A Tutoring System of Ideological and Political Education Data Resources for College Students Based on Intelligent CAD

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Abstract. As educational institutions increasingly emphasize the importance of ideological and political literacy, the need for effective tools that engage students is paramount. This study explores how HCI principles can be integrated into the design of an interactive platform that facilitates access to diverse educational materials, promotes critical thinking, and encourages active participation. By employing AI-driven CAD tools, the system visualizes complex ideological concepts and political frameworks, making them more accessible and engaging for students. The findings demonstrate that an intuitive HCI design significantly improves user engagement and learning outcomes, fostering a deeper understanding of political ideologies. A model-sharing data matching algorithm based on the DL(Deep Learning) model is proposed in order to address the issues of low matching efficiency and poor stability when standard matching algorithms match the entire shared data. When structural and semantic similarity are combined with the idea of similarity probability, mapping elements between patterns are constructed, and the relationship between them is determined based on the similarity probability. On the data set, the technique model suggested in this work outperforms the comparison algorithm and has an accuracy rate that is around 18% higher. The testing findings unequivocally demonstrate the efficacy of the suggested algorithm.

Keywords: Intelligent CAD; Ideological and political education; Tutoring System; Data resource sharing; Data matching
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1 INTRODUCTION

The formalization and superficiality of Chinese college students' IPE continue to be issues at this time (Ideological and Political Healthcare Education). The majority of college students struggle to attain the union of knowledge and action because they receive education in a passive manner and need to comprehend its content. This phenomenon falls under the category of surface knowledge. The advancement of network and computer technologies has paved the way for the interchange of data resources. There are some data resource-sharing platforms that started earlier and have progressed better both domestically and internationally, while new sharing platforms are continually emerging. By developing new IPE material and instructional methods, the IPE data resource-sharing platform hopes to increase its effectiveness [1]. The IPE resources of schools are dispersed because of the limitations of technology and environmental factors. It is crucial to share resources, increase resource utilization, and guarantee the efficient and long-term use of IPE resources.

At present, the management of teaching resources is mainly limited to directory management and structured data storage, while on the physical structure, data is mainly stored centrally. Once the server hardware fails, the service provided to users will stop [2]. Therefore, building an open and interactive platform for sharing teaching resources can realize the unification and integration of teaching resources. The developed resource base is often based on different system platforms and database platforms. Therefore, it is difficult to realize the mutual utilization of teaching resources among school resource database systems [3-4]. Based on this, this paper takes the university IPE data resource exchange platform as the research object and then provides theoretical and practical significance for the university IPE data resource exchange platform. More and more attention has been paid to IPE in national universities, and many measures have been taken to improve the overall level and effectiveness of IPE. From today's point of view, a certain degree of co-construction and sharing has also become a common phenomenon of university IPE.

This Research presents the development of a Human-Computer Interaction (HCI) system designed to enhance ideological and political education for college students, utilizing AI-powered Computer-Aided Design (CAD) technology to manage and present educational data resources. As educational institutions increasingly emphasize the importance of ideological and political literacy, the need for effective tools that engage students is paramount. An efficient platform for IPE shared education and teaching resources should integrate multi-disciplinary, multi-category, and multi-user education and teaching resources so that many educational subjects, including IPE class teachers, students, faculty, and staff, can upload shared education resources with the same authority. Have a detailed and perfect organizational structure, operation process, and communication and coordination mechanism. Select a unified research topic, make a cultural synonym questionnaire, and file and share data in a unified way. Detailed sampling parameters are specified in the data collection process, which is subject to the background information of visitors, weight coefficient, etc. This paper analyzes the problems existing in the construction of IPE resources in universities based on DL(Deep Learning) technology so as to reduce the waste of resources, make up for the shortage of resources, improve the utilization rate of IPE resources, and promote the coordination of IPE resources among universities. Expanding the short board of national IPE is of great significance in further realizing educational equity.

Research innovation:

(1) In this paper, an open, unified, and widely applicable IPE data resource-sharing platform for college students is developed. This system aims to solve the existing problems of uneven distribution of university teaching resources, repetitive construction of resources, low utilization rate of resources, etc., so as to shorten the cycle of sharing teaching resources, reduce the investment of each school in educational equipment and promote the effective sharing and integration of teaching resources.

(2) Aiming at the problems of low matching efficiency and poor stability when traditional matching algorithms match comprehensive shared data, this paper studies a new comprehensive shared data matching algorithm based on DL. The parameters are determined to provide a reliable guarantee for the effective and stable operation of the matching algorithm.

