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Retraction

Retracted: Application of Improved Machine Learning and Fuzzy Algorithm in Educational Information Technology

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Security and Communication Networks has retracted the article titled "Application of Improved Machine Learning and Fuzzy Algorithm in Educational Information Technology" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

The authors do not agree to the retraction.

References

[1] Z. Wang and G. Wang, "Application of Improved Machine Learning and Fuzzy Algorithm in Educational Information Technology," *Security and Communication Networks*, vol. 2022, Article ID 4912841, 11 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

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Research Article

Application of Improved Machine Learning and Fuzzy Algorithm in Educational Information Technology

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In order to improve the teaching effect of intelligent education, this paper combines machine learning and fuzzy algorithm to improve the application effect of educational information technology and the use of information platform. Moreover, this paper collects the user's behavior information in the process of using the platform as the user's interest description and selects personalized upgrade resources for the user. In addition, this paper introduces the similarity as a personalized recommendation evaluation standard and calculates the average similarity between the recommended related resources and the user's interest. Finally, this paper constructs an educational information system based on improved machine learning and fuzzy algorithms. The experimental research results show that the intelligent system proposed in this paper can play an important role in educational information processing and teaching quality improvement.

1. Introduction

The application of educational information technology refers to the educational and teaching activities that use educational information technology under the guidance of educational science and information science theory and in accordance with certain educational goals, educational principles, and educational plans. Through the analysis of the basic concepts of educational information technology and its system structure, we can find that the application of electronic education or modern science and technology in education and teaching that we have been engaged in for a long time is the application of educational information technology.

There is another reason for the concept of educational information technology, that is, educational informatization is the process and result of the popularization and application of educational information technology. This is just as networking is the promotion and application of network technology, and multimedia is the promotion and application of multimedia technology [1]. The "five modernizations" that represent the basic characteristics of educational informatization, namely, multimedia display of educational information, digitization of educational information processing, CD-based educational information storage, networked educational information transmission, and intelligent educational information management are the processes and results of the promotion and application of various educational information technologies. From the perspective of informatization, it can be said that educational information technology is a general term for various technologies used to realize educational informatization. The purpose of the national informatization construction spending huge sums of money to carry out some informatization projects is to promote the application of information technology, make it a multiplier of productivity, and produce advanced and efficient social functions [2].

In the era of "Internet + education", the integration of information technology and classroom teaching is an inevitable trend of education reform. At present, traditional information technology cannot cope with the challenges brought by the explosion of information in the digital environment to classroom teaching, and educational information technology is gradually playing a role. The actual process of educational information technology facing the teaching of various disciplines focuses on the development and application of information technology suitable for teaching [3].

This paper combines improved machine learning and fuzzy algorithms to explore the application of educational information technology, improve the application effect of educational information technology, and provide a reference for the further development of subsequent educational information technology.

2. Related Work

Traditional education has always been faced with practical problems such as lack of learning resources, single learning method, and single teaching mode. Of course, this is not unrelated to the ideal education that people have been looking forward to, that is, learning can be more convenient, relaxed, and free. The invention of technology contains people's purposes and values. The application of technology in the field of education is expected to produce beneficial value and promote practical teaching. In this way, it is logical for some scholars to study the educational application of technology [4]. In recent years, with the gradual development of educational technology, the exposure of various problems in educational technology practice, and the frequent occurrence of alienation, some researchers have begun to consciously think about the nature of educational technology and human development, philosophical methodology has gradually introduced into the study of educational technology, and Marx's theory of alienation and his thoughts on the all-round development of human beings are gradually cited by people and they try to find solutions to problems from Marx's theoretical nutrition [5]. This undoubtedly promotes the deepening of the research on the basic theory of educational technology. The opportunities and challenges brought by modern information technology to education are unprecedented. It is an inevitable choice to reshape the form of education under the background of information technology by extensively absorbing the research results of the philosophy of technology and re-examining the problem of alienation in the field of education [6]. The problem of technology alienation is a very important issue in the philosophy of technology. The problem of modern educational technology alienation discussed in the literature [7] undoubtedly draws theoretical nourishment from the philosophy of technology and regards the development of technology, education, and human beings as the starting point and destination of this paper. In the following, the author will make a general summary of the research on this issue at home and abroad.

Literature [8] raised the duality of computer and online education and believed that the purpose of developing technology in education should be aimed at people and should be filled with care for people's development. However, one-sided emphasis on the practical value of technology in educational technology will, to some extent, lead to indifference to cultural and spiritual life other than technology, ignore the value of life, and make education lose its responsibility of "making people into people." Value pursuit: literature [9] pointed out that technology itself does not help students to learn actively, the difference lies in how technology is applied to the learning process, and the key lies in how technology is integrated to provide an effective learning experience. Literature [10] believes that when technology is applied to teaching and promotes learning, it also produces a series of new problems and points out that, among many new problems, it is particularly noteworthy that, with the continuous strengthening of technological power, technology itself has from an extended tool of human power to an ideology that controls people and educational technology has evolved into a hegemonic power in the education and teaching system, which seriously threatens the subject and object of education—teacher and student. The dominant position of human beings faces the danger of losing their free choice.

Literature [11] defines information technology as: science applied in information processing and processing, training methods, and management skills of technology and engineering; application of skills and methods; computer and its interaction with humans and machines; and corresponding social, economic, and cultural storage things. Literature [12] divides the concept of information technology into two types: chivalrous and broad. In a broad sense, information technology is a general term for technologies that can expand and extend human information organs. The basic content of information technology is composed of sensing technology, communication technology, computer technology, and control technology. The chivalrous information technology refers to the human experience of collecting, transmitting, processing, storing, publishing, and retrieving various information such as data, language, text, sound, pictures, and images which is only the sum of its means and tools. These technologies enhance the human ability to process information. The understanding of information technology from different angles is also different. In this article, it is more appropriate to use chivalrous information technology, which can promote the modernization of educational ideas, methods, concepts, and means.

