www.cadanda.com
Computer-Aided Design AND APPLICATIONS

Enhancing College English Learning through Digital Art-Infused Smart Classroom Models Construction Industry with Fuzzy Neural Networks

Wen Zou[1*]

[1]Dongguan Polytechnic, Guangdong, Dongguan, 523808, China

Corresponding Author: Wen Zou, 101044@shengda.edu.cn

Abstract. Traditional teaching practice activities have kept pace with modern science and technology, but the Internet and modern information technology are increasingly used in teaching practice activities. As a result of the development results of the combination of modern network technology and teaching practice activities, the hybrid teaching mode has emerged as one of the most common teaching modes. Teaching practice activities benefit from activities because they provide a more comprehensive personalized space and a broader range of resource utilization options for the students participating in them. Fuzzy rough neural networks are used in this paper to address the low recommendation efficiency of the English resource recommendation module in a smart classroom and the insufficient use of related information. First, a personalized recommendation model is proposed, and the recommendation algorithm flow is given in accordance with the association rules in this method The above model is solved using a fuzzy rough neural network, and the characteristics of user behavior are obtained by calculating the fuzzy correlation coefficient and fuzzy correlation degree. This is all happening simultaneously. Prediction error can be reduced to some extent by using this algorithm in comparison to other algorithms. This means that students will receive more accurate recommendations.

Keywords: College English smarter classroom; Fuzzy Neural Network; Recommendation model; Construction Industry; Digital Art-Infused
DOI: https://doi.org/10.14733/cadaps.2024.S11.84-95

1 INTRODUCTION

The development of science and technology has a significant influence on the progression of society as a whole. This influence can be seen in a variety of ways. Integration of cutting-edge scientific and technological innovations into classroom instruction is essential to the success of education reform in the modern era[32],[25],[19],[21],[27],[12]. Emerging in today's educational landscape is a

novel instructional method known as the hybrid approach, which integrates time-honored classroom practices with the most cutting-edge forms of information network technology. The current state of research that focuses on the Internet and education has made it possible for smart classrooms to not only overcome limitations of time and space that are imposed on teaching practice activities, but they are also able to use a combination of online and offline resources to realize rich educational resources and innovative teaching ideas. The practice of unity as a way of life Because of the modern educational system, the English language is currently the one that is utilized the most in a variety of human endeavors[2],[31]. The end goal of all of China's college English teaching practice activities is to produce more English-speaking professionals who can support the Chinese socialist cause. The construction of additional "smart classrooms" is one strategy for improving the quality of English instruction offered in Chinese universities. As a direct consequence of this, one of the most important concerns that must be addressed is the question of how to design a technologically advanced classroom for the instruction of college English in a mixed setting[17]. The construction industry is a dynamic and rapidly evolving field that demands effective communication skills, particularly in English, to succeed in a globalized market

A "smart classroom" is one that makes use of multimedia technology and network information technology to help students learn more effectively in the classroom as well as better manage their time in the classroom. This is done so that students can keep up with the fast-paced world that we live in today. The classroom has undergone a transformation as a consequence of societal shifts as well as technological advances[24],[26]. When it comes to the "smart classroom," its design and methods of application demonstrate that it is an entirely different kind of classroom than traditional classrooms.

Smart classrooms are an essential component that cannot be left out of the mix of modern educational and instructional methods[7],[14],[18]. During the process of education, each component of a smart classroom plays a unique and important role in the overall operation. To begin, a smart classroom significantly lessens the amount of work required of teachers[30],[3]. By utilizing high-tech teaching methods and information technology as teaching tools, English professors at colleges and universities can more easily prepare for and deliver their lectures to their students. There are two additional benefits associated with utilizing technology in the classroom. Students can improve their overall comprehension of the content they are learning by conducting independent Internet research to find information that is pertinent to their studies and then applying that research to supplement the instruction they receive in the classroom. Because of the new approaches to education, there is more opportunity for interaction between students and teachers in a smart classroom[9]. The interaction between teachers and students in a traditional classroom can be stiff and monotonous, which can easily lead to students becoming resistant to the teaching method. On the other hand, the smart classroom can reawaken students' enthusiasm for learning and classroom participation in a novel and relaxed manner of interaction, which can be helpful in improving the quality of teaching[1],[4].