The theoretical structure and specific research contents of this paper are as follows:

The first chapter introduces the background work of the Research. The second chapter mainly introduces the current situation of educational resource construction or sharing Research. The third chapter presents the design of a shared data-matching algorithm based on DL. The fourth chapter verifies the performance of the model studied in this paper. The fifth chapter is the conclusion.

2 RELATED WORK

2.1 The Present Situation of Research on the Construction or Sharing of Educational Resources

In recent years, with the rapid development of the economy and education and the progress of information technology, more and more attention has been paid to resource sharing, but the focus of attention is mainly on the allocation of educational resources and the exchange of information. Aydogan believes that the sharing of educational resources is mainly a process of inter-school cooperation and joint use of educational resources [5]. Costello regards resource sharing as a kind of service, thinks that educational resource sharing is a way that educational resources can serve different subjects, and pays attention to the conditions and limitations in the process of educational resource sharing [6]. Jewitt et al. put forward from the angle of economics that resource sharing is because schools can't provide the services that students need independently, but they must realize this through sharing. Schools need to improve their competitiveness and consolidate their own IPE university resource sharing. Construction sharing means that all resource providers jointly establish an IPE resource pool with a certain openness and allow the IPE resource pool to serve different universities [7].

Camobreco pointed out that IPE resources are the sum total of the elements that bring benefits to educators and create conditions for realizing the purpose of IPE in the process of IPE, and emphasized that IPE resources are composed of human, financial, organizational, cultural, and institutional elements [8]. Di et al. believe that the construction of an IPE co-construction and sharing platform system is conducive to improving the breadth and depth of co-construction and sharing, not only breaking through the current bottleneck of IPE development and sharing university resources but also further enriching the connotation of theoretical courses [9]. Zhao et al. set up an educational resource portal to enable teachers and students to obtain this organized information efficiently and accurately [10].

2.2 DL Technology-related Research

DL algorithm belongs to the category of machine learning, which is one of the important branches of artificial intelligence applications. It extracts hidden features from data by algorithm, then classifies and regresses the data, and completes the functions of intelligent identification and prediction. In recent years, artificial intelligence products based on DL algorithms have emerged endlessly, which brings a lot of convenience to our work and life.

Cui et al. designed and trained a CNN (Convective Neural Network) using a backpropagation algorithm. CNN is a DL framework generated by minimizing the error function based on the error correction principle [11]. Tankus et al. put forward DBN(Deep Belief Network) model. You can build a DBN by stacking multiple RBM(Restricted Boltzmann Machine) from bottom to top. The state of the node can be a continuous Gaussian state or a Bernoulli binary state [12]. Wood proposed an unsupervised layer-by-layer training method to overcome the difficulty of training deep neural networks. This layer-by-layer learning strategy improves the lower bound of the probability of training data based on the mixed model and generates model parameters suitable for data characteristics [13]. Zhang et al. proposed an approximate reasoning method, a DBM based on the Depth Boltzmann machine. By using a single recognition model, all hidden layer values are initialized by one operation, from bottom to top [14].

Feng et al. introduced a self-training algorithm in the field of target detection and achieved the best results at that time [15]. Wei et al. put forward a variety of methods to automatically segment the sample set, which divided the sample set into two sets with relatively independent features for subsequent collaborative training and got a good classifier [16]. The MTAT(Mean Teacher Average Teacher) model proposed by Xie et al. tries to overcome this problem by considering the moving average of connection weights instead of network activation [17]. Cho studies the situation when the input interference is large, trains the input samples after lifting them, and then performs the same lifting on the unlabeled samples to make predictions. According to the prediction result, the marked data and the unlabeled data are merged. Therefore, a new category is generated to update the network training, and this method has achieved good results [18].

3 METHODOLOGY

3.1 Overall Design of IPE Data Resource Sharing Platform

University IPE resources have many related contents, which are expressed in various ways and passed on to college students to achieve the purpose of ideological education. With the development of society, the rich ideological education resources in universities are more abundant, and the degree of development and utilization will be continuously strengthened. The development and utilization of resources is to link objective resources with purpose so that resources that can't play a direct role can be turned into practical resources and serve university IPE. One is to increase the quantity by finding and exploiting new resources, and the other is to carry out in-depth development on the basis of existing resources, tap the potential of resources, and improve the utilization rate.