Literature [13] believes that the alienation phenomenon existing in the application of modern educational technology in modern teaching is embodied in three categories: purpose without means, means inconsistent with the purpose, and means becoming the purpose. It is an effective way to eliminate alienation by improving teachers' awareness of education and enhancing their practical ability to use educational technology. Literature [14] summarizes the connotation and performance of educational technology alienation and points out the inevitability and controllability of educational technology alienation and then discusses the elimination countermeasures of educational technology alienation from the level of educators. Literature [15] has a good understanding of the modernization of education in the field of education. The source of modern information technology alienation has been deeply analyzed, and it is pointed out that the competition between technology and people is the direct source of alienation. Literature [16] discussed the problem of technological alienation from the specificity of educational practice.

3. Educational User and Resource Description Model and Modeling Method

The basic information of users is mainly described in terms of school name, school type, characteristic theme, natural situation, and informatization level. Among them, the natural situation includes the level of economic development where the school is located, the area of the school, the number of classes, the number of students, the number of teachers, and the composition of teacher education. The level of informatization includes teachers' information literacy level, students' information literacy level, campus network construction, computer room configuration, and teacher computer configuration.

In order to reflect user interest more realistically, the user interest model is represented by background and tense vector space model (BTVSM). That is, subject and school stage are introduced into the model as background constraints, and the interest weight function $\omega_n(\overline{T}_n)$ based on temporal changes is introduced into the vector space, so as to calculate the attenuation and update of the user interest weight.

At certain time t, the user interest model is expressed as

$$\begin{aligned} &UI = \{s, g, K\},\\ &\quad s \in S, \quad g \in G,\\ &K = \{(k_1, \omega_1(\overline{T}_1)), (k_2, \omega_2(\overline{T}_2)), \ldots, (k_n, \omega_n(\overline{T}_n)\},\\ &\overline{T}_n = \{t_{n1}, t_{n2}, \ldots, t_{nm}\}. \end{aligned} \tag{1}$$

Among them, S represents the subject set; G represents the school section set; K represents the user interest keyword vector space; k_n is the nth keyword describing interest; $\overline{T}_n$ represents the time set of each submission of the keyword k_n; t_{nm} is the time of the mth submission of the keyword k_n; and $\omega_n(\overline{T}_n)$ is the weight function of the keyword k_n with respect to time.

For the attenuation and update of user interest, the calculation based on the time window mechanism is adopted here, that is, within a certain time window Δt, if the keyword is submitted, the weight is increased; otherwise, the weight is attenuated.

Assumptions are as follows:

(1) If each time the keyword k_n is submitted in each time window Δt, the interest weight increases by unit a

(2) If the keyword k_n is not submitted within each time window Δt, the interest weight decays by unit b;

Then, at certain time t, the interest weight function of the keyword k_n is expressed as [17]

$$\begin{aligned} &\omega_n(\overline{T}_n) = \begin{cases} \sum_{i=1}^{f(t_{n,t})} \left(f\left(t_{nl} + (i - I)\cdot \Delta t\right)\cdot a - c\cdot b\right), & \omega_n(\overline{T}_n) > 0,\\ 0, & \text{otherwise}, \end{cases}\\ &c = \begin{cases} 0, & f\left(t_{nl} + (i-1)\cdot\Delta t\right) > 0,\\ 1, & \text{otherwise}. \end{cases} \end{aligned} \tag{2}$$

In the formula, $f(t_{n1}, t)$ represents the number of time windows Δt in the time period $[t_{n1}, t]$ and $f(t_{nl} + (i - I)\cdot\Delta t)$ represents the number of times the keywords were submitted in the time window $[t_{nl} + (i - l)\cdot\Delta t, \quad t_{nl} + i\cdot\Delta t]$.

The user interest model is described in a tree structure as shown in Figure 1.

The resource description file in the system adopts the representation method similar to the user interest model, namely background and cognitive level vector space model (BCLVSM) representation. Each resource R is represented by the vector space of the subject and academic stage as the background combined with the cognitive level of the required user [18]:

$$\begin{aligned} &R = \{s, g, cl, K\},\\ &\quad s \in S, \quad g \in G, \quad cl \in \mathrm{CL},\\ &K = \{(k_1, \omega_1), (k_2, \omega_2), \ldots, (k_n, \omega_n)\}. \end{aligned} \tag{3}$$

Among them, S represents the subject set; G represents the school section set; CL represents the cognitive level of the required user; K represents the keyword vector space of the resource description file; k_n is the keyword of the nth resource description; ω_n is the weight of the keyword k_n in the resource description; and $\sum_{j=1}^{n}\omega_j = 1$ [19].

The cognitive level CL of the users required for the resource is expressed by fuzzy language, and the domain of discourse is $\mathrm{CL} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$:

Fuzzy set $L = 1/1 + 0.8/2 + 0.6/3 + 0.4/2 + 0.2/5 + 0.1/6$

Fuzzy set $M = 0.7/5 + 0.8/6 + 1/7 + 0.8/8$

Fuzzy set $H = 0.7/7 + 0.9/8 + 1/9 + 1/10$

Different forms of personalized service systems can be abstracted into a general architecture. That is, the system first collects user information, then models users according to the user information, and then provides personalized service policies and service contents on the basis of the constructed user model. The general architecture of the personalized service system is shown in Figure 2.

In the architecture of the personalized service system, the user information collection module is the basic module of the personalized service system. Since the personalized service is customized for the user, no matter what kind of personalized service it is, the collection of user information is the basis of the personalized service.

