. The design of the learning module that will be created will focus on the application of the fuzzy logic method to the Matlab application in artificial intelligence courses. The stages of research in this study are as follows:

- a) Literature Review. By studying material on artificial intelligence and fuzzy logic methods from various sources.
- b) Preparing the application to be used namely the Matlab Software application via the fuzzy toolbox.
- c) System analysis is carried out to analyze and create module designs with the Matlab application.
- d) Carry out the process of data retrieval that has been done on the Matlab software.
- e) Creating a Learning Module based on the results of the design that has been done on the Matlab application. In this activity the stages of practice activities are carried out

3. Results and Discussion

Results of the Analysis Process

The analysis process was obtained based on the results of observations and interviews that were analyzed using a qualitative approach. Researchers found several problems. The results obtained in the analysis process are as follows:

- a. There is no reference (guidance) in the implementation of learning activities in class. Classroom learning is still centered on lecturers in presenting practical material.
- b. The ability of each student to receive material is not the same in this case related to understanding the material, especially in practical activities.
- c. Learners, most of whom have not used laptops and the allocation of learning is long enough that many students are late in participating in practical activities which causes learning activities to be less effective.
- d. The still limited media (sources) of learning so that learning activities are less than the maximum, therefore the need for additional media that is able to improve student

learning outcomes, among others, by providing guidance in practical activities, namely the existence of learning modules

Fuzzy Logic Method in Matlab Applications

The product produced in this research is the fuzzy logic method learning module in the Matlab application. Before making a learning module, it must be done making fuzzy logic applications first.

Some steps that are very important to note in a Fuzzy Logic Method include determining the input variables and output variables in the form of exact values in a certain range. The stages performed in the fuzzy logic method are:

a. Determination of system variables.

The initial stages carried out in the fuzzy logic simulation are determining system variables. Determination of system variables in the fuzzy logic method consists of 2 types, namely MISO (Multi Input Single Output) and Single Output Multi Output (SIMO). The system variable used in this study is categorized as a MISO consisting of 2 input variables and 1 output variable. Variable input consists of Speed and Time while the output variable is Distance.

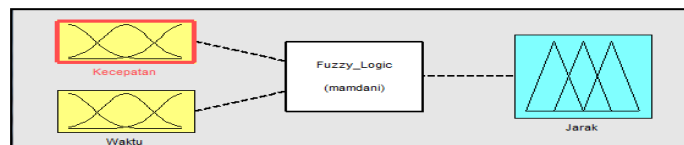


Figure 1. Variable input and output fuzzy logic simulation

The next stage is determining the range of each input and output variable :

- Speed range between 0-100
- Time Range is between 0-5
- Distance Range 0-500

In this study the method used in this simulation is the Mamdani method or better known as the Min-Max method while the selected membership function is a triangle shape.

b. Fuzzification Strategy

After determining the system variables, the next step is to determine the membership function. The speed input variable is determined in the range 0-100 which is then mapped into 3 cryptic sets of Low, Medium, and High. Time input variables in the range of values 0-5 are mapped into 3 cryptic sets of Fast, Medium, and Long.



Figure 2. Speed variable membership function input

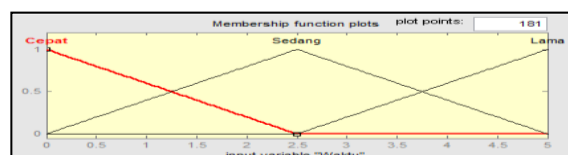


Figure 3. Membership function input variable Time

Distance Output Variables in the range 0-500 are mapped into 3 cryptic sets of Near, Medium and Far.



Figure 4. Distance Membership function.

c. Inference Strategy

Stages of the Arrangement Strategy (Inference) is the determination of fuzzy rules related to fuzzy relations. In the inference strategy, the following form is usually used.

IF x is A and y is B then z is C

The rules in fuzzy logic used in this study are as follows:

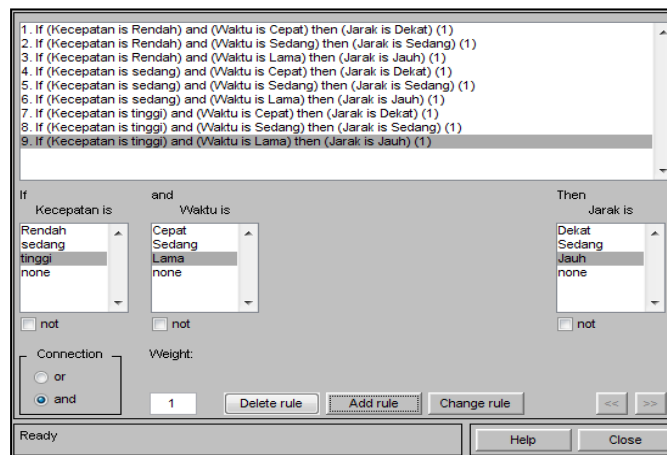


Figure 5. Inference Strategy.

d. Defuzzyfication Strategy

At the Defuzzyfication stage, the rules to be created are displayed in the form of a graph plot. In defuzzyfication using the Centroid method. This stage display can be seen in the Rule Viewer display as shown below:

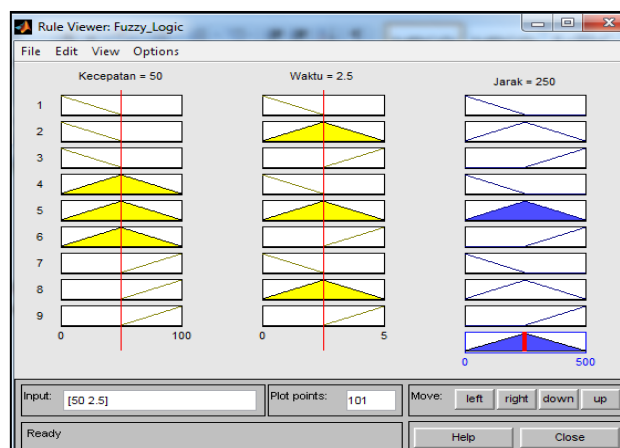


Figure 6. Display Rule Viewer

e. Surface Viewer Display

In Surface Viewer Display produces a graphical display of the results of the stages of the fuzzy logic method in the form of 3 dimensions. In this graph we can see the characteristics between input and output variables.

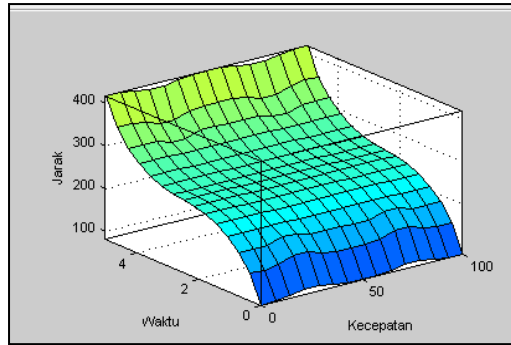


Figure 7. Display surface Viewer

Design of Learning Modules

The module is one of the tools in learning that is packaged systematically, and in it contains a set of planned and specific learning experiences and is designed to help students master their learning goals. Independence and experience of students to be actively involved are preferred in utilizing module media. The module components include:

- Cover Page. Contains: module title, university logo, university institution writing, faculty, and study program, the year the module was prepared.
- Foreword. Contains information about the role of modules in the learning process.
- Table of contents. Contains module outline and is completed with page numbers.
- Module Position Map. Is a diagram that shows the position of the module in the whole learning program.
- Glossary. Contains an explanation of the meaning of each term, difficult and foreign words used and arranged in alphabetical order.

Introduction

- a. Competency Standards. Competency standards will be studied in the module
- b. Description. A brief explanation of the name and scope of the module content, learning outcomes to be achieved after completing the module, as well as the benefits of these competencies in the learning process and life in general.
- c. Time. The amount of time needed to master the competencies that are the target of learning.
- d. Prerequisites. The initial abilities required to study the module, both based on evidence of mastery of other modules as well as by mentioning the specific abilities needed.
- e. Module Usage Instructions. Contains the procedure guidelines for using the module, namely 1. Steps that must be taken to learn the module correctly, 2. Equipment, such as facilities / infrastructure / facilities that must be prepared in accordance with learning needs.
- f. Final Purpose. Statement of the final goal (performance objective) that students want to achieve after completing a module. The final goal formulation must contain.
- g. Check Competency Standards. Contains a list of questions that will measure the initial mastery of student competencies, towards the competencies that will be studied in this module. If students have mastered the standard competencies / basic competencies to be achieved, then students can submit competency tests to the assessors.

Learning

- a. Purpose of the Practicum. Contains abilities that must be mastered for a single learning activity
- b. Material Description. In the basic theory of contents of the substance contained in the module in the form of concepts / principles, important facts that are directly related and support for the achievement of competencies and must be mastered by students
- c. Practicum Implementation. Contains instructions or work procedures for a practical activity that must be done by students in the context of mastering psychomotor abilities. in the implementation of practicum includes tools and materials used, work steps, and work drawings (if needed) in accordance with the objectives to be achieved.
- d. Student Activity Sheet. The worksheet needs to be completed as a practice activity result sheet that is designed in accordance with the practical activities carried out.

Evaluation

Evaluation techniques or methods must be adapted to the domain (domain) being assessed, as well as indicators of success that are referred to.

- a. Cognitive Test. Cognitive assessment instruments are designed to measure and determine the level of achievement of cognitive abilities. Questions are developed according to the characteristics of the aspects to be assessed and can use the types of written tests that are considered suitable.
- b. Psychomotor Tests. Psychomotor assessment instruments are designed to measure and determine the level of achievement of psychomotor abilities and behavior change. Questions are developed according to the characteristics of the aspects to be assessed.
- c. Attitude Assessment. Attitude assessment instruments are designed to measure work attitudes.

Cover

Module writing is the process of preparing learning material that is systematically packaged so that it is ready to be studied by students. The preparation of learning modules must refer to the competencies contained in the RPS and SAP in the curriculum in the Informatics Engineering Study program. To produce a learning module that is able to portray its function and role in effective learning, the module needs to be designed and developed by following the rules and elements that require it.

References

All references / libraries are used as references during the preparation of the module.

4. Conclusion

The learning module for the application of the fuzzy logic method to the artificial intelligence subject course is designed to make it easier for students to understand the fuzzy logic method and be able to practice it in the matlab application so that it can help students achieve a number of learning objectives in accordance with competency standards.

The results of the design of this learning module will be one of the learning media that can help lecturers in learning activities in the classroom. Modules are learning tools or tools that contain objectives, materials, methods, and ways of evaluating that are designed systematically and attractively to achieve competency / subcompetency standards expected in accordance with the level of students' abilities.

5. Citation and References

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