The definition of IPE resources also reveals the relationship between resources, practical activities, and goals. IPE resources achieve IPE goals through a series of practical activities. Fusion is a necessary stage in the development of things, and it is also a stage in the evolution process. IPE resource integration is used to make disorganized elements orderly through certain methods so as to maximize the overall benefits. The author believes that community IPE resources refer to various elements that can be used for community IPE practice activities and promote the realization of community IPE goals under certain social and historical conditions.

On the premise of not increasing or increasing the contribution of IPE, implementing resource sharing among universities, society, and universities can maximize the role of existing universities' IPE resources and improve the use efficiency of educational resources. In fact, IPE resources of various universities are scattered in different regions and units, which are limited by time and space and cannot be effectively aggregated.

IPE's data resource-sharing platform includes all kinds of educational resources. It is not about the arrangement and storage of educational materials but about how to design and organize teaching resources to better serve learning. Therefore, the construction of an IPE data resource-sharing platform should focus on how to apply it to learn this problem. With the rapid development of science and technology, the conditions and facilities of education and teaching are also changing. Keeping pace with the times and unifying resource files are very important to the overall progress of education. IPE's data resource-sharing platform serves education and teaching, and its construction should highlight the perfect unity of teaching and learning. The construction of an IPE data resource exchange platform should organize resources reasonably according to a certain educational model, which is in line with the development law of pedagogy and psychology under the current educational environment. Therefore, adopting advanced educational technology is to promote the construction of an IPE data resource-sharing platform.

At present, most of the research results are aimed at semantic similarity between elements, and the Research in this area is quite mature. In this chapter, a new matching method using pattern structure information is proposed. That is, the mapping relationship between elements is selected according to similarity probability. We use the same formula as the similarity of secondary structures to calculate the similarity of main structures:

$$asim(s,t) = (\delta(s,t))^2 \times \left(\frac{m}{m+\alpha}\right) \tag{1}$$

Among them is the candidate matching pair, the stability factor, and the smaller the value of the parameter, the smaller the influence of the stability factor on substructure similarity. On the contrary, the stability factor has a greater influence on the similarity of substructures.

Similarity probability indicates the probability value of each element matching with its candidate elements [19]. For any item in the source pattern, the greater the sum of similarity values of all candidate matches, the greater the probability that the item actually matches in the target pattern.

For any element x in the source pattern and its candidate matching set $CAND(x)$, the probability that x matches in the target pattern can be calculated by formula (2):

$$P(x) = \frac{\sum_{y}^{y \in CAND(x)} sim(x,y)}{\sum_{y}^{y \in CAND(x)} sim(x,y) + d} \tag{2}$$

Where d is the parameter, in the same case, the larger d is, the smaller the probability of candidate matching of x is, that is, the more pessimistic the algorithm is. The smaller d is, the more likely there is a candidate match for x, and the more optimistic the algorithm is.

As the educational resource management platform runs on the Internet and is open from a distance, users can access the platform from any networked machine, get the required resources and information, and at the same time, they can also learn daily. Life management is not limited by time and space. The system adopts a typical Web-based B/S three-tier architecture: presentation layer, business layer, and data access layer, and realizes inter-site communication with Web service technology. The structure of the educational resource management system is shown in Figure 1 below.

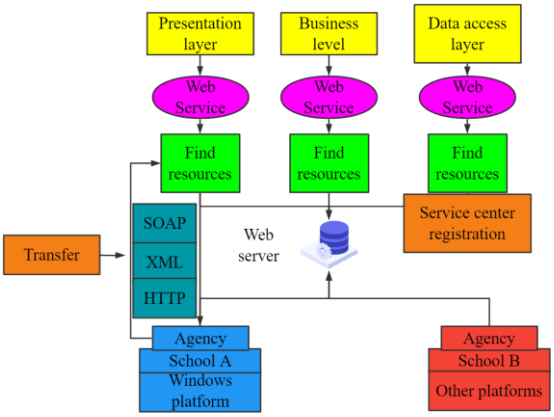

Figure 1: System structure.

The resources needed to retrieve big data are fundamentally different from traditional database queries. Therefore, in the Hadoop cluster environment, all resources uploaded to HDFS are not only stored on different DataNodes but also the index files corresponding to the resources are generated. Log in to the system background management interface and select User Management, which is related to common user information. Administrators can obtain all the information filled in by ordinary users when registering, including user names, passwords, ratings, and major ratings, and can add ordinary users and modify or eliminate processing, resulting in E-R, as shown in Figure 2.