According to the analysis of the personalized service architecture, combined with the structural characteristics of ERDDS (one is that the resource description information is stored on the proxy server; the other is that the user's task request processing is implemented on the scheduling

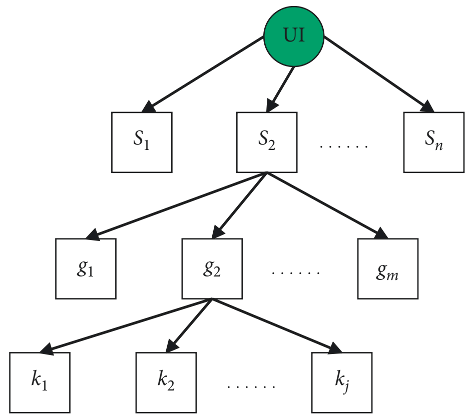


Figure 1: User interest tree.

server), the personalized service system of this system adopts the structure of the combination of client and proxy server, as shown in Figure 3.

The personalized service connotation of this system includes two aspects. One is to select personalized initial resources for new users of the information platform based on the basic information of resource users. The second is to recommend updated resources of interest to the old users of the information platform based on their interest.

The personalized initial resource recommendation process for new users is shown in Figure 4.

The service process of personalized update resource recommendation service for old users is shown in Figure 5.

In order to accurately express the resource distribution rules based on the basic information of users, the weighted uncertainty representation with credibility is used to express them in the following form [20]:

$$R\text{: if } E_i(\omega_i), \text{ then } H(\mathrm{CF}(H, E), \lambda). \tag{4}$$

Among them, E_i is the precondition of the rule, which can be either a simple condition or a combined condition formed by connecting multiple simple conditions with AND. H is the conclusion, which can be a single conclusion or a combined conclusion formed by connecting with AND. $\mathrm{CF}(H, E)$ is the credibility of the rule, called the credibility

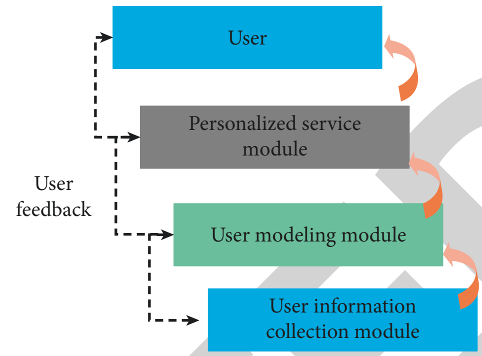


Figure 2: General architecture of personalization services.

factor (certainty factor) or rule strength. Credibility is a quantitative representation of the degree of belief that something is true, and its initial value is determined by domain experts. λ is the threshold, which sets a limit on the applicability of the corresponding rule, and only when the credibility $\mathrm{CF}(\mathrm{E_i})$ of the precondition $\mathrm{E_i}$ reaches or exceeds this limit, that is, $\mathrm{CF}(E_i) \geq \lambda$, the corresponding rule is likely to be applied. $\omega_i\,(i = 1, 2, \ldots, n)$ is a weighting factor whose values are all given by domain experts:

$$\begin{gathered} \sum_{i=1}^{n} \omega_i = 1\{0 \leq \omega_i \leq 1, \quad (i = 1, 2, \ldots, n)\} \\ R = \begin{cases} \text{application rules,} & \text{if } \mathrm{CF}(E_i) \geq \lambda, \\ \text{does not apply rules,} & \text{otherwise.} \end{cases} \end{gathered} \tag{5}$$

In the actual processing, the initial decision tree should be prebranched. The generated initial decision tree can be pruned by the prepruning algorithm and the postpruning algorithm, and a pessimistic estimate is used in the pruning process to compensate for the optimistic bias in tree generation. The algorithm extracts classification rules from the resulting decision tree, creates a rule for each path from the root to the leaf, and forms a rule set. Through decision tree classification, the following distribution rules can be obtained:

$$\begin{aligned} &R_1\text{: if } E_8 \text{ is } A \text{ and } E_9 \text{ is } A \text{ and } E_{12} \text{ is } A, \text{ then result is } Y\,(CF = 0.8, \lambda = 0.6), \\ &R_2\text{: if } E_1 \text{ is } A \text{ and } E_3 \text{ is } B \text{ and } E_4 \text{ is } C \text{ and } E_5 \text{ is } C \text{ and } E_6 \text{ is } A \text{ and } E_9 \text{ is } A \text{ and } E_{12}, \\ &\qquad \text{is } A, \text{ then result is } Y\,(\mathrm{CF} = 0.8, \lambda = 0.5), \\ &R_3\text{: if } E_1 \text{ is } B \text{ and } E_2 \text{ is } B \text{ and } E_3 \text{ is } C \text{ and } E_5 \text{ is } C \text{ and } E_6 \text{ is } A \text{ and } E_9 \text{ is } A \text{ and } E_{11}, \\ &\qquad \text{is } A \text{ and } E_{12} \text{ is } B, \text{ then result is } Y\,(\mathrm{CF} = 0.7, \lambda = 0.7), \\ &R_4\text{: if } E_3 \text{ is } B \text{ and } E_4 \text{ is } B \text{ and } E_6 \text{ is } C \text{ and } E_7 \text{ is } C \text{ and } E_8 \text{ is } A \text{ and } E_9 \text{ is } A \text{ and } E_{12}, \\ &\qquad \text{is } A, \text{ then result is } Y\,(\mathrm{CF} = 0.9, \lambda = 0.6), \\ &R_5\text{: if } E_7 \text{ is } C \text{ and } E_9 \text{ is } C \text{ and } E_{12} \text{ is } C, \text{ then result is } Y\,(CF = 0.8, \lambda = 0.6). \end{aligned} \tag{6}$$

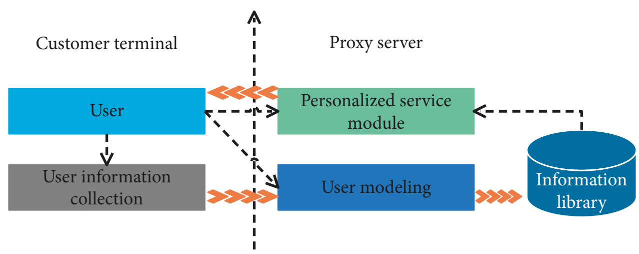


FIGURE 3: Personalized service architecture.

