

FUZZY AGENT-BASED MODEL FOR LEARNING BEHAVIOR IN  
FORMAL EDUCATION

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## SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of of Computer Science (Computer System and Networking) with Honors.

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## STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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## **ABSTRACT**

The student group behavior emerges from interaction with fellow students and teachers, emotional and social influence, interaction with environment, teaching style and personal characteristic (e.g., self-efficacy). Since the student behavior is a complex system, the best solution for modelling this type of system of interacting agents is by using agent-based modelling. Agent-based modelling is good in handling the arising of system complexities, however in this system that involves with social relationship and human behavior, the subject uncertainty also include which are not accounted in this model. So, fuzzy logic is implement in this study since fuzzy logic can deals with vagueness and subject uncertainty. Integrating both agent-based model with fuzzy logic is a good idea in determining the learning behavior of student in education. In this study, the process of integrating fuzzy model with agent-based model is explained. Finally the development of fuzzy agent-based model of student group is present to allow the prediction of learning behavior of student. The contribution that we made of this paper is the process of integrating fuzzy logic with agent-based model in student group to determine the learning style is well-explained.

## **ABSTRAK**

Tingkah laku sekumpulan pelajar muncul dari interaksi dengan sesama pelajar, emosi dan pengaruh sosial, interaksi dengan persekitaran, gaya pengajaran dan ciri peribadi (contohnya, keberkesanan diri). Oleh kerana tingkah laku pelajar adalah sistem yang kompleks, penyelesaian terbaik untuk memodelkan jenis sistem agen interaksi ini adalah dengan menggunakan pemodelan berasaskan agen. Pemodelan berasaskan agen adalah sesuai dalam mengendalikan sistem yang rumit, namun dalam sistem ini yang melibatkan hubungan sosial dan tingkah laku manusia, ketidakpastian subjek juga termasuk yang tidak diambil kira dalam model ini. Oleh itu, logik fuzzy dilaksanakan dalam kajian ini kerana logik fuzzy dapat menangani ketidakjelasan dan ketidakpastian subjek. Menggabungkan kedua-dua model berasaskan agen dengan logik fuzzy adalah idea yang baik dalam menentukan tingkah laku pembelajaran pelajar dalam pendidikan. Dalam kajian ini, proses mengintegrasikan model fuzzy dengan model berasaskan agen akan diterangkan dengan terperinci. Akhir sekali, pembangunan model pelajar kumpulan berasaskan agen fuzzy hadir untuk membolehkan ramalan tingkah laku pembelajaran pelajar. Sumbangan yang kami buat dari kajian ini adalah proses mengintegrasikan logik fuzzy dengan model berasaskan agen dalam kumpulan pelajar untuk menentukan gaya pembelajaran dijelaskan dengan baik.

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## **LIST OF ABBREVIATIONS**

ABM	Agent-Based Model
HBM	Human Behavior Model
CGPA	Cumulative Grade Points Average
MAS	Multi Agent System

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of Study**

For many years, educator noticed that each student has their own preferred method in learning which is called learning style. The authors in his book *How People Learn* argued that “learners are different from each other, these differences affect their performance, and teachers should take these differences into account.” Learning style can be defined as the way or technique that student preferred to be taught. It is important to know student learning style since it influences the student performances and understanding in class. The preferred styles will guide the way student learns, absorbs, processes, comprehends and retains information from the lecturer.

There are many variables and parameter that influence the type of learning style. The first one is student cognitive load that can be divided into mental load and mental effort. These two factors refer to the cognitive capacity of individual when they are conducting a task or in the middle of problem solving activity. In other word, this factor will check the understanding of students in doing the task in the classroom.

The second variable is emotion. Emotion can be defined by the expression of feeling that occurred in certain situation or condition such as sad, happy, bored and etc. And in this context the emotion that student feels during learning time. The emotion plays the important role in learning behavior of student because it will drive the student attention to focus in class which then drive learning and memory (Sylwester,1994).

The third one is teaching style. The teaching style is the way lecturer convey the information in class or also can be defined as the method used during the learning. There are several type of teaching style such as authority, group, coach and activity style. The

duration for each class usually take for 2 or 3 hours and the student usually cannot stay focus in long time of period. So here comes the role of teaching style preferable by the each student since it important to determine the student performance in class. For example, if the student is compatible with group style of teaching, that student will interest and cooperate more in the class.

The last factor is the timetable of each subject. The timetable class be classified into morning, evening and night. It also plays the main roles in determining the learning style. For example in the hours such as in the evening, most of students usually feel tired and sleepy. During this time, the lecturer must play the right role to make the class more interactive. If the lecturers fail to cope with this problem, the student will get bored and their performances during the class decreases.

In short, this study will apply fuzzy model for human behavior in learning education to determine the interaction of element with each other in formal education. Besides, the fuzzy logic will be incorporated with agent-based model (ABM) to simulate the interaction between human behavior in order to give more accurate result.

## **1.2 Problem Statement**

The problem statement is the clear description about the issue that need to be solved in the research. This statement will ensure that the research will focus on solving the stated problem and it is important in keeping the research on track. The Table 1.1 shows the problem statement that need to be solved in this study.



Table 1.1: The problem statements of the research

Problem	Description	Effect
i. Students lack of understanding in the class	The student cannot understand and concentrate well during the lecture or lab.	It will affect the student performances. As their focus and concentration in the class is decrease, the performances in learning will decrease and it might affect their study and CGPA at overall.
ii. Lack of interaction between learning behaviors	The previous study on learning behavior apply the basic fuzzy logic without considering the interaction between the students in real world.	It do not simulate the real world scenario. Each student have different behavior in learning. This can be determined by using fuzzy logic. However, there are exist interaction among the students. The interaction will influence the other student behavior. So in this case, the study used ABM to model the interaction among the students.

Note: The first problem statement is adapted from Dunn et al. from Survey of Research on Learning Styles (1988) and Ahmed from Granular Fuzzy Model for Learning Human Behavior in Formal Education (2017) for second problem statement.

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