

Design of English Autonomous Learning Platform Based on RBF Algorithm of Neural Network

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Abstract. With the continuous development of science and technology, internet technology has been rapidly developed and widely used in education. English autonomous learning platform has emerged simultaneously. Nowadays, English autonomous learning platform has been widely popularized, which has laid a good foundation for college English autonomous learning. Based on the above conditions, this paper briefly introduces the advantages of autonomous learning platform in assisting students' English learning, and of RBF algorithm. Besides, this paper introduces the design method of English autonomous learning platform based on RBF algorithm of neural network from the aspects of topological structure and platform database design, so as to provide reference and help for college English teaching.

Keywords: Neural network; RBF algorithm; English teaching; Autonomous learning platform

1 Introduction

With the rapid development of English teaching in colleges, skills of English reading, writing and communication for college students has become more and more important. The rapid development of information technology allow students to strengthen their personal English ability quickly, and modern college students tend to expect their education to be impeccable. Traditional English teaching model can no longer meet the needs of current higher education. Researchers are exploring self-constructed English teaching methods to improve teaching quality through the introduction of information technology. In order to enhance the quality of college English teaching, many researchers attempted to apply RBF algorithm of neural network into English teaching and establish an English autonomous learning platform, so that the college students immerse themselves in English learning environment. [1] Therefore, how to establish an English autonomous learning platform has become many researchers' main focus.

2 Advantages of English autonomous learning platform in college English autonomous learning

With the rapid development of intelligent technology, the application of smart phones in people's daily life is becoming more and more common, which lays a good foundation for the establishment and implement of English autonomous learning platform.

2.1 Wider application options

According to an investigation on college English learning platform in Yinchuan University of Science and Technology, Xinhua College(of Ningxia University), and Ningxia Institution of Science an Technology, about 74% students have used English autonomous learning platform and think the platform is useful and helpful for their English learning. About 7% of the students are interested in applying the English learning platform regularly.

Besides, English autonomous learning platform has been widely used in college English teaching, and also has received support and favorable comments by many users. Moreover, the campus network has been widely used in colleges and universities. Students can use the campus network for free just by registering their accounts, which not only provides students with the convenience of the network, but also enables students to realize the application of English learning platform. In the circumstance that network has been widely used, English autonomous learning platform has already obtained relatively convenient resources, and English learning is not limited to some certain situation that, traditionally, teachers just teach in a specific classroom. In a word, English learning platform has provided help for English teaching in colleges and universities. [2]

2.2 Stimulation of students' enthusiasm for learning

English autonomous learning platform provides students with more learning resources, such as pictures, audio and video documents, in order to make full use of advanced multimedia technology. As a result, students' hearing and vision have been attracted, because English learning is something that not just following the teacher's order during class time. Diversified animation videos and diversified English audio resources make college English learning more interesting. Moreover, English autonomous learning platform expands time and space of college English teaching. For example, students can download and browse English learning materials at any time and place, and practice their spoken English independently with audio materials. Besides, students can upload their homework after class without the limitation of time and physical position.

For a specific example, the English autonomous learning platform has an "Fun Dubbing" learning platform, which provides students with a variety of video clips of dubbing materials. The platform allowed college students to do autonomous imitation by combining the subtitle contents with the original sound prompts. At the same time, it can provide students with a large number of resources in various fields to meet the learning needs of students of different majors, including series public speeches and movie resources. Diversified English learning methods and abundant learning resources can effectively stimulate students' learning enthusiasm to some extent. [3]

2.3 Enhance students' autonomous learning ability

Traditional teaching modes can no longer meet the learning needs of students in the new era. Traditionally, the specific teaching location, time, and the resources of teachers are relatively limited. Consequently, the traditional teaching mode leads to the constraints of students' learning methods, which in turn declines students' learning enthusiasm. Besides, students' learning needs are different from person to person that cannot be met by any certain teaching mood. While using an English autonomous learning platform, the abundant learning resources and flexible learning time change students into the designers of personal learning planners. Students can use English learning platforms to design their own learning plans and become masters of their own learning, rather than relying on teacher supervision for learning. In addition, students can design a learning model suitable for their actual needs and learning troubles, and then generate their own learning style. In a word, the English autonomous learning platform not only transmits knowledge to students, but also improves students' autonomous learning ability, which will obviously improve students' further development in English learning and career.