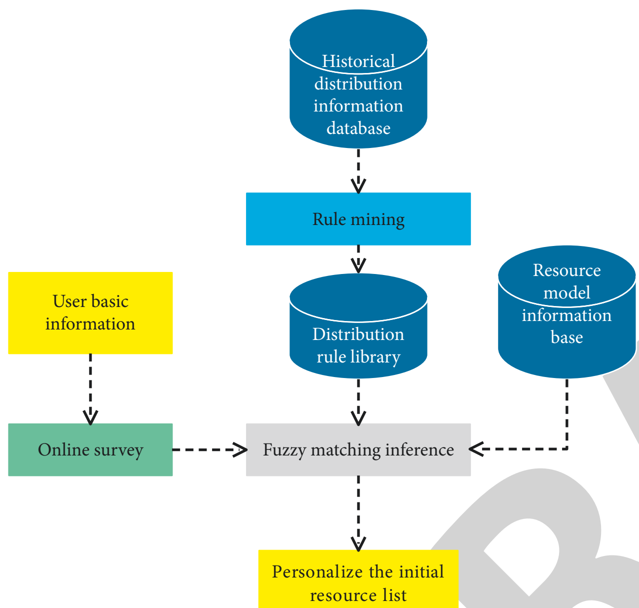


FIGURE 4: Flow chart of personalized initial resource recommendation for new users.

In the selection of distribution rules, a goal-guided reverse reasoning is used, and fuzzy matching and fuzzy reasoning are used to realize the selection of distribution rules. According to the basic information of the user, fuzzy matching is used to select the delivery rule for the user. If there is no matching rule, fuzzy reasoning can be used to generate new distribution rules to supplement the distribution rule base and continuously enrich the distribution rule base.

Assumptions:

Set of rules: $S_R = \{R_1, R_2, \ldots, R_i\}, \quad i \in N$

Rule: $R_i = \{S_E, S_C, \text{CF}, \lambda, \text{Grade}, \text{Subject}\}$. Among them, the set of preconditions is $S_E = \{E_1(\varpi_1) \wedge E_2(\varpi_2) \wedge \cdots \wedge E_1(\varpi_1)\}$, the set of conclusions is $S_C = \{C_1 \wedge C_2 \wedge \cdots \wedge C_1\}$, CF is the credibility, λ is the rule heuristic threshold, Grade represents the type of school, and Subject represents the characteristic theme of the school.

Known: the set of preconditions $S_E' = \{E_1' \wedge E_2' \wedge \cdots \wedge E_1'\}$, Grade = grade, and Subject = subject.

The fuzzy matching process is as follows:

(1) First, the algorithm extracts a set of rules that satisfy Grade = grade and Subject = subject from the rule set S_R to form the initial rule set S_{R1}.

(2) According to the evidence set S_E', the algorithm selects the rule set that meets the evidence and the preconditions from the initial rule set S_{R1} to form the intermediate rule set S_{R2}.

(3) The algorithm selects a rule R_i from the intermediate rule set S_{R2} to obtain the precondition set S_{Ei} and the threshold λ_i and calculates the total matching degree $\delta_i(S_{Ei}, S_E')$ of the condition and the evidence. If $\delta_i(S_{Ei}, S_E') < \lambda_i$, the algorithm selects the next rule R_{i+1} from the intermediate rule set S_{R2} to recalculate; otherwise, the rule R_i is stored in the target rule set S. The algorithm loops through each rule in S_{R2} until the end goes to (4).

(4) After conflict resolution processing, the algorithm obtains effective rules from the target rule set S, such as selecting the rule R_i with the largest matching degree. If the need is met, the rule is quoted and the end returns. If it is not satisfied, the algorithm tries fuzzy reasoning.

The fuzzy reasoning process is as follows:

(1) First, the algorithm extracts a set of rules that satisfy Grade = grade and Subject = subject from the rule set S_R to form the initial rule set S_{R1}.

(2) According to the evidence set S_E', the algorithm selects the rule set that meets the evidence and the preconditions from the initial rule set S_{R1} to form the intermediate rule set S_{R2}.

(3) The algorithm selects a rule R_i from the intermediate rule set S_{R2} to obtain the precondition set S_{Ei} and conclusion set S_{Ci}, credibility of the rules CF_i, and the threshold λ_i and calculates the total matching degree $\delta_i(S_{Ei}, S_E')$ of the condition and the evidence. If $\delta_i(S_{Ei}, S_E') < \lambda_i$, the algorithm selects the next rule R_{i+1} from the intermediate rule set S_{R2} to recalculate. Conversely, the algorithm computes the intersection $\wedge E_i$ of the combined conditions in the condition set S_{Ei}.

(4) The algorithm constructs the fuzzy relation $R_i(\wedge E_i, S_C)$ between the combination condition intersection $\wedge E_i$ and the conclusion set S_C using a fuzzy relation method such as Zade method (R_a or R_m) or Memdney method (R_S).

(5) The algorithm finds the intersection $\wedge E'$ of the combined evidence.