In recent years, there has been an explosion of English-teaching resources as well as smart classrooms, which has necessitated the development of user-specific online recommendation applications that are accurate, efficient, and tailored to the individual user[28]. Existing general search engines, portal websites, and the like make it challenging to satisfy the specific information needs of users who come from a variety of different backgrounds, have a variety of different purposes, and operate over a variety of different time periods. A personalized association recommendation system is becoming an increasingly effective method of addressing the issue of information overload.

Because the personalized recommendation system relies heavily on the historical learning records of individual students, it is able to determine the degree of correlation between various English teaching resources and extrapolate rules for recommending English teaching resources for

use by students. This allows the system to more effectively recommend English teaching resources for use[20],[5].

There are three distinct types of recommender systems that can be categorized according to the types of data they employ. These are collaboration filtering, content filtering, and social recommendation[8],[29]. Users whose interests are determined to be similar by algorithms are candidates for receiving personalized recommendations, which are then generated through the application of personalized weighting processing to user scores. Several researchers have come up with a variety of algorithms and models with regard to this topic. Some researchers have proposed a framework called probability matrix decomposition that incorporates information about users' social relationships as a way to improve the performance of traditional recommendation methods. This framework is intended to improve the performance of traditional recommendation methods. A recommendation method that is based on trust propagation has been proposed by a few researchers. This method, which they claim can reduce the Matthew effect in the recommender system by modeling the trust relationship between users, was proposed by these researchers[10],[11],[22]. In order to compensate for the drawbacks of the association rule algorithm, some academics believe that a TOP-K algorithm that takes into account user preference and stratification, as well as incorporates timeliness and interest, could be developed. Some researchers have proposed a recommendation algorithm based on social context information[15],[23]. They do this by using user-recommended Tweets as a constraint on the objective function, however, this method does not take into account the relationship that is displayed between the recommended objects. Some researchers have extended the use of traditional association rules to include cross-mining as well as mining that takes into account temporal relationships in addition to spatial ones. This expansion was made possible as a result of their work[16].

However, there are problems with the recommendation methods that are currently being used, including inefficiency and a lack of personalization. Following the introduction of a personalized recommendation model is the presentation of an algorithm flow for a system recommendation that is based on association rules. A fuzzy neural network is used to solve the problem of making personalized recommendations, and the results are validated through the use of simulation experiments. the effectiveness of the algorithm.

2 THE KEY TO THE CONSTRUCTION OF ENGLISH SMART CLASSROOM

It is not unusual for Chinese college English teachers to be forced to work with educational materials that are either out of date or nonexistent. The students who are currently in school have a different level of education and a different foundation than the students who were in school in the generation before them. People living in the modern era have easier access to the outside world and a better understanding of it as a result of advancements in science and technology, particularly the Internet. This has the effect of broadening their horizons and increasing the variety of information they can come into contact with. Students are experiencing a greater impact from information technology than ever before because it is the driving force behind the new era. The students have access to a wide variety of resources, including the Internet, from which they can obtain the content and information that they are seeking to fulfill their needs. Therefore, English professors at colleges and universities should provide their students with instruction that is more current and reflective of both the progression of the times and the instructors' own professional development. Because of this, the activities that are currently being used to teach English in colleges need to be brought up to date and supplemented with educational resources[6].

Second, in the practice of teaching English in Chinese colleges today, there are some educators who have educational ideas that are fundamentally backwards. It is easy for the phenomenon of cramming teaching to take place in the practice activities of college English teaching because some English teachers have educational concepts that are relatively behind the times. At this juncture, it

is essential to place an emphasis on the outmoded educational thinking and pedagogical practices that are utilized by English teachers. In light of the issues that have been discussed up until this point, this article offers the following fundamental recommendations for improving English instruction”

