Retraction

Retracted: Based on the Application of Deep Learning in College Education Evaluation

Mobile Information Systems

Received 25 July 2023; Accepted 25 July 2023; Published 26 July 2023

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

1. Discrepancies in scope
2. Discrepancies in the description of the research reported
3. Discrepancies between the availability of data and the research described
4. Inappropriate citations
5. Incoherent, meaningless and/or irrelevant content included in the article
6. Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article’s content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

References

Research Article

Based on the Application of Deep Learning in College Education Evaluation

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Received 2 March 2022; Revised 27 April 2022; Accepted 9 May 2022; Published 9 June 2022

Academic Editor: Hasan Ali Khattak

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The most significant material in teaching quality assessment is the teacher’s teaching evaluation; nevertheless, as education informatization accelerates, the current teaching management challenge is how to use network technology to evaluate instructors’ teaching quality in conventional teaching. The question of how to evaluate the network teaching environment is a crucial issue in the development of network teaching. The key to educational evaluation lies in the quality of teaching. Therefore, the effective processing and analysis of the huge original data collected in the teaching process of colleges and universities can provide decision support for the evaluation of teaching quality and the formulation of relevant improvement measures. Given the variety and large quantity of original teaching data, this paper proposes a deep learning-based teaching quality evaluation model that organically integrates various original data by constructing deep neural networks and can achieve more accurate teaching quality evaluation, which has practical value. Education evaluation is a complex system engineering, which needs to consume a lot of manpower, material, and financial resources. Through the use of the system to obtain a large number of statistical data, it will provide a basis for in-depth analysis and decision-making.

1. Introduction

Higher education evaluation’s ultimate purpose is to improve the quality of education and teaching, and it is a key tool for managing teaching quality in colleges and universities, as well as a macrosupervision and management department. While teaching evaluation is the school teaching management, how to scientifically, fairly, comprehensively, and objectively evaluate professional ethics and teachers’ professional quality level is a very important part of theoretical and practical work [1]. Traditional teaching evaluation methods are relatively rigid, there is only once each semester teaching evaluation, and this consumes a large number of time of the students, so the traditional teaching evaluation model does not meet the requirements of modern students of institutions of higher learning. Most of the evaluations start at the beginning of the semester or just at the end of the semester at the scheduled time, and the results are announced at the beginning or end of the next semester. This assessment teaching has no guide to course this semester’s performance indicators, the following semester’s course changes, and in the classroom, students have changed their traditional beliefs on different teacher evaluations due to a lack of interest in evaluation teaching. In addition, for traditional mechanical teaching evaluation, students generally choose A, B, C, and D as the corresponding evaluation scores according to the objective indicators, and the final published scores are greatly influenced by human factors. Teachers and administrators find it difficult to recognize the precise instructional importance of growth when considering the benefits and drawbacks of teachers and their teaching accomplishments. In the traditional teaching evaluation questionnaire or the general way of scribbling cards [2], each class is filled out by using a machine reader questionnaire or graffiti. As more and more students are fulfilling the information, as well as the lack of effective supervision mechanism, and students to elaborate the job, no filler, students, or others are part of the school evaluation. The phenomenon of writing and filling in questionnaires frequently occurs, and the reliability assessment of teaching data seriously loses trust. Moreover, it is difficult to guarantee the recovery of questionnaires, so it will also affect the
school’s judgment on the effectiveness of teachers [3]. At present, with the rapid development of high-speed information technology, we should make full use of its intuitive image and simple operation to establish a teacher evaluation system, according to the advantages of fast information, timely to enable the school to carry out real-time evaluation monitoring of teacher teaching, the school can master the problems in the teaching process for the first time. Compared with the traditional teaching practice, the advantages of using the teaching evaluation system are obvious. For example, the results of teaching evaluation can be analyzed from different dimensions, which greatly enhances the strength of teaching evaluation. As the questionnaire designs different indicators, it provides more scientific and accurate data. If the information network center opens ports, it will break through the regional limitations of original paper evaluation, allowing most users of the entire campus network resources and even Internet users to participate in evaluation and access to the system, regardless of geographical restrictions. This is also suitable for long-distance teaching, highlighting its advantages, thus greatly enhancing the flexibility and fairness of teaching evaluation. The application of the system breaks through the traditional time-consuming, and the labor-consuming situation of teaching evaluation makes teaching evaluation more convenient, and greatly reduces the consumption of educational administrators and evaluators [4].

The rest of the paper is organized as Section 2 represents related work, methods are given in Section 3, experiments and discussions are given in Section 4, and the conclusion is discussed in Section 5.