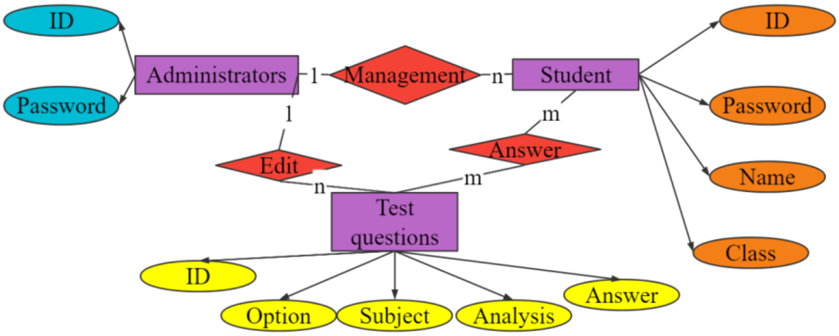

Figure 2: E-R diagram with administrators and users.

XML (Extensible Markup Language) is characterized by the separation of description and data representation, which makes it simple and feasible to use XML to construct personalized description of online education resources. When a client browses an XML document, the related DTD files will be downloaded to the client along with the document, and the client browser knows how to handle them. The stylesheet files are processed by the XSL (Extensible Stylesheet Language) processor to display the information in the correct format.

3.2 Design of Shared Data Matching Algorithm Based on DL

Dig up old resources and develop new ones. With the development of the Internet plus times and the innovation of teaching methods, it is imperative to find new teaching resources to ensure the smooth progress of IPE. Strengthen students' ability to use the Internet and create information. Teachers should be good at exercising their autonomy, improving their ability to use the Internet to judge, resist misinformation, and innovate, and making the Internet Plus a stage for them to express themselves. The active participation of resource-sharing subjects, the coordination and integration of various parties, and the promotion of the integration of new resources of the resource-sharing platform under such joint forces are the prerequisites for the success of the platform.

Machine learning is a collection of basic artificial intelligence algorithms, and its research interest is increasing day by day. The application of machine learning in payment, speech translation, disease diagnosis, unmanned driving, and other scenarios has achieved great success. Under the guidance of students' supervision information, through an inductive study of sample features, the mapping transformation between sample features and class labels can be found so that students can have the ability to predict unknowns. In this paper, the complete DL-based shared data matching algorithm is studied, and a matching algorithm is proposed to process the complete shared data effectively. it is determined that the content found through the parameters meets the running conditions of this matching algorithm [20].

Efficient management of parameters is also one of the important conditions for comprehensive data sharing. The parameters and contents of the matching algorithm are huge and complex, so only standardized management can be effectively applied. The descriptive parameters of the comprehensive shared data are determined by the distance between the comprehensive shared data

x, y and the discrete center of the algorithm, and finally, the similarity of the matching algorithm can be determined according to the following formula:

$$\delta(x, y) = 1 - \frac{\sum_{i=0}^{n} f_x - f_y}{V} \tag{3}$$

f_x, f_y are the function values of x, y, respectively, from which the similarity of matching data can be calculated.

Logistic regression is a common and efficient classifier that has many advantages, such as no prior assumption of data distribution, good mathematical properties of the model, and so on. The last layer of CNN is generally the classification layer, and CNN uses logistic regression as the classification layer of CNN. The assumed function of the logistic regression model is:

$$h_\theta(x) = \frac{1}{1 + e^{\theta^T x}} \tag{4}$$

This function, also known as the ratio function, is a convex function with any derivative order. $h_\theta(x)$ represents the probability of an event for sample x, and θ is a trainable parameter.

In the semi-supervised model, the main function of image reconstruction is to prevent over-fitting caused by too few supervised samples and enhance the generalization ability of the model. We call the constraint of image reconstruction: R_{data}. In this way, we get the objective function of the CNN-based semi-supervised clustering model:

$$\arg\min\left(R_{data} + \lambda \cdot R_{cls}\right) \tag{5}$$

Among them λ is the weight coefficient between two constraints. Using the given 1% labeled samples and the remaining 99% unlabeled images, we iteratively train the semi-supervised clustering network and stop the iteration when the cluster allocation is no longer updated.