2.1 Optimizing the Design of English Smarter Classroom

The capacity of college students to communicate effectively in English can be improved by encouraging them to make the most of the limited amount of time they spend in English classes by broadening their knowledge base and practicing their skills in contexts that are drawn from the real world. Teaching English in a traditional classroom setting places the instructor at the heart of the learning environment. But the dominant position of students is emphasized as the primary focus of the English instructor's instruction. More and more frequently, it is the students themselves who are taking responsibility for their own education. There is absolutely no reduction in the educational role that teachers play. But they will need to adjust the way that they conceive of and work toward achieving their own individual educational objectives as a result of this change. The capacity of students to learn a foreign language is regarded as the primary goal of instruction, and in order to concentrate on achieving this goal, teachers use the project teaching method. Each assignment must begin with the students conducting an exhaustive search for pertinent information sources. This can be accomplished in a number of different ways. In order to successfully finish the project, it is necessary to process and organize the English learning materials that were gathered through a variety of methods, such as individual and group study. It is possible to subdivide a single project involving English language study into a number of more manageable subprojects. The particulars of each of these smaller projects are distinct, but they all play a part in addressing the fundamental problems that are caused by the larger project. Students have the opportunity to take leadership roles in a variety of project components. For instance, a single student is accountable for the completion of a sub-project. In order to get ready for the project, you need to do things like read textbooks, look for materials online, and brush up on your basic English vocabulary. Students learn a relatively small amount of content through the pre-class learning link. But this information lays the groundwork for them to be successful in the smart classroom. Before coming to class, students have reviewed the fundamental teaching framework that is used in English class. This prepares them to take an active role in the interactive session that will follow. The students are given the assignment to prepare a presentation that is based on the research they did outside of class time. The content of the presentation may include an introduction to the project, an explanation of previously gained knowledge, or an expansion of previously gained cultural context. Students in elementary school all have their own distinct ways of acquiring knowledge, as well as their own individual perspectives on the same body of information. Students can learn to develop critical thinking skills in English and demonstrate their ability to think critically by having their thoughts collide in a smart classroom where students can share and discuss their ideas. During the time that the presenters are speaking, it is the responsibility of the other students to listen, record, and ask questions. Students will collect data according to the focus of the sub-research project they are working on. In this way, the learning direction will become more apparent.

When students are put under the appropriate amount of pressure, they experience significant improvements in both their sense of learning motivation and their learning efficiency. Teachers in today's smart classrooms have been able to increase student agency by employing learning strategies that are based on project-based learning. Students are finding it easier to accept teachers in the role of assistants rather than full-time teachers as a result of changes in teaching methods as well as appearances in the classroom[13].

2.2 Effective Use of English Educational Resources

In order to create a smart classroom, we need to make sure that the seating arrangement is based on scientific principles, and that the material covered in the class is exhaustive. By utilizing smart classroom technology, the curriculum of English classes at colleges and universities can be modified to better cater to the requirements of today's students. Without up-to-date educational resources and teaching materials, there is no way to have a smart classroom. Consequently, it is imperative that outdated educational resources be updated. Keeping up with the times requires integrating current network education resources with the content of teaching materials to achieve a more relevant and engaging learning experience. This is necessary in order to keep up with the times. The development of educational resources in tandem with technological advancements is essential to the construction of a smart classroom. It is essential to improve the English education resources available in colleges and construct high-tech lecture halls if one wishes to see the cultivation of English speakers of the highest caliber.

Smart classrooms are a significant step forward in the reform of English teaching at colleges and universities because they enable students to interact with computers and other technology in a way that was not previously possible. This is a significant step forward in the reform of English teaching at colleges and universities. Students in a "smart classroom" have access to a wide variety of information education tools and cutting-edge teaching methods, which gives them the opportunity to practice their practical English skills, learn new English knowledge, and come up with original ideas. Not only do students in the smart English classroom improve their ability to speak and write in English, but they also learn how to adapt to the changing needs of college students in the modern era by making use of various information tools. This is accomplished through the use of flipped classroom techniques. The construction of a smarter classroom begins with teachers acknowledging their own roles as educators, working to improve their own smarter teaching abilities, and elevating the level of effectiveness of smarter English classroom instruction as part of the process of building the classroom. Students' English literacy will improve as a result of the development and improvement of smart English classrooms, as well as the overall quality of English education in colleges and universities. This improvement will take place because of two factors. The ability to maximize the use of the resources at one's disposal is of the utmost importance for educators. As a consequence of this, it is essential to have an accurate model for resource recommendation.

3 RECOMMENDED METHOD

At the moment, the primary pillars of support for the personalized recommendation system are association rules and content-based recommendations. We primarily concentrated on recommendation systems that are grounded in association rules. Customers are not interested in this type of system because it is able to make recommendations dynamically based on shifts in the interests of the users and effectively remove those recommendations with strict association rules. This makes the system less appealing to customers. The following guidelines are obligatory for participation in the relevant associations.