2. Related Work

Since 2000, some key universities in China, such as Tsinghua University and Peking University, Fudan University, and Nankai University, have the earliest and most significant achievements. Shanghai Jiaotong University, Xi’an Jiaotong University have begun to build teachers and other teaching evaluation systems [5], although other universities have promoted the long-term application of its results. Yunnan Normal University in 2002 started to develop the teaching evaluation system step by step for overall planning and implementation plan for construction, guidance, and standardize the whole assessment system. The establishment of an online evaluation system to promote the teachers’ and students’ information feedback system is based on a common data platform of multiple management information summary systems, construction monitoring, realization of network statistics to set up a public database platform, and the establishment of an online evaluation system to promote the teachers’ and students’ information feedback system [6]. Our country has obtained the campus network teaching evaluation system of a vast number of colleges and universities. At present, multilevel studies have been carried out on the evaluation of college education quality at home and abroad. The evaluation index system is primarily used to rate teaching activities, student-learning effects, and feedback, and the scores that represent the quality of college education can then be derived by weighting the index system or using a mathematical model [7]. The researchers design the index system to make it suitable for different teaching processes: the design index is used to describe the standardization of the implementation of teaching procedures and the efficiency of the utilization of teaching resources. Design evaluation questionnaire to understand students’ evaluation of teachers’ teaching activities, to score the quality of teachers’ teaching activities. Teaching supervision is set up to randomly supervise classroom teaching, teaching plans, homework correction, exams, etc., and evaluate the implementation quality of the above links with the help of the experience of supervision [8]. At present, there are two main difficulties in the evaluation of teaching quality in colleges and universities. One is that the diversity and quantity of original teaching data are huge, and it is difficult to obtain an effective evaluation by using the traditional evaluation method based on the index calculation of definite formula. Second, the teaching process is a highly subjective process, which contains very complex internal laws, and it is difficult to get an evaluation close to the actual situation by using the analysis model in the general sense [9, 10]. It is for this reason that the teaching quality evaluation in colleges and universities is mostly judged by combining the scoring of teaching supervision with objective indicators (such as exam scores, attendance rate, homework submission) [11–13]. To cope with the above difficulties and challenges, a teaching quality evaluation model based on deep learning model is proposed. Deep Learning is a very active branch of machine learning research in recent years. The parameter scale of the model is enhanced and the model’s ability to express complex functions is improved by expanding the depth and breadth of the model, that is, increasing the number of operations from the input end to the output end and the number of channels of the model. Since Professor Hinton published an article on deep neural network training methods in Science in 2006 [14], deep learning has rapidly become a research hot spot and has been widely applied in image classification, face recognition, speech recognition, artificial intelligence, and other aspects [15]. It is appropriate to use deep learning in teaching quality evaluation. A wide number of successful application cases demonstrate that the deep learning model is particularly good in processing diverse data and extracting complex hidden laws, as well as effectively modeling expert expertise and experience.

3. Method

In this section, we will discuss neural network module design, education quality evaluation model based on deep learning in detail.

3.1. Neural Network Module Design. The neural network method, as one of the most extensively used neural network models, must go through two processes: training and execution. For each neural network, what “remembers” the information is the dendrite in BP neural network. The basic
idea is to generate a nonlinear data model and get the weights of the neural network through training. The model parameters belong to a nonlinear model, and a large number of input–output mode mappings are stored in the nonlinear model. It explains how to create mathematical equations for mappings and how to learn mathematical models of model parameters. Then the training mode is used in the implementation process. So how do you implement this mathematical model? The whole process involves the training process of the BP neural network, which can be divided into two training processes: tutor training process and unsupervised (tutor) training process.

The training process of the BP neural network is a process with feedback information, known as the learning process with a tutor. In this training process, you will learn how to use the BP algorithm, as well as the information feedback method. The ultimate goal of its training is to form a stable network so that the final output value fits the target value; otherwise, the feedback is recycled. The learning process with a tutor is a figurative metaphor, which means that in the whole learning process of function, there are appropriate functions to intervene the target, make the expected target serve as the output guidance, and make the output fit the target value. The main training process of the BP neural network involves mathematical formulas like:

\[
x_i = \frac{x_{\text{max}} - x_i}{x_{\text{max}} - x_{\text{min}}},
\]

where \( x_i \) represents the input component of the ith neuron before preprocessing, \( x_{\text{min}} \) represents the minimum value of each input component of the ith neuron, and \( x_i \) represents the input component of the corresponding neuron after preprocessing. \( x_{\text{max}} \) represents the maximum value of each input component of the ith neuron:

\[
h_i(k) = \sum_{i=1}^{p} w_{ij} x_i(k) - b_h,
\]

where \( k \) represents the KTH sample, \( h \) represents the hidden layer, \( w_{ij} \) represents the weight of the connection between the neuron of the ith input layer and the neuron of the h hidden layer, \( b_h \) represents the threshold of the neuron of the h hidden layer.