(6) According to the fuzzy hypothesis reasoning, the algorithm obtains the conclusion fuzzy set C_i' by synthesizing the intersection $\wedge E'$ and $R_i(\wedge E_i, S_C)$ of the evidence.

(7) Through the total matching degree $\delta_1(S_{Ei}, S_E')$ of conditions and evidence, the credibility $CF_{E'}$ of evidence, the credibility CF_i of rules, and the credibility CF_i' of the theoretical fuzzy set C_i' are calculated by the algorithm.

(8) The algorithm jumps to (3) and loops through each rule in S_{R2} until the end, after which the algorithm goes to (9).

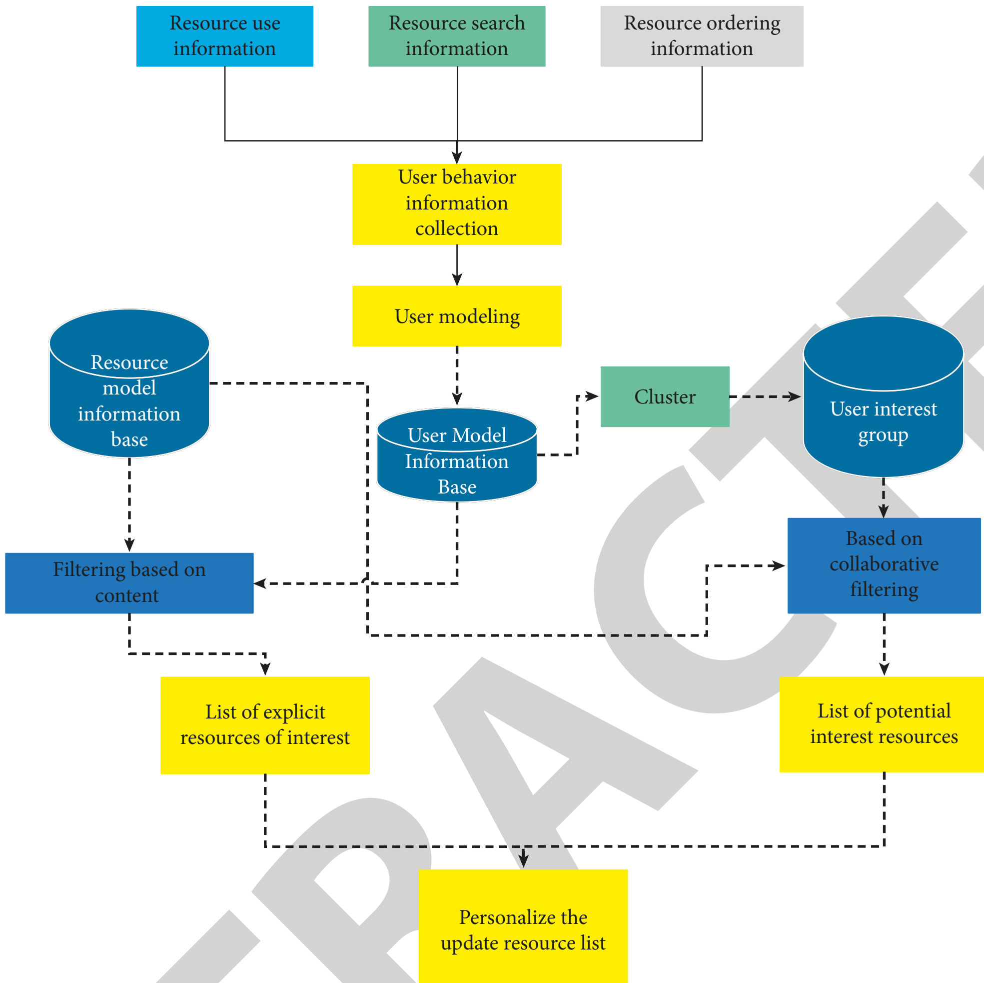


Figure 5: Flow chart of personalized update resource recommendation service.

(9) After conflict resolution processing, the algorithm selects effective rules, such as the conclusion $C_i'^{\circ}$ with the greatest reliability. If the need is met, the algorithm cites the conclusion C_i' and stores the deduced rules in the distribution rule base and returns at the end.

For vector space models, the commonly used methods are Euclidean distance, cosine distance, and inner product. For any two vectors $X = (x_1, x_2, \ldots, x_n)$ and $X' = (x_1', x_2', \ldots, x_n')$:

The Euclidean distance is

$$d(X, X') = \left(\sum_{i=1}^{n} (x_i - x_i)^2 \right)^{1/2}. \tag{7}$$

The cosine distance is

$$d(X, X') = \frac{\sum_{i=1}^{n} x_i x_i'}{\sqrt{\sum_{i=1}^{n} x_i^2 \sum_{i=1}^{n} x_i'^2}}. \tag{8}$$

The inner product is

$$d(X, X') = \sum_{i=1}^{n} x_i x_i'. \tag{9}$$

The greater the distance between the user interest keyword vector and the resource description keyword vector, the greater the similarity between them, and vice versa.

The first step of data mining is data preparation, which includes data selection, data preprocessing, and data transformation. For the clustering of user interest groups, it corresponds to clustering keyword selection, user interest model standardization, and interest degree conversion.

