STUDENT MODELING WITH NEURO FUZZY REASONER

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Abstract

The paper focuses on student modeling with the help of neuro fuzzy reasoner. The reasoner model includes the classification of students on the basis of their scores in the quiz proposed and the time required by them to answer the quiz , including the questions on general knowledge and intelligent quotient i.e. IQ . The system, being flexible, can be adapted by the teachers for categorizing the students according to their IQ levels.

Keywords: student modelling approaches, modelling of domain structure, neural network, fuzzy approach, glossology, forward network architecture.

Introduction

In student modeling, the main issue is explaining the student's behaviour, which is the factor for the teacher's preference for student's classification . A student model is a key part of an adaptive educational system. There is a wide range of student modeling approaches and many features, which can be included in the system.

In this work , we are comparing the impacts of two selected aspects i.e. first is modeling of domain structure involving definition of skills and mapping between skills and items and second one is utilization of response time of student modeling .

We have included the quiz here in this paper , through all the students will be passed and, from which their scores for each and every question will be stored and the time required by them to answer these questions , is also recorded and further , depending upon the matches found in the pattern , described in neuro fuzzy reasoner , the student will be predicted to be with low IQ , moderate IQ , and high IQ .

The proposing neural network enables adaptively of fuzzy model. And again, enables the creation of an easy-to-use, and customized student modeling component.

Fuzzy student modeling

The fuzzy approach enables approximate reasoning and it is suitable for modeling human decision process. By using the glossology variables and fuzzy sets, the translation from verbal to fuzzy model is straightforward. In this way, the fuzzy approach is also used for student modeling problem. The goal of fuzzy student modeling is to imitate the student modeling strategy used by human teacher. Human teachers do not build detailed models for understanding the student performance and adapting their teaching strategy. They gather information and form general ideas of what kind of teaching might work better for each student. According to some findings students are usually classified in terms of a few underlying dimensions like motivation, intellectual ability and knowledge level on some topic. According to the IMS LIP specification, the student classification can be based on activity evaluation. This sort of classification can be easily expressed in terms of fuzzy logic.

For example:

IF (TEST_RESULT IS LOW) THEN STUDENT_CLASS IS BAD

This rule says that if a student has low result on a test, he is classified as a bad student. The expression (TEST_RESULT IS LOW) is the premise, and the expression (STUDENT_CLASS IS BAD) is the consequence of this fuzzy rule. TEST_RESULT and STUDENT_CLASS are linguistic variables, and their corresponding values are LOW and BAD. The premise of a fuzzy rule is always a fuzzy value, but the consequence may be a fuzzy or a crisp value. In this example, LOW is a fuzzy set, and BAD is a crisp value - class representing the classification of the student. The value of the premise is evaluated as the value of the

membership function of the fuzzy set LOW. The premise can also include several expressions and tie them with fuzzy logic operators. For example: IF ((TEST_RESULT IS HIGH) AND (STUDENT_SPEED IS FAST)) THEN STUDENT_CLASS IS EXCELLENT.

Neuro-fuzzy reasoner

Neuro-fuzzy reasoner (NFR) is a software component capable of learning the set of predefined fuzzy rules. This learning capability enables creation of adaptive fuzzy-rule systems. Fig. 1 shows the structure of the NFR system, which we are proposing.

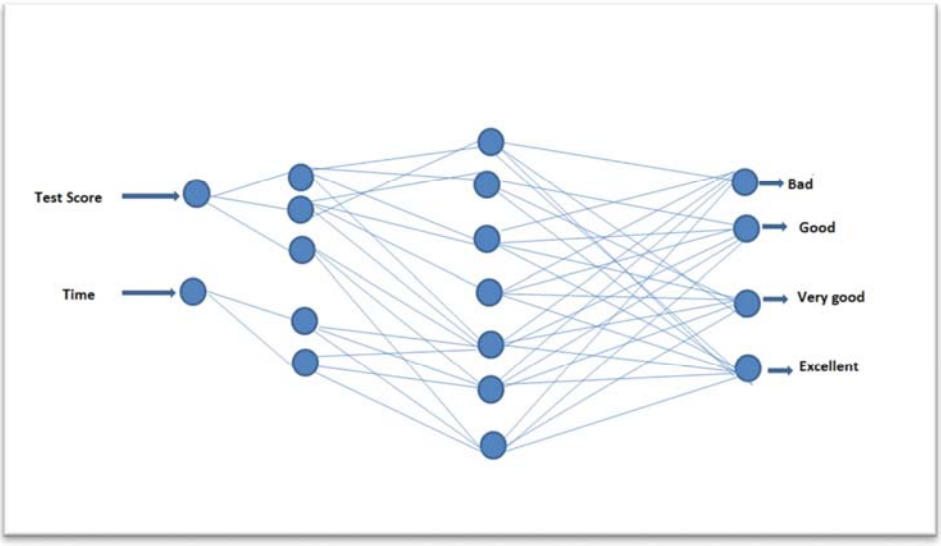

Figure 1: NFR structure

System numerical values describing the student features like test score; the system has a four-layer feed forward network architecture. The test time, number of correct or wrong answers, how many times student reviewed lesson , how many times student took test etc. L2 is the fuzzification layer. The units in this layer have fuzzy membership layers are denoted as L1, L2, L3 and L4. The L1 layer introduces to the functions as transfer functions. The purpose of this layer is to fuzzify the input values – to translate them into fuzzy sets. Each unit in this layer corresponds to a single fuzzy set that appears in the premise part of a fuzzy rule. L3 is the premise layer and its purpose is to calculate the activation of premises of the fuzzy rules. Each unit in this layer corresponds to a certain rule. The units in L3 implement AND operators by means of minimum type t-norms [3]. Minimum type t-norm is one way of implementing logical AND operation on fuzzy values, and it simply calculates min function. Connection weights between the layers L1 and L2, and L2 and L3 are fixed to 1. The fourth layer L4 implements output units, one for each consequence (in the case of student classification one for each type of students, e.g., BAD, GOOD, EXCELLENT, etc.). The connection weights between layers L3 and L4 are trained using least mean squares algorithm. The links between premises and consequences of fuzzy rules are stored in these weights. The training set creation is based on the parameters of fuzzy membership functions from the layer L2, and the explicitly defined set of fuzzy rules. The NFR system provides a simple way for the user to create a neuro-fuzzy classifier based on the student's prior knowledge. The corresponding NFR system is directly extracted from the fuzzy model, we are going to propose. Since the fuzzy model is very close to verbal model, NFR makes it easy to create fuzzy rule system according to the expert's knowledge .

The system we are proposing, will produce the category of the students, depending upon the test score, the speed of answering, the class of the student will be shown, as shown in the table below. Table: fuzzy rules for classification

SCORE	SPEED	CLASS
Bad	Slow	Bad
Bad	Moderate	Bad
Bad	Fast	Bad
Low	Slow	Bad

Low	Moderate	Good
Low	Fast	Good
Medium	Slow	Good
Medium	Moderate	Very good
Medium	Fast	Very good
High	Slow	Very good
High	Moderate	Excellent
High	Fast	Excellent

Conclusion

In this paper, we are proposing a neuro-fuzzy system that can be used for student modeling. The system, we are proposing, is relatively simple, and supports creation of high-level pedagogical strategies, and can be easily adapted to individual teacher's preferences. The system can be used in e-learning applications, and also in any other type of applications that require user modeling, classification or reasoning. Further, the development of this system will include a specialized software tool for creating and adjusting student modeling, classification, or reasoning components.

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