International Journal of Database Theory and Application
Vol.9, No.9 (2016), pp.157-166
http://dx.doi.org/10.14257/ijdta.2016.9.9.15

An Improved BP Learning Algorithm and Autonomous Learning of English Teaching Pattern Based on Network Survey

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Abstract

Colleges and universities should make full use of modern information technology to improve the teaching mode based on computer aided English teaching mode. The new teaching model should be based on modern information technology, especially network technology, so that English teaching is not subject to the restrictions of time and place, and toward the development of personalized, autonomous learning. In this paper, we analyze network topology structure and put forward an improved RTRL learning algorithm. Based on the empirical analysis, the result shows that with the increase of teaching time, the result of the experimental class is more obvious, so that the new teaching model promotes the improvement of students' autonomous learning ability. In conclusion, cultivating students' autonomous learning ability in a new and diversified foreign language teaching environment has become the core of College English teaching reform.

Keywords*: BP learning algorithm, network topology, English teaching, performance test*

1. Introduction

Colleges and universities should make full use of modern information technology to improve the teaching mode based on computer aided English teaching mode. The new teaching model should be based on modern information technology, especially network technology, so that English teaching is not subject to the restrictions of time and place, and toward the development of personalized, autonomous learning [1]. In response, all colleges and universities have carried out the development based on the reform of the teaching model of College English network, an important indicator of the successful reform of the teaching model is the student's individualized learning methods and the students' autonomous learning ability [2]. On the one hand, the network environment for students to carry out autonomous learning provides favorable material conditions; on the other hand, autonomous learning ability will promote the network learning time and learning resource use efficiency, it to improve the quality of education and teaching has important significance [3-4]. How to cultivate students' autonomous learning ability in a new and diversified foreign language teaching environment has become the core of College English teaching reform. However, influenced by the traditional teaching idea and the exam oriented education, College English teaching more with the teacher as the center, pay attention to imparting knowledge of the language, ignoring students' autonomous learning ability and the main role to play [5]. To guide students to change the concept of foreign language learning, to cultivate autonomous learning awareness, master autonomous learning strategies, teaching mode reform is essential. In view of this, autonomous learning research group of the project construction and practice based on multimedia network of College English teaching mode, aiming at cultivating autonomous

ISSN: 2005-4270 IJDTA

learning ability of English for the students under the network environment, explore new paths of the integration of information technology and subject teaching.

From the beginning into the era of big data, big data analysis has emerged. From the data source to the value of the life cycle of big data in the information system through the data preparation, data storage and management, computing, data analysis and knowledge show 5 main links, including data analysis from the huge volume, velocity, variety rules and extract knowledge discovery in large numbers [6]. Only through the "data analysis" link, in order to obtain valuable information, in-depth, the 4V characteristics of big data, it is also the most important characteristics as the value, it can truly be reflected. Therefore large data analysis is very important in the field of big data, is from data to information, the decisive factor. 4V characteristics of big data to big data analysis have brought new challenges. The global digital data every 2 years to double the rate of growth, this year will reach 8ZB, the equivalent of 18 million of the Library of Congress. From one hand to the intelligent mobile phone video surveillance cameras and other sensing equipment, all the time generation of complex structured data and unstructured data, unstructured data and the growth rate is faster than the structured data [7-8]. IDC 2011 survey pointed out that the unstructured data generated in the next 10 years of data will account for 90%. In all human digital data, only a small part of numerical structural data obtained and analyzed deeply mining is the traditional data mining. Web page index, social data, semi-structured data in Google, Facebook and other large Internet companies have been some shallow analysis.

2. Evolutionary Knowledge Network Model

2.1. Network Topology Structure

At present, the academic and industrial circles refers to the depth of the neural network, usually refers to a feed forward network with a certain depth, the characteristics of feed forward networks between neurons of the same layer without feedback connection, there is no time parameter attribute, so the depth of the neural network is good at dealing with static data. DNNs is a kind of recurrent neural network full interconnection, there are feedback connections between neurons. The feedback structure spread in the time dimension, with the continuous running time, the network can infinite. For each neuron in the infinite depth of the neural network, it is connected with three: the neurons with all the external input connection, connection and all other neurons, and the neurons and their feedback connections. Figure 1 is showing three neurons, two external input of infinite depth of the neural network.