3.1. Interest Degree Conversion. Interest is the degree to which people are interested in an event. For the keywords in the user interest model, the larger the weight (the more occurrences), the more the user is interested in the keyword. Therefore, the weight of keywords is used here to represent the user's interest. Since the degree of interest is set to be between [0, 1], the range transformation is used to normalize the weight of each keyword, and then the degree of interest is expressed.

$$I\ D\left(k_j\right) = \frac{\omega\left(k_j\right) - \mathrm{Min}\left(\omega\left(K\right)\right)}{\mathrm{Max}\left(\omega\left(K\right)\right) - \mathrm{Min}\left(\omega\left(K\right)\right)}, \quad k_j \in K. \tag{10}$$

In the formula, $I\ D(k_j)$ represents the user's interest in the keyword k_j; $\omega(k_i)$ represents the weight of the keyword k_j; $\mathrm{Min}(\omega(K))$ represents the minimum value of all keyword weights in the user interest model; and $\mathrm{Max}(\omega(K))$ represents the maximum value of all keyword weights in the user interest model.

3.2. Clustering Keyword Selection. Although the keywords of the user interest model can reflect the user's interest topics, it is inevitable that there will be some keywords that the user is not very interested or even not interested in. If these keywords that users are not very interested in are also used for interest clustering, it will inevitably increase the calculation amount of the interest clustering algorithm and also affect the quality of the clustering. Therefore, it is necessary to select the keywords participating in the interest clustering, and only those keywords with a high degree of user interest can be used for the interest clustering. Therefore, before the user interest group clustering, the keywords smaller than the initial interest degree threshold Min_ID are removed, and the keywords with higher interest degree are selected for clustering, and the initial interest degree threshold Min_ID is determined by the user.

3.3. Standardization of User Interest Model. The interests of users are different, the number of keywords involved in the corresponding interest model is different, and the degree of interest in a certain aspect is also different. In order to compare the similarity of user interest models, the user interest models need to be normalized. The standardized processing method is to perform a union operation on all user interest keywords with the same knowledge background (same subject and school stage) as a reference model of all user interest keyword vectors. For the keyword interest degree, the keywords belonging to the user themselves, the interest degree remain unchanged. However, if it does not belong to the user, the interest degree is set to 0.

For example, the set of users with the same knowledge background is $U = \{u_1, u_2, \ldots u_n\}$, and the interest keyword vector of each user u_i is $K_{ui} = \left\{k_1, k_2, \ldots, k_{m_{mi}}\right\}$, then the reference model of all user interest keyword vectors is

$$\begin{aligned} K' &= K_{u1} \cup K_{u2} \cup \cdots \cup K_{un} \\ &= \{k_1', k_2', \ldots, k_m'\}. \end{aligned} \tag{11}$$

All user interest keyword vectors take K' as the reference model and are correspondingly transformed into $K_{ui}' = \{k_1', k_2', \ldots, k_m'\}$. The interest degree of each keyword k_J' of K_{ui}' is processed as follows:

$$I\ D\left(k_j'\right) = \begin{cases} I\ D\left(k_j\right), & k', \in K_{ui}, \\ 0, & \text{otherwise.} \end{cases} \tag{12}$$

After obtaining user interest groups, the keyword entries in each interest group model are consistent with the clustered user keyword vector reference model. The interest degree of a keyword is the average value of the corresponding keyword interest degree in all user interest models in the group, namely,

$$\mathrm{ID}\left(k_i\right) = \frac{\sum_{j=1}^{m} ID\left(k_i\right)_j}{m}. \tag{13}$$

In the formula, $\mathrm{ID}(k_i)_j$ represents the degree of interest of user u_j to the keyword k_i and m represents the number of users in the interest group.

For personalized recommendation systems, the main recall rate and precision rate are generally used to evaluate the performance of the system. For a good recommender system, its precision rate and recall rate should be as large as possible. However, it is often not possible to have the best of both worlds. Sometimes the recall rate is high, the precision rate is low, and when the precision rate is high, the recall rate is low.

(1) Recall Rate. The recall rate refers to whether the recommended amount of resources can cover all qualified resource records and is used to indicate the ability of the system to recommend related resources. It can be expressed as the total number of recommended related resources divided by the total number of related resources in the resource upgrade package.

$$\text{recall rate} = \frac{\text{recommended relevant resources}}{\text{total relevant resources in the system}} \times 100\%. \tag{14}$$

(2) Precision Rate. The precision rate is the degree to which the recommended resources meet the recommended purpose and the ability to reject irrelevant resources. It can be expressed as the total amount of recommended related resources divided by the total amount of recommended resources.

$$\text{precision rate} = \frac{\text{recommended relevant resources}}{\text{total recommended resources}} \times 100\%. \tag{15}$$

4. Application of Improved Machine Learning and Fuzzy Algorithm in Educational Information Technology

The corresponding objects of this system are high school learners, teachers, school administrators, and parents of students. The system will be divided into four modules: adaptive module, student portrait module, early warning and intervention module, and learning incentive module. Figure 6 shows an educational information system based on improved machine learning and fuzzy algorithms.

As shown in Figure 7(a), the distance education intelligent decision support system is mainly composed of the following components, namely, database management system, model base management system, knowledge base management system, and decision information output management. Among them, the database includes courseware multimedia database, student information database,