3 RBF algorithm

RBF neural network model is a neural network structure proposed by Moody and Darken in 1988. It belongs to the forward neural network type and can approximate any continuous function with any accuracy. It is usually applied for solving problems about classification and other aspects of learning. [4]

3.1 Introduction of RBF algorithm

The neural network corresponding to radial basis function can be divided into three parts, namely, input layer, hidden layer and output layer. Among them, the node knowledge of the input layer transmits an input signal to the hidden layer, and the transformation from the input layer to the hidden layer is nonlinear. The nodes of the hidden layer constitute the action function, while the transformation from the hidden layer to the output layer is current. The weight from the input layer to the hidden layer should be fixed at 1, and only the weight from the hidden layer to the output layer can be adjusted. [5]

The transfer function of the hidden layer is a nonlinear function which is distributed locally and has mirror symmetry about the central point, and is generally a Gaussian function. The details are as follows:

$$\varphi_j(x) = \exp\left[-\frac{\|X - C_j\|^2}{2\sigma_j^2}\right] (j = 1, 2, \dots, h)$$

In the above formula, φ_j represents the output of the j-th unit in the hidden layer, while $X = (x_1, x_2, \dots, x_n)^T$ represents the input vector, and $\|\cdot\|$ represents the norm. $\|X - C_j\|^2 = (X - C_j)^T(X - C_j)$, where C_j represents the center of the j-th Gaussian unit in the hidden layer. σ_j represents the width of the Gaussian function of the j-th hidden layer borrowing point, and

$\|X - C_j\|$ represents the input vector and the distance test of the central band. φ_{kj} represents the connection weight before the j-th hidden layer borrowing point reaches the k-th output node. [6]

The network output can be expressed by the following formula:

$$Y_k = \sum_{j=1}^h \omega_{kj} \varphi_j(x) \quad (k = 1, 2, \dots, m)$$

Rewriting into matrix form is expressed as:

$$Y = W \phi$$

$$Y = [y_1, y_2, \dots, y_m]^T$$

$$W = [w_{11}, w_{12}, \dots, w_{1m}]^T \quad (w_k = [w_{k1}, w_{k2}, \dots, w_{kn}]^T)$$

$$\phi = [\varphi_1(x), \varphi_2(x), \dots, \varphi_n(x)]^T$$

In the above formula, Y represents the output vector. W represents the weight matrix from hidden layer to output layer, and ϕ represents the output of hidden layer.

The learning of RBF neural network can be divided into two steps. First, C_j and radius σ_j are defined in combination with input samples. Second, the weight W of output layer is adjusted by using error correction learning rules.

3.2 Model realization

The core of building a laboratory English learning platform model based on RBF algorithm is to introduce the idea of RBF algorithm into the platform design and fully show the algorithm during coding. The model algorithm meets the different needs of teachers and students. RBF algorithm can effectively deal with the quantitative indicators of English teaching, especially in terms of teachers. Teaching effects can be optimized in different teaching duration, teaching methods and teaching content configuration. [7] For students, the algorithm focuses on solving the problem of academic performance under different learning states and task progress, as shown in Table 1.

Table 1. Students algorithm model

Input layer (time)	Hidden layer (Change function $C_j \sigma_j$)			Output layer (result)	
	Reading range	Vocabulary	Knowledge point	Grammar	Final result
Oral practice	Economy	Word	Word	Noun	Final result
Writing practice	Politics	Phrases	Tense	Pronoun	Final result
Aural practice	Technology	Sentence	Voice	Adverb	Final result
Translation practice	Literature	Paragraph	Read	Adjective	Final result
Reading practice	Philosophy	Chapters	Subordinate clause	Article	Final result

Error correction exercise	Science and technology	Slang	Verb	Final result
.....	
Total					Total

The reference content of the above algorithm model is mainly based on the English test results of CET-4 and CET-6 in China. The input layer contains the learning time invested by students in this learning platform, and the hidden layer is aimed at the contents of the corresponding learning materials; The output layer represents the final scores of different subjects, all of which determine the optimal scores of CET-4 and CET-6, and compare the time invested by students in different subjects. In order to master the best learning rules of English ability, some researchers investigated the students who participated in the CET-4 and CET-6 examination in a regional university and analyzed the data. [8] Among them, students who have passed the grade examination and achieved excellent results are used as the cardinal model, which also reflects the English learning habits of excellent students to some extent. As shown in Table 2.

Table 2. Model of excellent students

Input layer (time)	Hidden layer (Change function $C_j \sigma_j$)				Output layer (score)
	Reading range	Vocabulary	Knowledge point	Grammar	
Oral practice (15%)	Economy (25%)	Words (30%)	Words (25%)	Noun (20%)	Final results (25%)
Writing practice (5%)	Politics (30%)	Phrases (10%)	Tense (10%)	Verouns (10%)	Final results (10%)
Aural practice (20%)	Technology (15%)	Sentence (35%)	Voice (30%)	Adverb (10%)	Final results (35%)
Translation practice (10%)	Literature (10%)	Paragraph (20%)	Reading (20%)	Adjective (20%)	Final results (15%)
Reading exercises (45%)	Philosophy (10%)	Chapters (5%)	Subordinate clause (10%)	Article (20%)	Final results (15%)
Error correction exercise (5%)	Science and Technology (10%)	Slang (5%)	Verb (20%)	
.....	
Total (100%)	100%	100%	100%	100%	Total 100%

4 Design and implementation of English learning platform

The platform is designed with a distributed network topology.