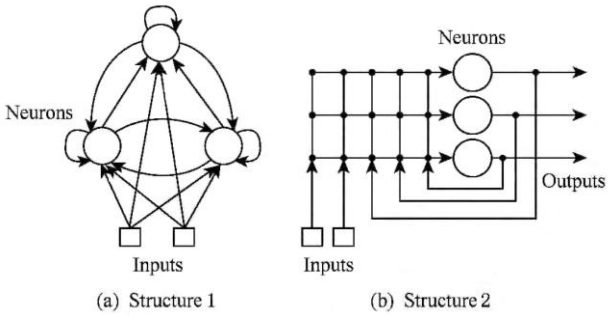

Figure 1. Two Structures of the Completely Connected RNN

In general, the assumption that an infinite depth network has m external inputs, n neurons, and the network at the time t of the external input x_t as:

$$x(t)=(x_1(t),x_2(t),\cdots x_m(t))^T$$

The output of the neuron is y_t:

$$y(t)=(y_1(t),y_2(t),\cdots y_n(t))^T$$

Obviously, any neuron K at time t + 1, the total input SK (T + 1) is composed by X (t) and Y (t), Let w for network connection weights is a n×(n + m) matrix. Without loss of generality, can make W = [Wu, Wi], which Wu said between neurons in the connection weights, Wi means connection weights between the neurons and the external network, and as T+1 neural network to obtain the total input as:

$$y_k(t+1)=f_k(s_k(t+1))$$

In order to facilitate the analysis, the feedback structure of the infinite depth network in time dimension. Assuming an infinite depth N network began running in time T_0, each time step N network was launched into a feed forward network upsilon N* , and identical activity value and this time step network T> T_0, the infinite depth network as shown in Figure 2.

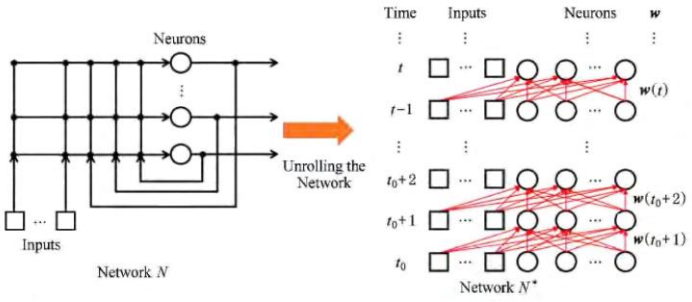

Figure 2. Infinite Depth Network

2.2. Learning Algorithm

Neural network computing power or "storage knowledge" is reflected in the connection weights between neurons. Therefore, learning algorithm is the method of regulating the network weight, that is:

$$w_{new}=w_{old}+\Delta w$$

Then, target output error can express as:

$$e_k(t)=\begin{cases} d_k(t)-y_k(t) & k\in T(t) \\ 0, & otherwise \end{cases}$$

The performance function of the network at the time of the t can be expressed as:

$$J(t)=\frac{1}{2}\sum_{k=1}^{n}[e_k(t)]^2$$

Assuming that the start and stop times of the network are t_0 and t_1, the total performance function of the network is:

$$J(t_o,t_1)=\sum_{\tau=t_0+1}^{t_1}J(\tau)$$

Calculation of the value of the W_{ij} value as:

$$\frac{\partial J(t_0,t_1)}{\partial w_{ij}} = \sum_{\tau=t_0+1}^{t_1} \frac{\partial J(t_0,t_1)}{\partial w_{ij}(\tau)}$$

Conclusion using the chain rule:

$$\frac{\partial J(t_0,t_1)}{\partial w_{ij}} = \sum_{k\in U} \frac{\partial J(t_0,t_1)}{\partial s_k(\tau)} \times \frac{\partial s_k(\tau)}{\partial w_{ij}(\tau)}$$

Error as:

$$\delta_k(\tau) = \begin{cases} f'(s_k(\tau))e_k(\tau), \tau = t_1 \\ f'(s_k(\tau))\left(\sum_{j=1}^{n} w_{kj}\delta_j(\tau+1) + e_k(\tau)\right) \end{cases}$$