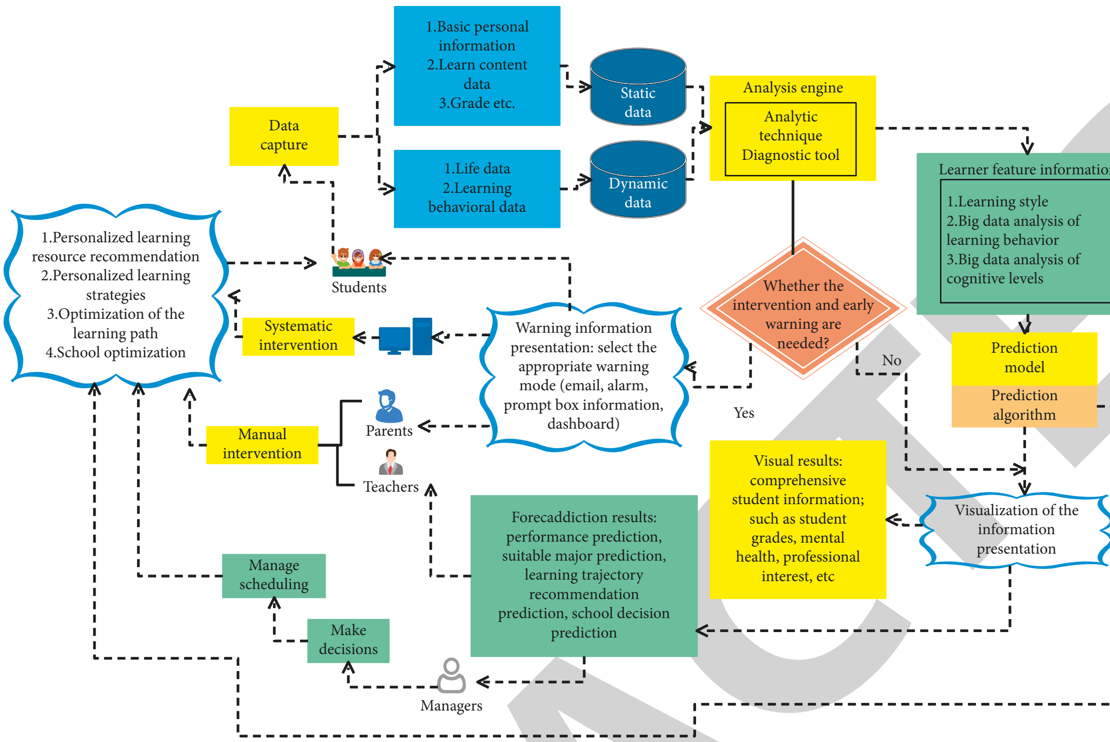
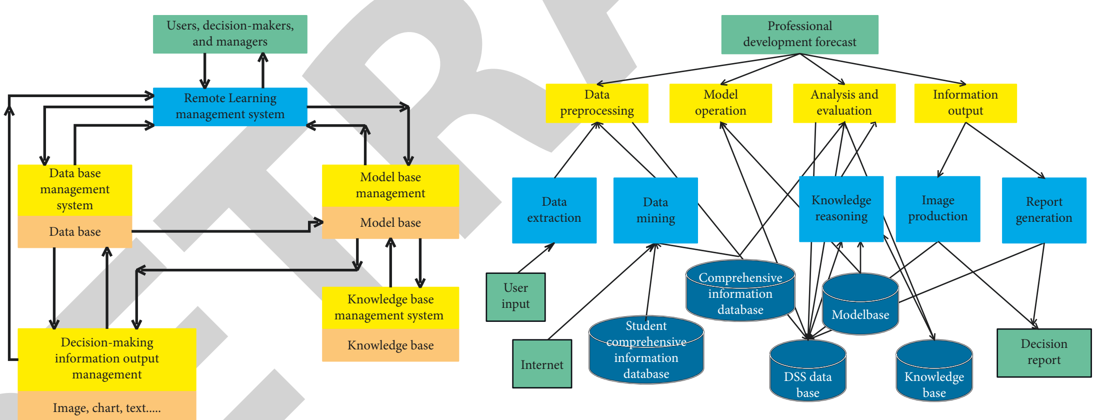


FIGURE 6: Educational information system based on improved machine learning and fuzzy algorithms.



(a) (b)

FIGURE 7: System function modules. (a) Logical structure of the intelligent decision support system. (b) Logical structure of the professional forecasting module.

and comprehensive information database. The database management system is responsible for the management and daily maintenance of each database. The model library stores various models required for decision-making. The model library management system is responsible for classifying and maintaining models, and supporting model generation, storage, query, operation, and analysis applications. The knowledge base stores all kinds of knowledge, and the knowledge base management system is responsible for knowledge reasoning, machine learning, and knowledge maintenance (including addition, deletion, and modification). The remote teaching management system completes the man-machine dialogue. In addition, decision information output management is responsible for displaying decision information in the form of charts, images, text, reports, etc.

As shown in Figure 7(b), professional development prediction consists of four modules, namely, data preprocessing, model operation, analysis and evaluation, and information output. First, the user inputs requirements through the distance education management system, and the data extraction module extracts the user input and the data mined by the data mining module is sent to the data preprocessing module for data preprocessing and then stored in the ADSS database. At the same time, the processed data is sent to the model operation module. Next, the model operation module calls the corresponding model in the model