The collection of English learning resources in the smart classroom is as follows:

$$X = \{x_1, x_2, \cdots x_n\} \tag{1}$$

The learning resource set (transaction set) selected by students in Smart Classroom is:

$$D = \{d_1, d_2, \cdots d_n\} \tag{2}$$

For a certain learning resource x_k, the number of x_k included in the transaction set d_k is

$$N = C\left(x_k \in d_k\right) \tag{3}$$

Then the support of x_k is

$$s\left(x_k\right) = \frac{N}{m} = \frac{C\left(x_k \in d_k\right)}{m} \tag{4}$$

In addition, this paper also introduces the minimum credible threshold s_t and minimum support $s_{\min}$, Because of association rules, the accuracy of recommendations is very high, furthermore, there is no requirement for a complicated user measurement model, and the approach is very feasible. The extraction of association rules is time-consuming and requires a significant amount of time. This rule is unable to differentiate between products that have the same nature but different names. If the database is large, the extraction of association rules takes a long time. If the products have the same nature but different names. In this paper, a method for the association recommendation that is based on a fuzzy neural network has been proposed. This method can cluster historical data, obtain data with a high similarity to data from the present moment, and use this data as a training sample, which can significantly improve prediction accuracy.

The calculation method of fuzzy correlation coefficient is

$$fcc = \frac{\sum\left(x_k\left(i\right) \wedge x_k\left(j\right)\right)}{\sum\left(x_k\left(i\right) \vee x_k\left(j\right)\right)} \tag{5}$$

The calculation method of fuzzy correlation degree is

$$fcd = \frac{\sum_{i \neq j} fcc}{n-1} \tag{6}$$

where $x_k\left(i\right)$ represents the eigenvalue of the student's i point.

The weight of each feature is

$$w_i = \frac{fcd}{\sum fcd} \tag{7}$$

The construction of a Fuzzy Neural Network (FNN) involves decreasing the amount of known information. In a FNN, the five main modules consist of the input layer, the membership function layer, the T-norm layer, the normalization layer, and the input layer. In the first layer of the model, the user behavior data $X = \left\{x_1, x_2, \cdots x_n\right\}$ are used as input variables, and each variable is represented by a node. The membership function layer receives the user variables from the input layer and uses those variables to determine the membership value for each node in the network. As its source of information, the T-norm layer pulls the data that has been simplified from the

membership function layer. The nodes that make up this network layer are the embodiment of fuzzy rules. After going through this layer, we are able to obtain the output of the jth rule, which is:

$$\varphi_j = \exp\left(\frac{\left\|X - C_j\right\|}{\sigma_j^2}\right) \tag{8}$$

The calculation formula of the normalized output result $\{o_1, o_2, \cdots o_n\}$ is

$$o_j = \frac{\varphi_j}{\sum \varphi_j} \tag{9}$$

The final student behavior data is

$$y_j = \sum I \cdot o_j \tag{10}$$

The overall algorithm flow chart is shown in Figure 1.

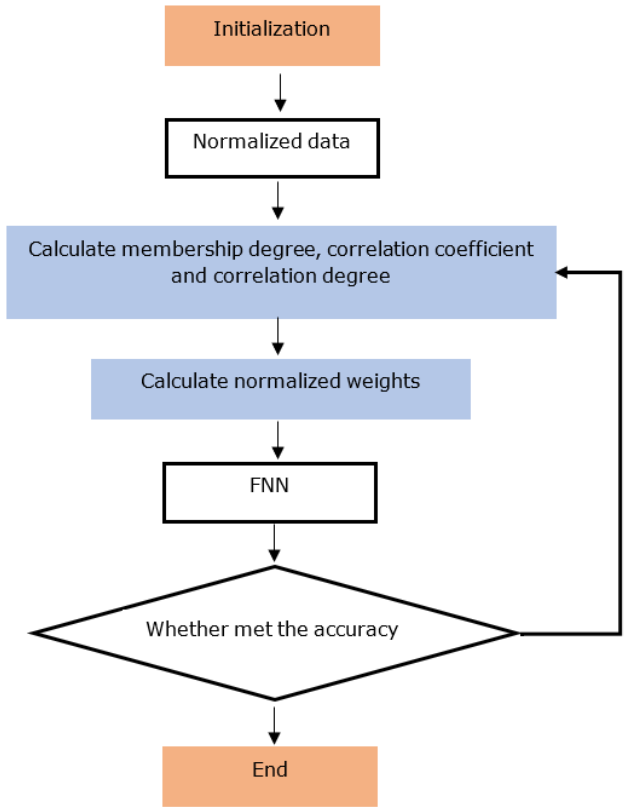

Figure 1: Flow Chart of Smart Classroom English Learning Resource Recommendation Model.