The gradient of the network performance function in the weight space is:

$$\nabla_w J(t_0,t_1) = \sum_{\tau=t_0+1}^{t_1} \delta_i(\tau) y_i(\tau-1)$$

At the moment when the T01 error back-propagation network, update:

$$w_{new} = w_{old} + \alpha \nabla_w J^{total}(t_0,t_1)$$

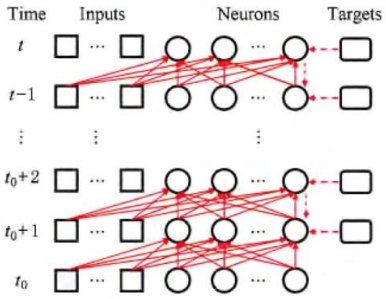

Figure 3. Error Propagation in Epoch-wise BPTT

2.3. RTRL and LSTM Learning Algorithm

RTRL is real time recurrent learning; it is a front to the dissemination of information on the activities of the algorithm. RTRL algorithm at the end of the eighties of the 20th century is proposed. The algorithm has a variety of different deformation, in the RTRL algorithm, the definition of "active" information:

$$P_{ij}^k(t) = \frac{\partial y_k(t)}{\partial w_{ij}}$$

The activity information of the network is transmitted:

$$P_{ij}^k(t) = f'(s_k(t)) \times \left(\sum_{l\in U} w_{kl} P_{ij}^l(t-1) + z(t-1)\right)$$

The gradient of the network performance function in the weight space is:

$$\frac{\partial J(t)}{\partial w_{ij}} = \sum_{k\in U} \frac{\partial J(t)}{\partial y_k(t)} \times \frac{\partial y_k(t)}{\partial w_{ij}}$$

As:

$$\nabla_w J(t) = \sum_{k\in U} e_k(t) p_{ij}^k(t)$$

In order to solve the infinite depth of the neural network of "vanishing gradient" and "gradient explosion" problem, Artificial Intelligence Laboratory in Switzerland 1997 proposed long Short-term Emory (LSTM) network.

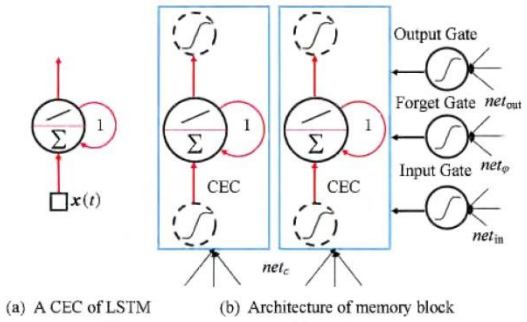

Figure 4. Illustration of LSTM

3. Research Design

3.1. Research Hypothesis

The trinity teaching mode is better than the traditional mode to improve students' ability of autonomous learning; autonomous learning ability must be accompanied by the promotion of students' achievement in English, therefore, experimental class English learning achievement will be better than the control class. The experimental class and the control class in two different teaching modes, the two were involved in the freshmen English diagnostic testing. According to the results of examination results of independent samples t test, English starting level of two groups of participants before the experiment without significant difference, from randomly selected three classes as the experimental class (182) and the rest of the three classes as the control class (184). Independent variables: the traditional college English teaching mode and the trinity of the new teaching mode and the mode of independent learning ability training program. Dependent variables: the subjects' English autonomous learning ability and the participants' grade one, grade two English final examination results.

3.2. Control Means

Two different teaching modes, and the textbooks, class hours equal (four hours per week) for the experimental class and the control class; objective test questions in part by the scoring machine, the subject part scanning to the computer by flows hop with blind rating. In order to eliminate the influence of subjective will on the objectivity of ratings; in order to eliminate the difference of teaching levels may be caused by the experimental results, the selected an experimental class and a control class by a teacher as English teaching; therefore, by three teachers bear the six participating in the task of teaching object.

According to the definition of autonomous learning theory to the five factors of autonomous learning ability, the teaching mode of Trinity is designed to cultivate the independent learning ability. (1) Supervise and urge the students to self-monitor the process of autonomous learning. Students in the experimental class per month required to fill out and submit independent study report, the contents of the report include autonomous learning plan formulation, completion of the task of autonomous learning, adjustment of autonomous learning methods and learning strategies, learning process encountered difficulties, problems and solutions. (2) Teach learning strategies, and urge students to use learning strategies. An integrated curriculum teachers' pay attention to