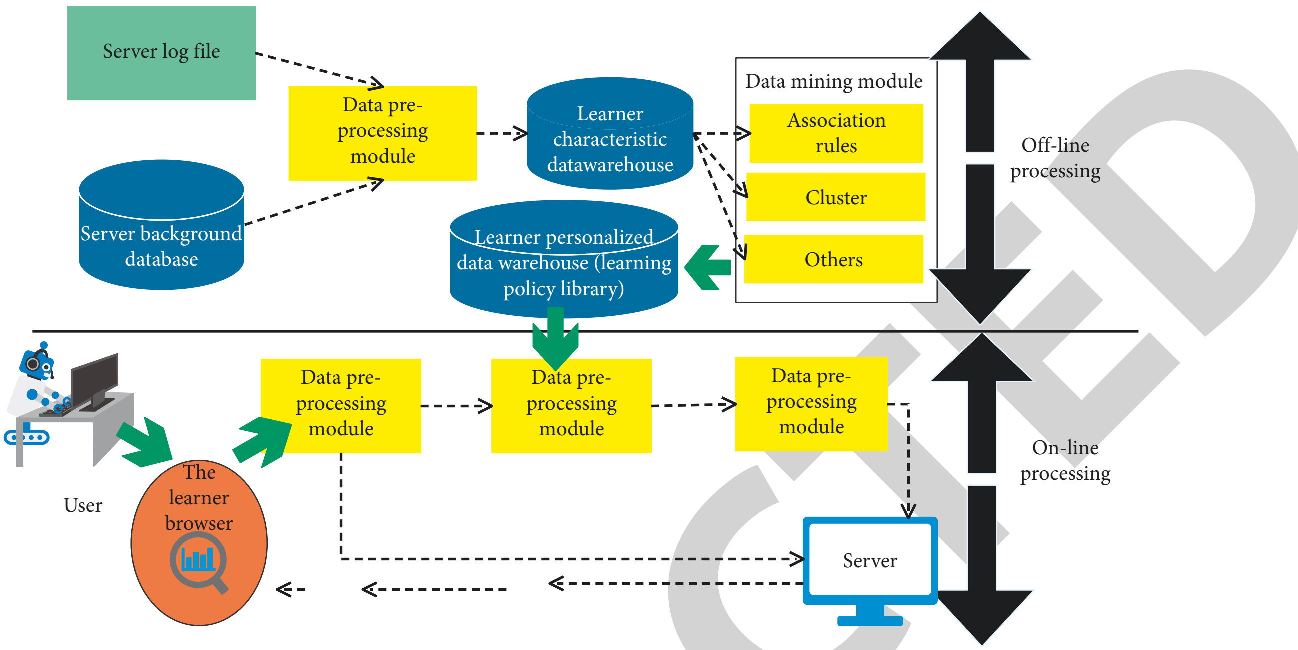


Figure 8: Web-based personalized learning system.

Table 1: Statistical table of the processing effect of educational information technology.

Number	Information processing	Number	Information processing	Number	Information processing
1	91.75	22	91.15	43	89.20
2	91.99	23	89.52	44	91.44
3	93.66	24	89.25	45	89.98
4	90.30	25	94.72	46	90.80
5	89.44	26	91.04	47	93.31
6	89.74	27	92.73	48	91.31
7	90.37	28	89.59	49	90.44
8	94.76	29	92.95	50	94.08
9	90.59	30	89.58	51	94.67
10	92.08	31	93.45	52	93.66
11	94.82	32	90.31	53	94.15
12	92.67	33	89.39	54	93.84
13	91.91	34	89.76	55	91.85
14	89.80	35	89.17	56	94.49
15	89.25	36	89.01	57	94.00
16	93.70	37	89.90	58	92.26
17	89.39	38	89.30	59	94.01
18	91.43	39	92.16	60	90.15
19	93.53	40	92.53	61	91.26
20	90.04	41	90.79	62	94.66
21	90.98	42	90.27	63	89.20

library and uses the corresponding prediction algorithm to operate on the processed data to obtain multiple different prediction results. However, the result cannot be directly output as auxiliary decision-making information, and the occurrence probability, reliability, and error of various prediction results must be evaluated through knowledge reasoning analysis. This process mainly uses models, knowledge, cases, experiences, and other data in the comprehensive information database and DSS database to reason, analyze, evaluate, and store the results approved by decision makers as a kind of knowledge in the knowledge base as an auxiliary decision-making basis. Finally, an auxiliary decision-making report is formed through the information output module.

Figure 8 is the main architecture of the web-based personalized learning system in terms of technology.

This paper verifies the effect of the educational information technology model constructed. First, the processing effect of the system model in this paper on educational information is tested. The statistical test results are shown in Table 1.

It can be seen from the above research that the system proposed in this paper can play an important role in the processing of educational information technology.

Table 2: Teaching evaluation effect.

Number	Teaching evaluation	Number	Teaching evaluation	Number	Teaching evaluation
1	81.25	22	78.18	43	74.21
2	74.09	23	77.33	44	76.03
3	75.61	24	85.51	45	82.61
4	81.50	25	77.27	46	85.19
5	78.63	26	76.11	47	82.71
6	75.38	27	80.80	48	85.65
7	81.78	28	82.41	49	83.44
8	78.80	29	84.13	50	76.30
9	74.78	30	76.20	51	80.57
10	81.96	31	78.95	52	78.60
11	77.12	32	85.29	53	80.43
12	83.45	33	85.75	54	74.78
13	76.94	34	74.59	55	76.77
14	79.27	35	78.89	56	74.04
15	84.31	36	82.93	57	79.47
16	82.41	37	77.43	58	78.15
17	76.62	38	80.97	59	80.73
18	79.04	39	80.88	60	84.52
19	77.86	40	77.81	61	74.34
20	74.95	41	76.91	62	78.70
21	77.83	42	82.38	63	85.30

Through the above experimental research (as shown in Table 2), we can see that the educational information system based on the improved machine learning and fuzzy algorithm proposed in this paper has a good effect.

5. Conclusion

Due to the rapid development of modern science and technology, people who are engaged in specific technical work will fall behind if they do not capture the latest information in time. Therefore, in the application of educational information technology, it is necessary to strengthen information awareness, improve information quality, and pay special attention to educational information and service objects. People who are engaged in technical work must have excellent skills without making themselves "technical idealists." The corresponding objects of this system are high school learners, teachers, school administrators, and parents of students. Moreover, the system will be divided into four modules: adaptive module, student portrait module, early warning intervention module, and learning incentive module. The experimental research shows that the educational information system based on improved machine learning and fuzzy algorithm proposed in this paper has a good effect.

Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

Disclosure

Due to the change of team members, Hetiao Hong left to work in other departments, so the author Hetiao Hong was removed, and Zhangfu Wang who contributed to this work was added.

Conflicts of Interest

The authors declare no conflicts of interest.

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