The application resources deployed in the service node provide exploration tools, select from the effective application resources, form a shareable application information base, and publish the shareable application information in the hub resource log. The resource registration center creates a directory of shared application resources and provides resource tables for end users to filter and form a menu of personal application resources in the personal computing environment. The main workflow of the resource registration center is shown in Figure 3.

Set a series of rules and thresholds. As long as the output confidence of the filter exceeds the threshold Θ, the sample is considered to belong to the category corresponding to the filter, and the discriminant value of the sample is accumulated by 1. Only the pictures of one predictive category will be kept in the voting result; that is, only the sample with the discriminant value of 1 will be kept and marked with a predictive mark. Category filter S_{c_i} is a set of subnetworks related to category c_i, and the model of this set will jointly decide whether the category of an input sample is c_i.

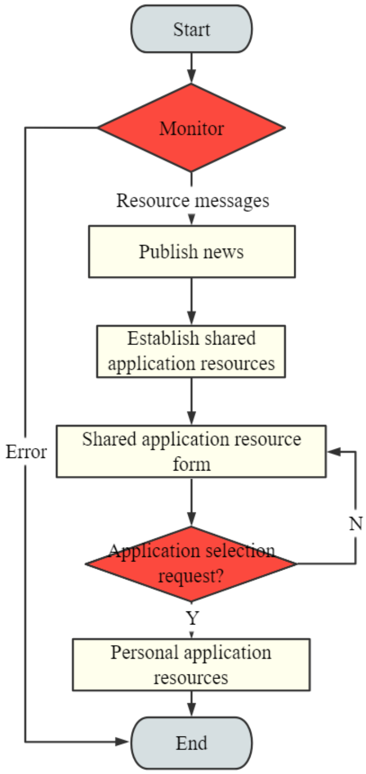

Figure 3: Main workflow

$$F\left(S_{c_i}\right)=\begin{cases}1, & \sum_{i=1}^{m(m-1)} f\left(M_{c_i,c_j}\right)\times\alpha_i \geq \Theta \\ 0, & \sum_{i=1}^{m(m-1)} f\left(M_{c_i,c_j}\right)\times\alpha_i < \Theta\end{cases} \tag{6}$$

α_i is the weight of the model i, and the output value of the category filter will be calculated by the weighted sum of each relevant model.

$W=\{W^1,W^2,W^3\}$ is the model parameter of the whole Boltzmann machine, W^1 is the weight matrix connecting the neuron nodes between the visible layer V and the first hidden layer h^1, and W^2,W^3 is the weight matrix of the neuron nodes between the hidden layer h^1,h^2 and the hidden layer h^2,h^3 respectively.

The energy of the whole Boltzmann machine can be defined as:

$$E(v,h,W)=-V^TW^1h^1-h^1W^2h^2-h^2W^3h^3 \tag{7}$$

Here v represents the state of neurons in the visible layer, and $h=\{h^1,h^2,h^3\}$ represents the state of neurons in the three hidden layers.

Its calculation method is as shown in Formula (8).

$$h_t = f\left(Wh_{t-1} + Ux_t + b\right) \tag{8}$$

Where W,U is a learnable parameter, f is an activation function, and h_t is the activation value of the hidden layer at time t.

In this paper, it is suggested that the decoder be kept unaffected and the clustering loss be added directly to the feature space. The reconstruction loss is put forward because this paper thinks that this adjustment will distort the feature space and weaken the representativeness of potential features, thus affecting the clustering performance. This paper aims to keep the decoder unchanged, such as reconstruction loss. As follows:

$$L_r = \sum_{i=1}^{n} \left\| x_i - g_w\left(h_i\right) \right\|_2^2 \tag{9}$$

Where $h_i = f_w\left(x_i\right)$, f_w, g_w is the mapping of encoder and decoder, respectively. The encoder can retain the local structure of data generation distribution. On this premise, using cluster loss operation will not lead to the damage of feature space.

We add the data reconstruction constraint and the in-class constraint together to form the feature clustering objective function with the in-class constraint:

$$\min\left(R_{data} + \alpha \cdot R_{samples}\right) \tag{10}$$

α is the weight coefficient, which is used to adjust the relationship between data reconstruction and intra-class constraints. Using the above objective function for iterative training, we can realize the clustering of samples.

4 EXPERIMENT AND RESULTS

Figure 4 shows the running efficiency comparison of the comprehensive shared data comparison algorithm. From the comparison results in figure 4, it can be seen that the matching algorithm in this paper adopts the data block formula for operation, which significantly improves the operation efficiency of the matching algorithm and is far superior to the traditional algorithm.