4 SIMULATION AND ANALYSIS

In this particular piece of research, a learning resource network will serve as the object of analysis. The user search resource records, resource transaction records, resource information, and other records are all recorded by the learning resource network. The network then selects one month from the historical data and allows users to purchase English learning resources for modeling purposes during that month. Concurrently, a value of 300 has been decided upon for the number of iterations. During the training phase of the FNN, the decay constant is set to 0.96, the maximum error is 0.5, the minimum error is 0.01, Adam is used as the optimizer, and MSE and MAE are utilized as prediction performance indicators. The calculation of MSE and MAE are

$$MSE = \frac{\sum (y_i - \hat{y})^2}{N} \tag{11}$$

$$MAE = \frac{\sum |y_i - \hat{y}|}{N} \tag{12}$$

The threshold for the dependency increment has been set to 0.005 in order to lessen the effect of each piece of noise and bad data individually. If the dependency increment is greater than this threshold, then only then will the attribute be considered to be a part of the reduction. The proposed algorithm, as well as BPNN and IDF, are compared with regard to the amount of prediction errors that each produces in Figure 2 and Figure 3. According to the figure, the errors of all three algorithms fluctuate within a certain range over time, however, the BP algorithm and the IDF algorithm have, on average, higher prediction errors than the algorithm that was proposed in response to this question. This algorithm, which is reasonable and has the potential to reduce prediction error to some extent, is capable of meeting the needs of customers more accurately.

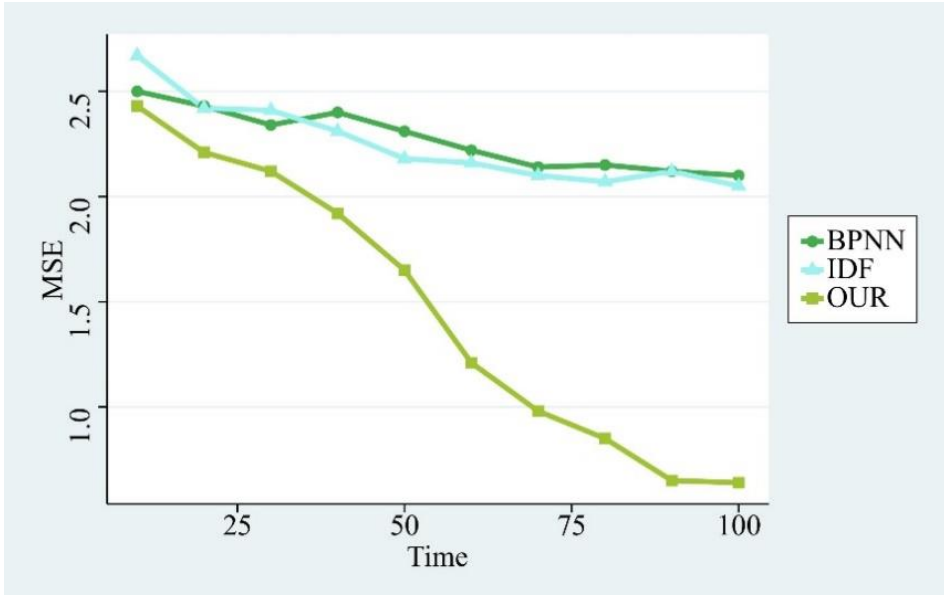

Figure 2: Variation Curve of MSE With Iteration Time.

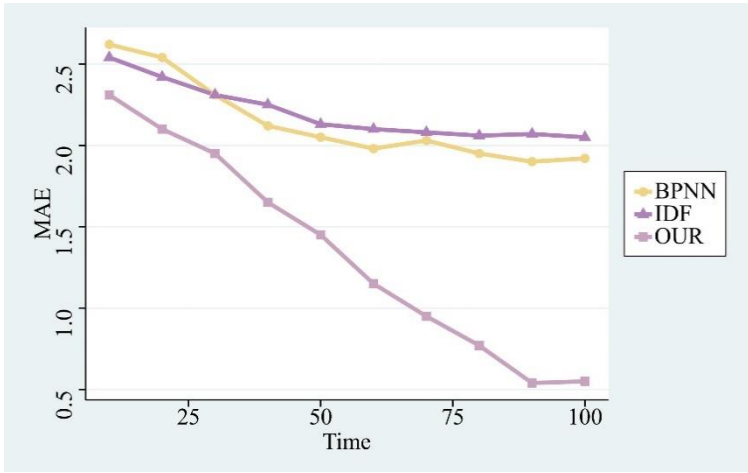

Figure 3: Variation Curve of MAE With Iteration Time.