4.1 Situation of topological structure

As shown in Figure 1, the platform is designed with a distributed network topology, which combines the user levels of teachers, students and administrators to support different identity rights. The corresponding services in it are different. [9] The constructivist English learning platform specifically includes autonomous learning, auxiliary exercises, audio-visual training and other modules, and the specific logical table is shown in Table 3.

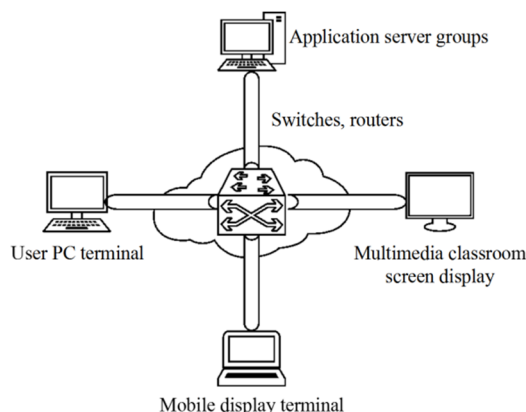


Fig. 1. A Schematic diagram of the network topology

Table 3. Logical table

Constructivist English autonomous learning platform	
Auxiliary exercises	Auxiliary inspection, learning content research, learning log situation
Autonomous learning	Basic practice, topic practice, writing training
Audio-visual training	Listening practice, reading practice, oral practice, personal knowledge point collection

Different modules need background question bank as support, which is supported by SQL Server database, so as to ensure that system integration can achieve automatic management and implement the overall scheme of data solution. [10]

4.2 Platform database design scheme

The core function of the platform database is to provide students with a question bank of English learning courseware, which includes listening training, single-choice topic practice, judging topics, reading comprehension, filling in the blanks, correcting mistakes and cloze. The information table of the database contains the information of test types, test knowledge points, grammar information and different types of multimedia files. The types and field contents of the above information list are partially shown in Table 4.

Table 4. List of database information (partial)

Field name	Field content interpretation	Data type	Category restriction	Remarks
Test_Type_id	Category number	Number (4)	Not Null	Types of test questions
Test_Type_Name	Category name	Varchar2 (40)		

Test_title	Test title	Varchar2 (1000)	Not Null	Description of test questions
Knowledge_id	Knowledge point number	Number (2)	Not Null	
Knowledge_name	Knowledge point name	Varchar2 (40)	Not Null	Tense, vocabulary and other primary keys

4.3 Design of Learning platform

The main operating environment of this learning platform is the integration of software and hardware. It is in a server environment, and the database server is already set up. The system uses 4G memory and 500G solid-state hard disk, dual CPU processor system and Gigabit network card, while the software uses system software and application software. The backup software uses Veritas for backup. The application server operating system uses at least MS Windows 2007 Enterprise Edition, and the system software uses WinCC. The platform has the following three modules. First, the basic exercise module. Basic exercises can provide students with two ways to carry out different types of English basic exercises, autonomous learning and learning arranged by teachers, and can carry out exercises for different types of exercises, multiple knowledge points and multimedia. Second, practice. The practice is mainly to guide students to carry out different types of basic English exercises by autonomous learning, which can be carried out for different types of questions, knowledge points and multimedia. Only when students' knowledge reaches the corresponding level of each level can they improve the corresponding level, and each student can only see the questions of their corresponding level. [11] Third, listening and translation practice. Listening and translation practice mainly utilizes students' independent ways to carry out training activities and improve their listening and translation abilities, and to carry out special skills exercises for different types of questions, knowledge points and multimedia, including Chinese-English translation and English-Chinese translation. Last, learning analysis module. It can carry out neuron model analysis by researching students' study habits, and carry out vertical and horizontal analysis in different ways, such as examination papers and individuals related to students, to help students make more suitable learning plans.

5 Conclusions

Today, with the rapid development of educational informatization, the application of network technology has changed the traditional teaching concept and thought. In the information age, teachers need to grasp the characteristics of English teaching under the network background, constantly creatively use network resources, and subtly cultivate students' autonomous learning ability to improve teaching quality. Therefore, colleges and universities need to actively develop English autonomous learning platform, and cultivate students' autonomous learning ability while completing teaching tasks. Nowadays, English autonomous learning platform based on RBF neural network is widely used in college English teaching, which really helps to improve students' learning efficiency and quality, and can also cultivate students' autonomous learning ability. In this regard, teachers should apply RBF neural network to English autonomous learning platform to effectively improve students' learning quality and efficiency.

project: Study on Empowerment Model of Mathematical Intelligence for Application-oriented English Majors in Ningxia

fund: scientific research project from Yinchuan University of Science and Technology in 2023

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