The number after the DL model name indicates the depth of the depth module, CNN indicates that the residual block with identity mapping is used, and RNN indicates that the sequence module is not used. The depth module formed by the stack of residual blocks contains 16 fully connected layers. The comparison results show that the residual structure has a positive influence on the model, and the model effect is greatly improved.

In order to evaluate the effect of the semi-supervised ensemble learning algorithm proposed in this paper, experiments were conducted on two data sets, and the experimental results were selected from the reference values in the two data sets. The Benchmark test results were compared with similar algorithms, and the ablation experiment was verified. The experimental results are shown in Table 1.

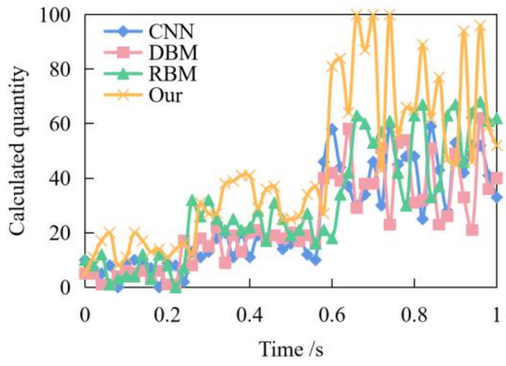

Figure 4: Efficiency comparison of algorithms.

Algorithm	Data set 1	Data set 2
CNN	52.36%	17.69%
DBM	47.28%	20.04%
RBM	33.01%	3.36%
Our	33.68%	3.25%

Table 1: Performance comparison of each algorithm

After using the algorithm in this paper, the average error rate under experimental conditions is the best, which is 1%~2% lower than the previous one. However, the results of ablation experiments show that the network performance is improved, and the error rate is reduced by 1%.

Visualization of the training process of the rotation angle prediction model using unsupervised data is shown in Figure 5 and Figure 6. It can be seen that the network can converge well. The accuracy rate in the model validation set can reach 92.17%, and the accuracy rate in the training set can approach 96%. The accuracy rate of samples is relatively low, and the degree of over-fitting is relatively small. Experiments show that the rotated samples have high separability and are suitable for classification data sets.

Category	Before improvement	After improvement
Character	5.32	1.96
Numeric	4.63	3.03
Rare type	2.58	1.24

Table 2: Comparison of matching time before and after improvement of the feature selection method.

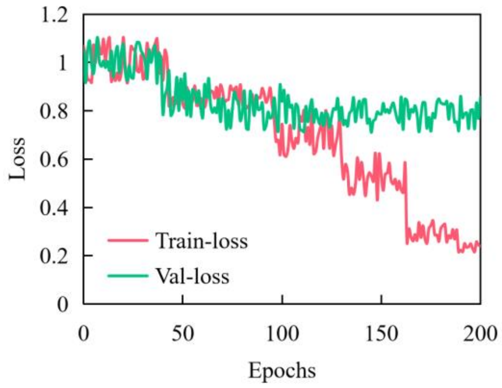

Figure 5: Loss curve.

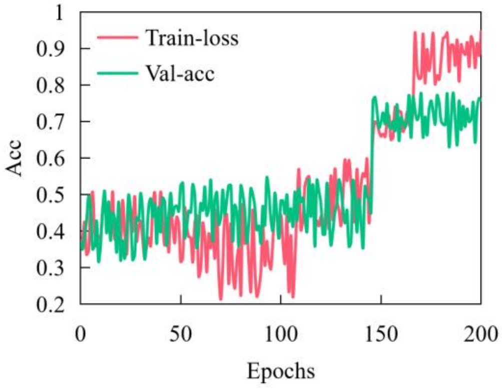

Figure 6: Accuracy curve.

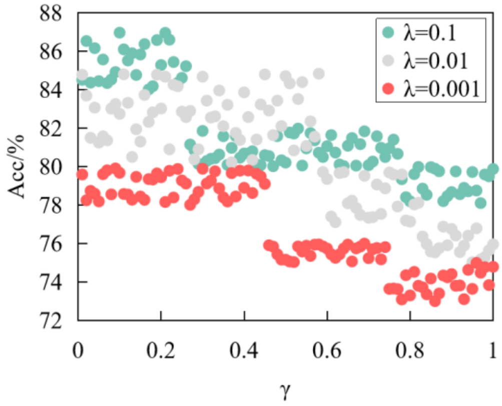

Figure 7: Influence of λ and γ.