English learning methods and learning strategies instruction and demonstration, class audio-visual said autonomous learning teachers to learning site for learning strategy guidance and supervision, teaching under the network environment of learning skills, promote students' effective use of network resources and tools to realize autonomous learning goals, urge the students to use learning strategies consciously, the implementation of study plan. (3) Promoting the communication and interaction in the process of autonomous learning. Teachers take the lead in the interaction of network learning, and urge students to participate. (4) The management and evaluation of the network learning process and learning effectiveness. Teachers regularly organize students to exchange their own learning situation, organize students to conduct self - Evaluation and mutual evaluation on the network learning behavior. The design of oral English activities based on the network audio visual language, and the effect of the autonomous learning in oral English class. The design of the above scheme is to enhance the sense of responsibility and independent consciousness, and promote the cultivation of autonomous learning habits. Using the "Trinity" teaching mode, the independent learning ability training program was carried out, and the experiment class was conducted for one year.

4. Empirical Analysis

4.1. The Development of Autonomous Learning Ability

Experimental class self-learning ability before and after the paired samples T test data (see Table 1) showed that: after the experiment, the experimental subjects in the independent learning ability of five dimensions have significant improvement (P value is less than.005). This shows that, in general, the "Trinity" teaching model and the training program used in this model can effectively promote students' autonomous learning ability. From the point of view of the mean difference before and after the experiment, the subjects in the use of learning strategies, to monitoring the use of learning strategies, learning the process of monitoring and evaluation, "the three dimensions of improve greatly. From the average level of the experimental results, the "understanding of the purpose and requirements of teaching", "learning objectives and plans to determine the formulation" two dimensions are still some room for improvement.

In addition to the overall comparison of the five dimensions of independent learning ability, we conducted a single comparison and analysis of the 32 item paired samples T test data (see Table 2). The results showed that there were significant differences (P<.005) in 29 (90.6%) of the project before and after the experiment, three items (9.4%) had no significant difference before and after the experiment (P>.005). Which in "learning objectives will be transformed into learning to act this one on, even after the experiment than those before the experiment mean lower. Possible reasons: newborn just entrance of network autonomous learning environment feel fresh, later due to the familiar and burnout, degree of effort has declined. According to the assignment of the five component table, the mean value is greater than 3 indicating that the statement of a single item is recognized by the student. There is no significant difference between the "cooperative learning" and others in the experiment, and the average value is less than 3, which indicates that the teaching model needs to be improved in the promotion of students' cooperative learning. This may be related to the students' understanding of the concept of autonomous learning; some students will understand the autonomous learning as individual learning. In fact, cooperative learning is an indispensable part of autonomous learning; cooperative learning with others is conducive to their own understanding, so as to solve their own problems. Appropriate measures should be taken in the teaching of the future, such as the arrangement of cooperative learning tasks and other measures to promote the exchange and cooperation of autonomous learning. To keep up with the progress of teaching in the experiment before and after the no difference, probably

because of the higher average before the experiment, there is not much room for improvement after the experiment (M=3.98, SD=.928, M=4.14, SD=1.080).

Table 1. Autonomous English Learning Ability

experiment		Mean value	standard deviation	Mean difference	T value	P value
Understanding of teaching objectives	pre	15.69	3.125	-2.56	-5.486	.000
	post	18.27	2.847			
Learning objectives and learning plans	pre	15.68	3.342	-1.83	-4.722	.000
	post	17.51	2.993			
learning strategy	pre	14.76	3.714	-3.59	-5.687	.000
	post	18.35	3.527			
Monitoring of strategy use	pre	23.71	4.334	-4.17	-7.914	.000
	post	27.88	5.147			
evaluation of learning process	pre	29.54	3.157	-4.21	-8.893	.000
	post	33.75	5.236			
total	pre	99.38	14.36	-16.38	-9.945	.000
	post	115.768	15.25			

Among the 29 options with significant differences, there are six options with a mean difference of more than 1, and one of the "conscious use of listening strategies" is the most significant difference (-2.29). In addition, the understanding of learning strategies, adjust learning plan and other five projects (see Table 3), the difference between the values are greater than 1. This shows the effectiveness of the training program of autonomous learning ability under the new teaching mode. In order to explore the reasons, in the period of teaching discussion meeting, we in the experimental class student representatives proposed related issues, collected the following feedback information: the beginning of autonomous learning, students don't make plans for their autonomous learning, not to mention adjust the learning program, on English learning strategies also do not quite understand, rarely reflect the process of autonomous learning, not consciously use and adjust the learning methods.

