Research on Teaching Quality Evaluation in Colleges and Universities Based on Data Mining

The Case of Chinese Language and Literature Teaching

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Abstract. In order to solve the deficiencies in the current teaching quality assessment process in colleges and universities and improve the accuracy of teaching quality assessment in colleges and universities, this paper takes the model of Chinese language and literature teaching as an example, and designs a college teaching quality assessment model based on data mining algorithms. The model firstly researches and analyzes the relevant literature on the current Chinese language and literature teaching quality evaluation, and establishes the influencing factors of the teaching quality evaluation in colleges and universities; then, collects the data of the influencing factors of the Chinese language and literature teaching quality, and establishes the learning sample of the teaching quality evaluation in colleges and universities. This paper introduces the data mining technology BP neural network to train the learning samples, form the Chinese language and literature teaching quality evaluation model, and analyze the superiority of the Chinese language and literature teaching quality model through specific examples. The results show that the data mining algorithm can describe the evaluation results of Chinese literature teaching quality level with high precision.

Keywords: Quality Assessment · Influencing Factors · Data Mining Algorithm · Learning Samples · Chinese language and literature teaching

1 Introduction

With the continuous increase of the number of college students, the status of teaching quality in the quality of college education has become more and more obvious [1]. It has become an indicator to measure the teaching effect and talent evaluation of colleges and universities [2]. The consensus of colleges and universities. In a university, because there are quite a lot of subjects, there is a certain overlap between disciplines, and the teaching methods are flexible and diverse, the evaluation of teaching quality in colleges and universities has become quite complex, which is a rather challenging problem [3]. Taking the model of Chinese language and literature teaching as an example, this paper designs...
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2 Current Situation of Chinese Language and Literature Teaching in Universities Under the Background of Big Data Mining Technology

According to McKinsey, a world-renowned consulting firm, in its research report big Data: Innovation, Competition and The Future Frontier of Productivity, “data as an important factor of production has permeated all industries in today’s society.”[9] “Modern education must be data-driven, not a purely empirical exercise.”[10] Therefore, in the teaching of Chinese language and literature, only by clarifying the research status of this major can we provide corresponding technical support for the subsequent improvement of the corresponding education quality.

2.1 Impact on Educational Objectives

Under the background of big data mining technology, the corresponding teaching goal, great changes have taken place, focus on the Chinese language and literature education in such aspects as data collecting, sorting, analysis the influence of, when making relevant Chinese language and literature teaching goal, needs to use data mining technology, fully analyzing the students’ learning and cognitive level, targeted to the classroom teaching. Then improve the quality of teaching.

2.2 Influence of Teaching Resource Allocation

Big data mining technology makes it easier to capture students’ learning status and interests, understand students’ autonomous learning, and optimize the allocation of teaching resources to improve the overall teaching efficiency and quality. The precision, bias and pertinence of learning resources brought by data mining analysis are more in line with diversified and personalized classroom teaching and easier to teach students according to their aptitude. At the same time, Chinese language and literature teachers will also use big data mining technology to collect and sort out data in advance, change the content and method of classroom teaching, so as to fully mobilize students’ enthusiasm and initiative, enrich classroom content and improve learning efficiency.

2.3 Influence of Teaching Methods and Methods

Big data mining technology has great impact and change on teachers’ teaching and students’ learning style in the traditional teaching, teachers or make a centralized “education”, or “cramming” teaching, it is difficult to give attention to two or more arrives the enthusiasm of students learning and subjectivity. Using data mining technology, fully tap before, during and after the student to study the large data analysis, can students learning interest and learning at any time control the degree, is beneficial to improve the efficiency of classroom teaching, students can also command the difficult point of teaching, to dispose the lines, to enhance the perception of learning.
3 Data Mining Algorithms

The current teaching quality assessment in colleges and universities can be divided into two branches: one is the assessment method of college teaching quality based on qualitative analysis. Analyze the overall trend of changes [5]. Another branch is the quantitative analysis-based teaching quality assessment method in colleges and universities, which is subdivided into: traditional statistical college teaching quality assessment methods and machine learning algorithms for colleges and universities. Teaching quality assessment methods. Traditional statistics mainly include linear regression and gray theory. The factors they consider are simple, and they can only describe the simple and linear statistical relationship between the influencing factors and the teaching quality of colleges and universities, so that the accuracy of teaching quality evaluation in colleges and universities cannot meet the actual requirements. In practical applications, the problem of parameter optimization of BP neural network and the problem of structure determination of extreme learning machine have not been effectively solved, which directly affects the evaluation results of teaching quality in colleges and universities [6].

Aiming at the problem that the current model cannot accurately evaluate the teaching quality of colleges and universities, aiming at improving the accuracy of teaching quality evaluation in colleges and universities, this paper designs a teaching quality evaluation model based on data mining algorithm, and analyzes the superiority of the teaching quality model in colleges and universities through specific examples.

