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Model of a learning process using fuzzy logic deduction

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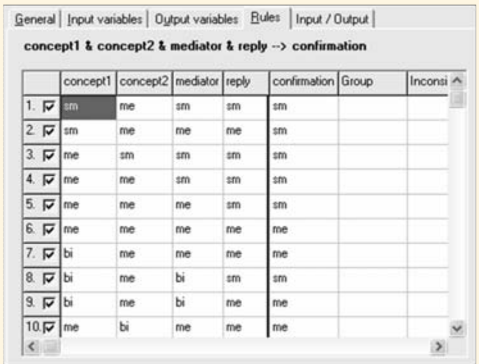
Abstract

Using LMS systems requires a description of the process in symbolic tools, selection of linguistic tools, definition of deductive principles and formulation of knowledge when creating a knowledge base. The algorithm of the decision making process in an educational process depends on a number of internal and external conditions. The decision making process is influenced by information indeterminacy which might be caused by deficiencies in measuring the outcomes or insufficiency when using a description by natural language. The description of the decision making process can conveniently employ fuzzy logic deduction, which works with formulas IF-THEN and truth values of linguistic expressions. The paper describes a proposal of a model of learning process using fuzzy logic deduction, which stems from a formal description using Petri nets. The formal description of the model of learning process was exploited in the learning theory described in *Conditions of Learning* by Robert M. Gagné.

Fuzzy logic deduction

To design a description of a learning process which is based on decision making and structured hierarchically, it is suitable to use *fuzzy logic deduction*. Fuzzy logic deduction works with formulas of IF-THEN type and truth values of linguistic expressions appearing in them. When interpreting logically, it is necessary to have a higher number of rules, but the calculation is usually carried out with only one rule. Fuzzy logic deduction has been chosen as a method to create a model of a learning process. Software tool LFLC 2000 has been chosen to implement, verify, and adapt the rules.



General | Input variables | Output variables | Rules | Input / Output

concept1 & concept2 & mediator & reply --> confirmation

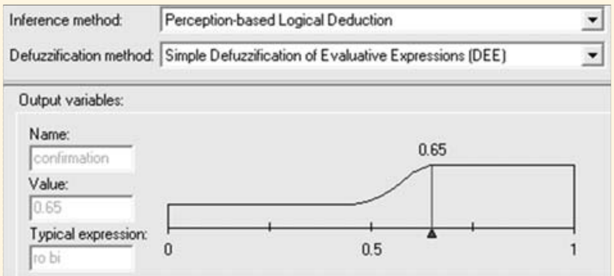
	concept1	concept2	mediator	reply	confirmation	Group	Inconsi
1.	sm	me	sm	sm	sm		
2.	sm	me	me	me	sm		
3.	me	sm	sm	sm	sm		
4.	me	me	sm	sm	sm		
5.	me	me	me	sm	sm		
6.	me	me	me	me	me		
7.	bi	me	me	me	me		
8.	bi	me	bi	sm	sm		
9.	bi	me	bi	me	me		
10.	me	bi	me	me	me		

Creating rules

Rules are recorded in folder *Rules* using defined linguistic expressions. Selecting a rule using the ticking filed *Number of the rules* enables to select rules which will be used in interference. Combining the selection of rules enables to carry out experiments which can show the influence of certain rules on the result of the interference.

Defuzzification

For the name of the output variable, the area *Output variables* shows the form of the final fuzzy set with marked defuzzified value *Value*, typical evaluation expression *Typical Expression*, and all rules used in interference. It is possible to experiment with the values of the input variables and observe their influence on the defuzzified value of the output variable. It is also possible to add other rules which would better correspond to the required course of the process.



Conclusion

In order to be able to use the proposed model, it will be necessary to didactically process the learning subject matter into modules according to the goals which should be reached by the students in individual phases. Learning materials have to lead to gradual fulfilment of individual partial goals, their completion must be tested at the end. Higher learning modules require knowledge and successful completion of lower modules.

Successful completion of a module will be tested if the student does not reach the required level of the target knowledge, they will be returned back to the module knowledge of which is required as a premise for further learning. Learning occurs only when each learning phase is completed by student's success. Learning cannot advance until each partial phase of the learning process is successfully completed.

Processing the subject matter into modules will be dependent on the approach of the teacher to the subject matter analysis, on their pedagogical skills and didactic qualification to create a hierarchical structure of the subject matter that might be included into individual modules. Learning occurs if all external and internal conditions are fulfilled.