Autonomous learning interaction (including autonomous learning report and teacher interaction and discussion meeting and students interaction), and teachers in class of learning methods, guidance and teaching, arouse the awareness of learning strategies of the students in the experimental class. The statistical results of the questionnaire and further research shows that: the autonomous learning ability training plan better promote the students on the autonomous learning process of self-monitoring and evaluation, promote the students on learning methods and learning strategies of the master, application, evaluation and adjustment, and all this and due to new teaching mode for independent learning to create good conditions and environment, provides the opportunity for more autonomous learning and language practice, using a series of measures and plans for the cultivation of autonomous learning ability.

Table 2. Autonomous English Learning Ability Survey Project

Survey project		Mean value	standard deviation	Mean difference	T value	P value
Transforming learning objectives into efforts	pre	3.01	1.111	.07	1.811	.072
	post	2.94	1.129			
Cooperative learning with others	pre	2.69	1.082	-.05	-1.670	.096
	post	2.74	1.265			
Can keep up with the	pre	3.98	.928	-.16	-1.84	.068

progress of teaching	post	4.14	1.080			
Monitoring and evaluation of learning process	pre	2.80	1.072	-1.01	-13.947	.000
	post	3.81	1.054			
Evaluation of autonomous learning methods	pre	2.88	.987	-1.16	-19.696	.000
	post	4.04	.962			
Adjust the autonomous learning plan	pre	2.68	0.863	-1.21	-20.488	.000
	post	3.89	1.023			
Effective use of network learning resources	pre	2.61	1.217	-1.23	-26.367	.000
	post	3.84	1.111			
Understanding of learning strategies	pre	2.25	.940	-1.53	-29.648	.000
	post	3.78	1.031			
Conscious use of listening strategies	pre	1.62	1.081	-2.29	-34.913	.000
	post	3.91	.976			

4.2. English Proficiency Test

Experimental class and the control class three English exam scores of independent samples t test results (see Table 3) shows two groups of subjects entrance English diagnostic test results had no significant difference P>.005, suggesting that their initial state of the English level. With the different modes of teaching practice, the first and two final examinations, the experimental class and the control class test scores reached a significant level (P<.005), the former is better than the latter. When the final examination, the two groups were divided into 3.01 points, to the end of two, the average difference increased to 5.12 points, which shows that with the growth of teaching time, the results of the experimental class is more obvious. In other conditions are under the control of the situation, will performance of the experimental group is better than control class this result is mainly due to the new teaching model promotes the students' autonomous learning ability improve, examination results of t test also verified the our hypothesis: autonomous learning ability will promote the learning achievement.

Table 3. Independent T Test of English Test Scores

Test name	participants	Mean value	standard deviation	Mean difference	T value	P value
placement test	Experimental classes	69.25	11.60	-.61	-.534	.593
	control class	69.86	10.09			
end of first semester	Experimental classes	73.56	14.05	3.01	2.187	.002
	control class	70.55	12.19			
end of second semester	Experimental classes	76.53	13.39	5.12	3.810	.000
	control class	71.41	12.19			

5. Conclusion

College English teaching mode provides a specific environment and conditions for the development of autonomous learning ability. It not only helps to improve students' autonomous learning ability, but also effectively improve their English learning achievements. This mode breaks through the single teachers teaching mode, the use of network resources and multimedia tools, students created multiple learning environments, introduction of stereoscopic and interactive mode and multiple evaluation model, provides

the opportunity for more language practice and autonomous learning, embodies the teaching concept of constructivism learning of English practice, interactive, strategy and autonomy. The model will be placed under the network environment, breaking the limitations of time and space, will be extended to the outside of the school. Non completely independent to the outside completely independent from the class supervision, reflecting the autonomous learning ability of scientific development, also reflected the dominant position of the leading role of teachers and students, avoid the grew up in the traditional mode of students face learning, all of a sudden the transfer of at a loss, or self - monitoring deficits of self-indulgence. The ability of autonomous learning training scheme effectively promote the students on the autonomous learning process of self-assessment and monitoring, to improve the students' cognitive and metacognitive strategy awareness, but the model in promoting autonomous learning interaction, the effect is not satisfactory. Language application ability raise need practice, need to have a partner, the network is a good platform for the exchange, can greatly expand the circle of exchange. It has even provided with opportunities for native English speakers to communicate directly.

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