\[
f(x) = \frac{1}{1 + e^{-x}},
\]

where \( x \) represents the hidden layer input, and \( f(x) \) represents the hidden layer output.

\[
y_{i_o}(k) = \sum_{h=1}^{p} w_{ho} h_o(k) - b_o,
\]

\[
y_{o}(k) = f(y_{i_o}(k)).
\]

3.2. Education Quality Evaluation Model Based on Deep Learning. A deep neural network with a standardized input layer, full connection layer, and shielding layer is used in this model. A set of real-value input neurons makes up the input layer. The results are output to the adjacent complete connection layer after the input has been normalized:

\[
v = \frac{v - v_{\text{min}}}{v_{\text{max}} - v_{\text{min}}},
\]

where \( v \) is the input data component, \( v_{\text{max}} \) and \( v_{\text{min}} \) are the maximum and minimum values of this component in the training data set, respectively. After the input layer is standardized, the values obtained are in the interval \([0,1]\).

Each neuron in the fully connected layer is connected with all neurons in its adjacent layer by an edge, and each edge has a weight, whose value range is \([0,1]\). After applying the weighted sum of all inputs, a nonlinear activation function is used. The sigmoid function is used in this paper to obtain a real-valued output, as shown in Formula (7):

\[
f_i = \frac{1}{1 + \exp(-\sum_{j=1}^{M} w_{ij} v_j)},
\]

where, \( f_i \) is the output of the ith neuron in the fully connected layer, \( M \) is the number of neurons in the previous layer, \( v_j \) is the input of the JTH neuron in the previous layer, and \( w_{ij} \) is the weight of the edge connecting the JTH neuron in the previous layer and the current neuron. The shielding layer makes the output of the neuron of the upper layer become 0 according to the preset percentage, and the neuron of the layer whose output is not zero is fully connected with all the neurons of the next layer. According to the conclusion of literature [16], the percentage of preset random shielding in this paper’s work is 30%. The entire deep neural network requires two full connection layers followed by a shielding layer, depending on the complexity of the problem. Figure 1 shows the basic structure of a deep neural network.

Finally, the evaluation score of the model for teaching quality is obtained by a softmax output layer, and the softmax function performs the continuous maximum evaluation of the input components. Let \( \nu = (v_1, v_2, \ldots, v_n) \), softmax function calculate the standard value of the largest component in \( V \) in a continuous way, namely,

\[
S_i = \frac{e^{v_i}}{\sum_{v} e^{v}},
\]

The network training adopts the method of error backpropagation gradient descent. Based on the directional derivative of a multivariate function, the error of each neuron is calculated from back to front, and then the weights of connections between neurons are adjusted accordingly. The specific calculation method is shown in formulae (8) and (9):

\[
\frac{\partial f(x + au)}{\partial a} = u^T \nabla f(x),
\]

\[
\min_{u} \min_{u \neq 0} \|u\|_2 \|\nabla_{x}f(x)\|_2
\]

where \( u \) is a direction vector with modulo 1, \( u^* \) is the optimal direction vector, \( \nabla_{x}f(x) \) is the error value of a neuron, and
\| \cdot \|_2 \text{ is the 2-norm. By adjusting training intensity, the convergence speed of the network can be changed during training.}

4. Experiments and Discussion

In this section, we will discuss the realization of the neural network module, the direction of the vector, and experimental analysis and results in detail.

4.1. The Realization of Neural Network Module. The neural network analysis toolbox of MATLAB is used to train the evaluation and teaching data of different personnel, and the evaluation and teaching prediction model is established. Then the dynamic data exchange technology is used to send the trained network model back to the server, and the system calls the model to predict and display the teaching quality.

A three-layer RBF neural network is adopted: input data is the evaluation value of each indicator. The number of neurons in the input layer, which is 12 in total, is regarded as the lowest indicator in the education quality evaluation method. The output layer creates a neuron with a value between \([0, 1]\). The number of neurons in the hidden layer is related to the accuracy and efficiency of the network. According to the empirical formula, \(M \) is the number of neurons in the input layer and \(N \) is the number of neurons in the output layer. In this paper, the number of neurons in the hidden layer is set to 9.

Based on the teaching quality evaluation of RBF, data related to the teaching quality evaluation of 1000 teachers and students in our school are collected. The first 500 groups of data in the table are used as training samples of the RBF neural network, and the last 500 groups are used as test samples. Using MATLAB programming, given learning accuracy \(E = 0.00001\). The training error curve is shown in Figure 1.

