English Teaching Quality Evaluation Model Based on the Combined Dempster–Shafer (DS) Theory and Support Vector Machine (SVM)

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Abstract. The English teaching quality evaluation model based on the DS-SVM is put forward aimed at the defect of scientific nature and low reliability of the evaluation results of current English teaching quality. First of all, from the perspective of information integration, construct the evaluation index system and adopt SAM to establish the evaluation models of English teaching quality in view of the students, the counterparts and the supervisor group. Then, determine values of the reliability function of each model by virtue of SVM. Finally, obtain the evaluation results of current English teaching quality through the combination of DS and values of the reliability function. The simulation experiment results show that output value from this English teaching quality evaluation model agrees well with the true value and is of better evaluation effectiveness.

Keywords: Dempster–Shafer Theory, Support Vector Machine, Teaching Quality Evaluation, English Teaching

1   Introduction

How to enhance accuracy and scientific nature of the evaluation results of teaching quality and provide the education managers with decision-making reference has become the important subject in the research of higher teaching management [1].

Teaching quality evaluation is a multi-objective and multi-level evaluation problem [2, 3], of which the methods can be divided into two types: statistical method and machine learning method. The former mainly includes analytic hierarchy process, cluster analysis method, entropy method etc. With a complex non-linear relation existing between university teaching quality evaluation index and evaluation results, it is difficult to set up a scientific and reasonable mathematical model with these

methods, therefore the evaluation is of low accuracy and unbelievable results [4]. Machine learning algorithms primarily contain nonlinear methods, such as neural network and SVM [5, 6], which can give a better description on the non-linear relation between evaluation index and evaluation results.

2   DS-SVM teaching quality evaluation model

2.1   Working framework for teaching quality evaluation model

Divide the whole dataset into three samples: student, counterpart and supervisor group and then build up the teaching quality evaluation model based on SVM for each type of sample. The evaluation indices are mapped to evaluation results by SVM, which contribute to increase the teaching quality evaluation efficiency. Meanwhile, structure the evaluation layer of teaching quality with these three types of SVM, consider the evaluation results as one evidence body coupled with the evidence theory and acquire the teaching quality evaluation results to improve the evaluation accuracy. In this case, the inferential capability of DS theory and the capability of nonlinear approximation of SVM are comprehensively utilized, which plays their respective advantages and the teaching quality evaluation model in view of DS-SVM is shown in Fig. 1. The model falls into two layers: ① Result layer of preliminary evaluation for teaching quality based on SVM; ② Decision layer integrated with evidence theory and SVM.
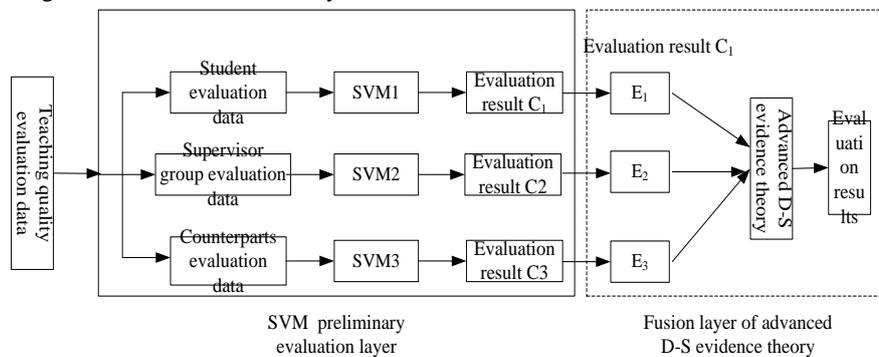

Fig.1. working framework for teaching quality evaluation model based on DS-SVM

2.2   Establish the teaching quality evaluation index system

The first step for teaching quality evaluation model is to construct the corresponding evaluation factor set (index system).Whether the index system is

scientific and rational is directly related to its scientific nature and rationality. However, the teaching quality evaluation is subject to various factors, such as teaching method, teaching attitude, teaching contents, classroom management and teaching efficiency. Through systematic analysis and expert commentary, and taking the relevant documents and research as reference [10, 11], teaching quality evaluation system is built in this paper as shown in Table 1. This index system manifests the teachers' teaching process to a certain extent. The evaluation on teachers' teaching can be presented by marking the evaluation of indices, from which it is recognized to which type the teachers' teaching quality belongs, and the teaching quality is promoted. Wherein the teachers' quality (B_1), the teaching attitude (B_2), the teaching contents (B_3), teaching method (B_4) and the teaching efficiency (B_5) worth 20 points respectively.

Table 1. Teaching quality evaluation index system

First grade index	Second grade index
teachers' quality	Be of good teaching skill (x_1)
	Be highly knowledgeable in the teaching subject (x_2)
	Be of strong capacity for scientific research (x_3)
	Be of appropriate teaching characteristics (x_4)
teaching attitude	Be serious and responsible for teaching (x_5)
	Obey regulations and disciplines of the school (x_6)
teaching contents	The course content is correct and reasonably designed (x_7)
	Be able to teach the students in accordance of their aptitude (x_8)
teaching method	The teaching methods are flexible and diverse, rational and effective (C_9)
	The teaching is inspirational and can stimulate interest in learning (C_{10})
teaching efficiency	The students acquire necessary knowledge about the subject and general curriculums (x_{11})
	The students acquire somewhat learning ability and are of improved capability in solving practical problems with theoretical knowledge (x_{12})

2.3 Determine the weights with analytic hierarchy process (AHP)

It is imperative to confirm the weights of indices in the middle of teaching quality

evaluation, which will affect whether the evaluation results are reliable or not. With the decision-related elements being disintegrated by AHP into target, criterion, scheme etc., conduct the qualitative and quantitative analysis, delete the subjective components as much as possible by virtue of mathematical logical reasoning and make the weights in conformity with the practical situation. Above all, construct the judgment matrix in criterion layer through pair-wise comparison. Then calculate the maximum eigenvalue of matrix λ_{max}. Finally evaluate the eigenvectors of maximum eigenvalue prior to normalizing them and then each index weight ω is obtained. The judgment matrices may not be consistent due to people's subjective judgment on importance elements. Therefore, the formula below is needed to test the consistency and randomness after the weights are calculated.

$$CI = (\lambda_{max} - n)/(n-1)$$
$$CR = CI \ / \ RI$$

(5)

3 Conclusion

The evaluation system of teaching quality is a complicated nonlinear system, having a lot of uncertain factors between the input and the output, therefore, this paper puts forward a kind of evaluation method of the teaching quality that fusing evidence theory and support vector machine. The simulation results show that, the output value of teaching quality evaluation model established in the paper is in good agreement with the real value, the error of the evaluation result is smaller, and can meet the requirements of the practical application of the evaluation of teaching quality, can be expected to provide beneficial reference to teaching management departments on seeking a scientific solution of evaluation of teaching quality. The evaluation of teaching quality is a system engineering, there is a controversial research topic, the theoretical research and applied research of this thesis is still at the starting stage, there are still many problems to be solved, such as if the student being not considered it is difficult to evaluate the ability of scientific research of teachers, how to use more scientific analyzed method to choose right sample data and determine reflecting the essential, typical and objective index remains to be further researched and discussed.

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