Figure 4 illustrates how the accuracy of the algorithm's predictions shifts as the number of iterations in the process is increased. In this study, we investigate whether or not the number of iterations has an impact on the accuracy of the prediction made by the recommendation set. Figure 4 demonstrates that there is a positive correlation between the number of iterations and the accuracy of the prediction, however, once the number of iterations reaches approximately 200, the accuracy of the prediction tends to remain stable.

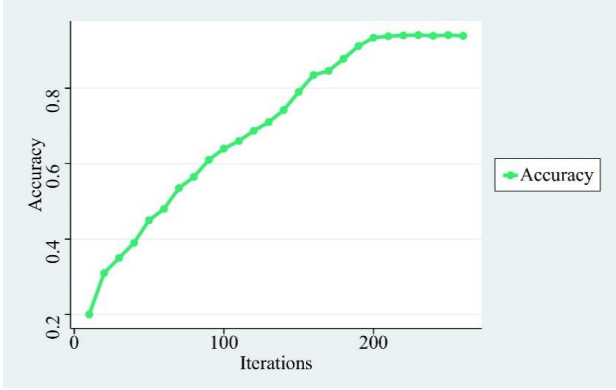

Figure 4: The Variation Curve of the Prediction Accuracy of this Method With the Number of Iterations.

It is only possible to find a significant correlation if both the minimum credible threshold and the minimum support are satisfied. Figure 5 presents an illustration of the impact that the minimum credible threshold and the minimum support have on the results of the prediction. Figure 5 illustrates the accuracy of the predictions made for a variety of S_t and $S_{\min}$ after going through 200 iterations. As can be seen, the minimum thresholds for credibility and support have an effect on the accuracy of the prediction. When there is an increase in the accuracy of the prediction, there is a corresponding

decrease in the minimum credible threshold and the minimum support. the more things improve. To put it another way, the degree to which there is a strong association between an advertisement and its minimum credible threshold and minimum support value is inversely proportional to the degree to which users favor the advertisement. When making product recommendations to end users, it is important to look for products that have a strong correlation to one another so as not to bore or confuse the end user.

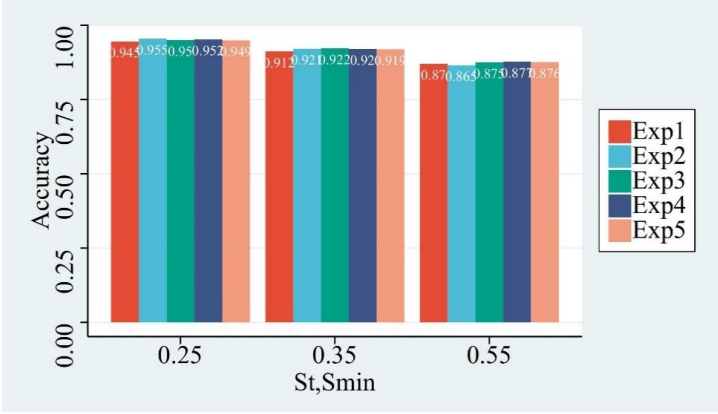

Figure 5: Comparison of Prediction Accuracy Under Different Parameters in Five Experiments.

5 DISCUSSION

Traditional teaching practice activities have kept up with advances in modern science and technology, however, teaching practice activities are increasingly making use of the Internet and other forms of modern information technology. The hybrid teaching mode has emerged as one of the most common teaching modes as a result of the development results that have come about as a result of the combination of development results of modern network technology and activities related to teaching practice. The students who take part in teaching practice activities benefit from the activities because they provide a more comprehensive and personalized space as well as a wider range of options for utilizing resources than the activities themselves do. In this paper, fuzzy rough neural networks are used to address the low recommendation efficiency of the English resource recommendation module in a smart classroom as well as the insufficient use of related information. These issues were found due to the use of related information. First, a personalized recommendation model is suggested, and then the recommendation algorithm flow is presented in accordance with the association rules contained in this method. The aforementioned model is solved with the help of a fuzzy rough neural network, and the characteristics of user behavior are obtained by computing the fuzzy correlation coefficient and the fuzzy correlation degree. All of these things are occurring at the same time. When compared to other algorithms, this algorithm has the potential to result in a lower level of prediction error. Because of this, the recommendations that are provided to students will be more precise.