The BP neural network includes an input layer, an output layer and a hidden layer. If the input of the input layer is \(x(i)\), then its output is:

\[
O_i^{(1)} = x(i), \quad i = 1, 2, \ldots, n
\]  

(1)

Assuming that the weight coefficient of the hidden layer of the BP neural network is \(w_{ij}^{(2)}\), and \(f[\cdot]\) represents the mapping function, then the input and output calculation formulas are respectively expressed as:

\[
net_i^{(2)}(k) = \sum_{j=1}^{m} w_{ij}^{(2)} O_j^{(1)}(k)
\]

(2)

\[
o_i^{(2)}(k) = f[net_i^{(2)}(k)]
\]

(3)

Assuming that the weight coefficient of the output layer of the BP neural network is \(w_{ij}^{(3)}\), and \(g[\cdot]\) represents the mapping function, then its input and output calculation formulas are respectively expressed as:

\[
net_i^{(3)}(k) = \sum_{i=1}^{m} w_{ij}^{(3)} O_i^{(2)}(k)
\]

(4)

\[
o_i^{(3)}(k) = g[net_i^{(3)}(k)]
\]

(5)

For the Mth sample, its actual output and network output are \(O_M(k + 1)\) and \(O'_M(k + 1)\) respectively, then the calculation formula of its error is:

\[
E_M = \frac{1}{2} \left[ O_M + (k + 1) - O'_M(k + 1) \right]^2
\]

(6)
For all training samples, their total error is calculated as:

\[ E_M = \sum_{M=1}^{M} E_P = \sum_{M=1}^{M} \frac{1}{2} \left[ O_M + (k + 1) - O'_M (k + 1) \right]^2 \]  

(7)

where M is the number of training samples.

4 Design of Teaching Quality Evaluation Model Based on Data Mining Algorithm

4.1 Quality Assessment Algorithm Model

See Fig. 1.

4.2 Factors Influencing the Quality of Chinese Language and Literature Teaching

In order to better evaluate the teaching quality of colleges and universities, first of all, it analyzes some influencing factors related to the evaluation of Chinese language and literature teaching quality. The details are shown in Table 1.

4.3 Evaluation Steps of Chinese Language Teaching Quality Based on Data Mining

1) Collect data according to the influencing factors of college teaching quality evaluation in Table 1.
2) The corresponding college teaching quality grade value is determined by experts according to the influencing factors of college teaching quality evaluation.
3) Determine the structure of the neural network BPNN according to the influencing factors of college teaching quality evaluation.

Fig. 1. Evaluate Model Structure Process
Table 1. Influencing factors of teaching quality evaluation

<table>
<thead>
<tr>
<th>Internal factors</th>
<th>External factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjust the number of class hours</td>
<td>Teaching skills</td>
</tr>
<tr>
<td>Number of suspensions</td>
<td>the logic of the content</td>
</tr>
<tr>
<td>Substitutes</td>
<td>teaching atmosphere</td>
</tr>
<tr>
<td>Number of revision assignments</td>
<td>depth of teaching content</td>
</tr>
<tr>
<td>Early dismissal times</td>
<td>teacher’s responsibility</td>
</tr>
<tr>
<td>Postponement of classes</td>
<td>Professionalism in marking assignments</td>
</tr>
</tbody>
</table>

4) The adaptive genetic algorithm is used to determine the initial value of the hidden layer and the output layer weight, the value of the learning rate and the momentum factor.
5) Determine the number of hidden layer nodes according to the number of input nodes of the neural network.
6) According to the learning samples of college teaching quality assessment, the BP neural network is trained until the training error meets the preset range.

5 Case Analysis of Teaching Quality Evaluation Model

5.1 Comparison of the Performance of the Teaching Quality Evaluation Model in Colleges and Universities with the Classic Model

In order to analyze the advantages of the data mining algorithm’s teaching quality evaluation model in colleges and universities, on the same platform, the standard BP neural network and the college teaching quality evaluation model in the literature [8] are used for comparative analysis. Select the Chinese language and literature of a certain 20 universities as the research object. The number of teachers selected by each university is shown in Fig. 2. The corresponding influencing factor values are collected. Due to the limited space, they are not listed one by one.

The average accuracy of the Chinese language and literature teaching quality evaluation of the standard BP neural network is 78.45%, and the Chinese language and literature teaching quality evaluation error is the largest. This is because its parameters are determined in a random way, and it is impossible to establish an evaluation model that describes the complex and changing characteristics of Chinese language and literature teaching quality, resulting in many overfitting points of Chinese language and literature teaching quality evaluation, and the worst effect of Chinese language teaching quality evaluation.

5.2 Effectiveness of Big Data Mining Technology

Education is neither a tool nor an appendage of technology [7]. In specific teaching, the application of big data mining technology has achieved good results in the richness of lesson preparation, effectiveness of class, independent learning effect and pass rate of grades (Table 2).
Fig. 2. Comparison of Teaching Quality Assessment Accuracy

Table 2. Effectiveness of big data mining technology

<table>
<thead>
<tr>
<th>Year</th>
<th>Effect of preparation</th>
<th>Class effect</th>
<th>Effect of learning</th>
<th>Passing Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>85%</td>
<td>83%</td>
<td>General</td>
<td>84%</td>
</tr>
<tr>
<td>2021</td>
<td>96%</td>
<td>95%</td>
<td>Good</td>
<td>96%</td>
</tr>
</tbody>
</table>

6 Conclusion

In order to obtain better teaching quality evaluation results in colleges and universities, the BP neural network of data mining technology was introduced to establish a teaching quality evaluation model in colleges and universities. The introduction of Chinese language and literature teaching into data mining technology has important theoretical and practical significance. At the same time, this technology also has a good development trend and broad development space. Making full use of this technology can create more benefits and values in Chinese language and literature education. The results show that the model in this paper is an efficient teaching quality evaluation model in colleges and universities, and has a very wide range of application value.

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