From the accuracy of experimental matching results, the accuracy of the two attribute matching methods is the same, but the improved method has a greater improvement in matching time than the previous literature method [19], especially for character types and rare attributes. Table 2 shows the comparison of matching time before and after feature selection method enhancement.

In order to verify the influence of the clustering coefficient γ in the formula on the performance of this algorithm, a sampling experiment is carried out on the data set in $\left[10^{-1},10^{-2}\right]$ range. The experimental momentum is 0.8, and the learning rate is set to $\lambda \in \left[0.1,0.001\right]$. The results are shown in Figure 7.

When the learning rate is 0.01, the experimental results are better, too small γ will eliminate the positive impact loss term of the cluster, and large γ value will often distort the feature representation space. The learning rate λ is coupled with the clustering coefficient γ. For a larger λ, it requires a smaller γ retention performance. But the combination of small λ and large γ will lead to higher performance.

Figure 8 shows the comparison results between the proposed method and CNN, DBM and RBM methods. It can be seen that the method model proposed in this paper is superior to the comparison algorithm on the data set. The accuracy rate is about 18% higher than that of the comparison method, and the experimental results clearly prove the effectiveness of the proposed algorithm. After repeating about 50 iterations, we stopped the iteration and got the final result of the pool. Using the constrained feature space clustering algorithm proposed in this paper can further improve the distinguishability of features.

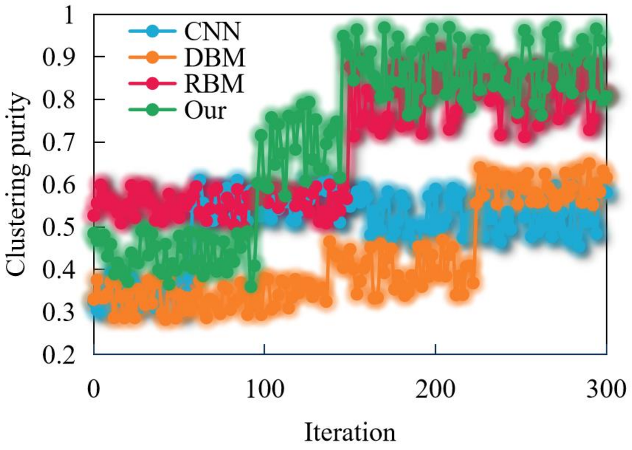

Figure 8: Comparison results of clustering purity of algorithm.

If the interval does not match, there is a significant difference between the two methods being compared. On the contrary, if their corresponding solid lines overlap, there is no significant difference between the two methods compared. The more overlap, the greater the difference. Using only one iteration, the average classification rate reaches 92.0%, while the classification results corresponding to more iterations are very similar, and the average accuracy rate is close to 96.0%. However, it takes more time to solve the low-rank representation matrix. We hope that the iterative method can play a greater role in learning a larger-scale domain to adapt to the scene.

The resource subject puts its own resources on the platform, and the sharing platform needs to select the newly provided resources, which is the initial link of the resource-sharing platform. In the whole process of teaching, students' preparation level before class, whether they study consciously and independently and preview what they have learned. Participate in classroom activities and classroom activities, as well as student coordination in class. In teaching, the key point is whether students have correctly mastered the psychological debugging skills of the items they have learned and whether they can choose the correct methods. If they do, they should not apply them superficially.

5 CONCLUSIONS

Since the advent of the Internet and the widespread adoption of information technology, educational informatization has undergone a thorough investigation and now plays a significant part in the modernization of the country's educational system. University IPE data resource-sharing platforms present a challenging issue. This Research introduces a DL-based platform for sharing IPE data resources among university students. The B/S structure, which underpins the entire system, achieves unified description, practical management, and practical transmission. Features of the educational resources. The operation of the shared data matching algorithm will be improved by the data partitioning algorithm and the data significance algorithm based on DL technology, which has been thoroughly investigated in relation to the entire shared data set. On the data set, the technique model suggested in this work outperforms the comparison algorithm and has an accuracy rate that is around 18% higher. The testing findings unequivocally demonstrate the efficacy of the suggested algorithm. Additionally, it can significantly decrease the amount of network communication data and node power consumption, increase network lifespan, and produce superior merging effects.

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