Wen Zou, https://orcid.org/0009-0000-7686-0590

REFERENCES

[1] Ahmadian Yazdi, H.; Seyyed Mahdavi Chabok, S. J.; Kheirabadi, M.: Dynamic Educational Recommender System Based on Improved Recurrent Neural Networks Using Attention

Technique, Applied Artificial Intelligence, 36(1), 2022, 2005298. https://doi.org/10.1080/08839514.2021.2005298
[2] Blanton, L. L.: Classroom Instruction and Language Minority Students: On Teaching to 'Smarter'readers and Writers, Generation 1.5 Meets College Composition: Issues in the Teaching of Writing to US-Educated Learners of ESL, 1999, 127-52.
[3] Cabada, R. Z.; Estrada, M. L. B.; Cabada, R. Z.: et al. A Fuzzy-Neural Network for Classifying Learning Styles in a web 2.0 and Mobile Learning Environment, 2009 Latin American Web Congress, IEEE, 2009, 177-182. https://doi.org/10.1109/LA-WEB.2009.18
[4] Castellano, G.; Castiello, C.; Dell'Agnello, D.: et al. Learning Fuzzy User Profiles for Resource Recommendation, International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems, 18(04), 2010, 389-410. https://doi.org/10.1142/S0218488510006611
[5] Chaves, P.; Kojiri, T.: Deriving Reservoir Operational Strategies Considering Water Quantity and Quality Objectives by Stochastic Fuzzy Neural Networks, Advances in Water Resources, 30(5), 2007, 1329-1341. https://doi.org/10.1016/j.advwatres.2006.11.011
[6] Chen, S. F.: Cooperative Learning, Multiple Intelligences and Proficiency: Application in college English Language Teaching and Learning, ACU Research Bank, 2005.
[7] Chen, Y. C.; Teng, C. C.: A Model Reference Control Structure Using a Fuzzy Neural Network, Fuzzy Sets and Systems, 73(3), 1995, 291-312. https://doi.org/10.1016/0165-0114(94)00319-3
[8] Feng, Y.; Cui, N.; Gong, D.: et al. Evaluation of Random Forests and Generalized Regression Neural Networks for Daily Reference Evapotranspiration Modelling, Agricultural Water Management, 193, 2017, 163-173. https://doi.org/10.1016/j.agwat.2017.08.003
[9] Giupponi, L.; Agusti, R.; Perez-Romero, J.: et al. A Novel Approach for Joint Radio Resource Management Based on Fuzzy Neural Methodology, IEEE Transactions on Vehicular Technology, 57(3), 2008, 1789-1805. https://doi.org/10.1109/TVT.2007.907012
[10] Gong, Y.; Zhang, Y.; Lan, S.: et al. A Comparative Study of Artificial Neural Networks, Support Vector Machines and Adaptive Neuro Fuzzy Inference System for Forecasting Groundwater Levels Near Lake Okeechobee, Florida, Water resources management, 30(1), 2016, 375-391. https://doi.org/10.1007/s11269-015-1167-8
[11] Guo, L.; Gao, J.; Yang, J.: et al. Criticality Evaluation of Petrochemical Equipment Based on Fuzzy Comprehensive Evaluation and a BP Neural Network, Journal of Loss Prevention in the Process Industries, 22(4), 2009, 469-476. https://doi.org/10.1016/j.jlp.2009.03.003
[12] Han, B.: Application of Artificial Intelligence in Autonomous English Learning Among College Students, Int. J. Emerg. Technol. Learn., 14(6), 2019, 63-74. https://doi.org/10.3991/ijet.v14i06.10157
[13] Huang, Q.: Strategy Analysis of Wireless Internet of Things Technology in College English Teaching, Wireless Communications and Mobile Computing, 2022, 2022. https://doi.org/10.1155/2022/1516378
[14] Jahromi, A. T.; Er, M .J.; Li, X.: et al. Sequential Fuzzy Clustering Based Dynamic Fuzzy Neural Network for Fault Diagnosis and Prognosis, Neurocomputing, 196, 2016, 31-41. https://doi.org/10.1016/j.neucom.2016.02.036
[15] Kan, X.; Li, L.: Comprehensive Evaluation of Tourism Resources Based on Multispecies Evolutionary Genetic Algorithm-Enabled Neural Networks, Computational Intelligence and Neuroscience, 2021, 2021. https://doi.org/10.1155/2021/1081814
[16] Kisi, O.; Alizamir, M.: Modelling Reference Evapotranspiration Using a New Wavelet Conjunction Heuristic Method: Wavelet Extreme Learning Machine vs Wavelet Neural Networks, Agricultural and Forest Meteorology, 263, 2018, 41-48. https://doi.org/10.1016/j.agrformet.2018.08.007
[17] Lawrence, W. K.: The Experience of Contrasting Learning Styles, Learning Preferences, and Personality Types in the Community College English Classroom, Northeastern University, 2014.