The results of the evaluation after network training and expert evaluation, as well as the simulation evaluation results of five test sets and expert evaluation results, show that not only are all training samples nearly identical to the expert evaluation results but also the simulation evaluation results of 500 test sets are completely consistent with the expert evaluation grade.

4.2. The Direction of the Vector. The original teaching data collected in the course of undergraduate teaching at a university can be classified into two categories: the expert and student teaching evaluation index, and the objective index. Tables 1 and 2 show the details of the two categories of indicators.

The teaching evaluation index of students in Table 1 is a questionnaire, which contains 15 multiple-choice questions. In this study, the answers to each choice question are converted into a Boolean vector and input into the model.

A three-layer RBF neural network is adopted: input data is the evaluation value of each indicator. The number of neurons in the input layer, which is 12 in total, is regarded as the lowest indicator in the education quality evaluation method. The output layer creates a neuron with a value between \([0, 1]\). The number of neurons in the hidden layer is related to the accuracy and efficiency of the network. According to the empirical formula, \(M \) is the number of neurons in the input layer and \(N \) is the number of neurons in the output layer. In this paper, the number of neurons in the hidden layer is set to 9.

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4.3. Experimental Analysis and Results. The deep neural network is adopted as the evaluation model, in this application case, the deep neural network as shown in Table 3 is used.

The standardized input layer, full connection layer, shielding layer, and output layer are represented by the ABCD of the type column, respectively. The dimensions of the inputs and outputs at each level are represented by the input and output columns. The Function column shows the activation function for each layer, as well as the percentage of random masking for masking layers of type.

The whole model was implemented and trained in the famous deep learning project matconv-Net. The project is based on MATLAB deep learning algorithm implementation,
including network configuration, training algorithm, and a variety of mainstream trained network models.

To test the model’s validity, the data set is split into two parts: a training set and a testing set, with a ratio of 1:9 to 9:1. With training, the neural network’s depth is built first, and then the test set of data input to the already trained neural network is a set of output, the output, and the real output comparison test set. Considering that the output is a six-dimensional real-value vector representing the teaching quality, we adopt the mean square error to measure the difference between the output value and the real value, as shown in formula:

\[
\text{loss} = \frac{1}{N} \sum_{i=1}^{6} \sum_{j=1}^{N} (h_{ij} - h_{ij}^*)
\]

where \(h_{ij}\) is the ith output component of the model for the JTH testing sample. For each ratio of data set randomly divided 10 times, test results are shown in Figure 2.

MSE in Figure 1 is listed as mean square error, which is calculated by the formula (10). It can be seen from Figure 1 that when the ratio of the training set to the test set is 6:4, the model has the lowest test error. At the same time, it should also be noted that the more training data the model has, the better the effect will be, because in the case of too much training data, the model will excessively fit the existing data, and the generalization ability of the model will decline.

We also report the effect of different deep neural network configurations on model prediction results. Change the number of layer combinations of type BBC in the network from 2 to 10, train and predict the network once for each configuration, and report MSE, as shown in Figure 3. As can be seen in the graph, when the number of combinations is eight, the network’s prediction performance is at its best.

Through experiments, it can be found that the college education evaluation method proposed in this paper is feasible, which greatly enhances the flexibility and fairness of college education evaluation and teaching. The application system breaks through the traditional situation of time-consuming and labor-consuming evaluation of teaching, evaluates teaching as more convenient, and can greatly reduce the consumption of educational administrators and evaluators.

### 5. Conclusion and Future Work

This research investigates the use of deep neural networks in the assessment of teaching quality and provides an example. Deep neural networks have a strong expression ability, can effectively extract the deep rules affecting teaching quality, and can be used as an auxiliary means of teaching quality evaluation in colleges and universities, helping to reduce the impact of subjective factors on the evaluation results in the evaluation process. In future research work, we will further sort out the original data of teaching quality, and introduce a new deep learning model with stronger expression ability and a more effective evaluation system, to establish a more intelligent evaluation model.

### Data Availability

The data used to support the findings of this study are available from the author upon request.

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**Table 3: Structure of deep neural network.**

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<th>The output</th>
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<td>64</td>
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<td>2</td>
<td>B</td>
<td>64</td>
<td>128</td>
<td>Relu</td>
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<td>Relu</td>
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<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>256</td>
<td>512</td>
<td>Relu</td>
</tr>
<tr>
<td>6</td>
<td>B</td>
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<td>Relu</td>
</tr>
<tr>
<td>7</td>
<td>C</td>
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<tr>
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<tr>
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Conflicts of Interest

The author declares that he has no conflicts of interest.

References