[18] Lee, C. H.; Teng, C. C.: Identification and Control of Dynamic Systems Using Recurrent Fuzzy Neural Networks, IEEE Transactions on Fuzzy Systems, 8(4), 2000, 349-366. https://doi.org/10.1109/91.868943
[19] Li, M.: Multidimensional Analysis and Evaluation of College English Teaching Quality Based on an Artificial Intelligence Model, Journal of Sensors, 2022, 2022. https://doi.org/10.1155/2022/1314736
[20] Lukovac, V.; Pamučar, D.; Popović, M.: et al. Portfolio Model for Analyzing Human Resources: An Approach Based on Neuro-Fuzzy Modeling and the Simulated Annealing Algorithm, Expert Systems with Applications, 90, 2017, 318-331. https://doi.org/10.1016/j.eswa.2017.08.034
[21] Luo, Q.; Yang, J.: The Artificial Intelligence and Neural Network in Teaching, Computational Intelligence and Neuroscience, 2022. https://doi.org/10.1155/2022/1778562
[22] Maier, H. R.; Jain, A.; Dandy, G. C.: et al. Methods Used for the Development of Neural Networks for the Prediction of Water Resource Variables in River Systems: Current Status and Future Directions, Environmental Modelling & Software, 25(8), 2010, 891-909. https://doi.org/10.1016/j.envsoft.2010.02.003
[23] Maroufpoor, S.; Bozorg-Haddad, O.; Maroufpoor, E.: Reference Evapotranspiration Estimating Based on Optimal Input Combination and Hybrid Artificial Intelligent Model: Hybridization of Artificial Neural Network with Grey Wolf Optimizer Algorithm, Journal of Hydrology, 588, 2020, 125060. https://doi.org/10.1016/j.jhydrol.2020.125060
[24] Mehring, J.: Present Research on the Flipped Classroom and Potential Tools for the EFL Classroom, Computers in the Schools, 33(1), 2016, 1-10. https://doi.org/10.1080/07380569.2016.1139912
[25] Mitra, S.; Hayashi, Y.: Neuro-Fuzzy Rule Generation: Survey in Soft Computing Framework, IEEE Transactions on Neural Networks, 11(3), 2000, 748-768. https://doi.org/10.1109/72.846746
[26] O'Neill, P.; Adler-Kassner, L.; Fleischer, C.: et al. Creating the Framework for Success in Postsecondary Writing, College English, 74(6), 2012, 520-524.
[27] Pal, S. K.; Talwar, V.; Mitra, P.: Web Mining in Soft Computing Framework: Relevance, State of the art and Future Directions, IEEE Transactions on Neural Networks, 13(5), 2002, 1163-1177. https://doi.org/10.1109/TNN.2002.1031947
[28] Shamshirband, S.; Rabczuk, T.; Chau, K. W.: A Survey of Deep Learning Techniques: Application in Wind and Solar Energy Resources, IEEE Access, 7, 2019, 164650-164666. https://doi.org/10.1109/ACCESS.2019.2951750
[29] Valueva, M. V.; Nagornov, N. N.; Lyakhov, P. A.: et al. Application of the Residue Number System to Reduce Hardware Costs of the Convolutional Neural Network Implementation, Mathematics and Computers in Simulation, 177, 2020, 232-243. https://doi.org/10.1016/j.matcom.2020.04.031
[30] Wu, J.; Feng, Q.: Recommendation System Design for College Network Education Based on Deep Learning and Fuzzy Uncertainty, Journal of Intelligent & Fuzzy Systems, 38(6), 2020, 7083-7094. https://doi.org/10.3233/JIFS-179787
[31] Yang, X.; Zhou, X.; Hu, J.: Students' Preferences for Seating Arrangements and Their Engagement in Cooperative Learning Activities in College English Blended Learning Classrooms in Higher Education, Higher Education Research & Development, 2021, 1-16. https://doi.org/10.1080/07294360.2021.1901667
[32] Zhang, F.: Innovation of English Teaching Model Based on Machine Learning Neural Network and Image Super Resolution, Journal of Intelligent & Fuzzy Systems, 39(2), 2020, 1805-1816. https://doi.org/10.3233/JIFS-179953