Scholar Publishing Group
International Journal of Educational Curriculum Management and Research
https://doi.org/10.38007/IJECMR.2021.020404
ISSN 2790-0967 Vol. 2, Issue 4: 28-46

The Strategy of Information Fusion Technology to Improve Micro-course Design and Online Education in the Context of Smart Education

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Keywords: Smart Education, Information Fusion Technology, Micro-Course Design, Online Education, Big Data

Abstract: Micro-course design and online education are new education models that have emerged in recent years. Both are based on the emergence and development of Internet of Things, big data, cloud computing and other network technologies. Because of its flexible teaching format, it has gradually received people's favor. The purpose of this article is to study how to use information fusion technology to improve the design of micro-courses and online education in the context of smart education, and to promote the development of education. This article first introduces the background of the emergence and development of smart education, then studies and analyzes the characteristics of micro-course design and online education, and finally designs a method of combining information technology with the Internet. And in the comparison experiment between the improved fusion algorithm and the traditional one, the accuracy rate of the improved fusion algorithm is as high as 90%-95%, which is a very obvious improvement over the traditional 85%-92%. Education has a very effective promotion.

1. Introduction

With the all-round development of the information society, China has entered the era of comprehensively deepening the information. The popularization and development of 4G networks have brought great convenience to the lives of the people. The innovation and development of information technology have changed the way of life and work of mankind in the 21st century to a

certain extent. In such an environment, wisdom education has emerged. Big data, Internet of Things, cloud computing and other technologies have enriched the way people learn. Fragmented learning, mobile learning, and personalized learning have emerged. Micro-classes and online education have ushered in development opportunities.

Under the traditional teaching model, education is centered on teachers and books, and the teaching is mainly written on the blackboard, which is time-consuming and laborious, and it is difficult to pay attention to the individual development needs of students, while micro-classes and online education can greatly compensate for the traditional Insufficient teaching, this kind of education breaks the limitations of traditional teaching in time and space, and expands the scope of students' knowledge and the range of people who receive knowledge. However, this new teaching model also has shortcomings. Online teaching has weakened the connection between teachers and students. The disappearance of supervisors has made users need to be more self-disciplined in the learning process. In addition, classroom interaction is reduced, teaching quality is not guaranteed, and information sources are too mixed. Therefore, this article needs to use information fusion technology to automatically analyze, comprehensively process, and filter the observation information of several objects under certain criteria to complete the required decision-making and task information processing, optimize the industry model, improve the client's experience, and assist Promote the construction of smart education in an all-round way. Therefore, the application of information fusion technology to the research on strategies to improve the design of micro-courses and online education in this article has certain theoretical and practical significance.

With the development of network technology and the advent of the era of big data, more and more scholars and groups are studying information fusion technology. Among them, Liu Y proposed a navigation technology based on adaptive Kalman filter with attenuation factor to suppress noise. By collecting estimated and measured values, constantly updating the measured noise variance and processing the system's noise variance, this method can suppress white noise and improve the quality of audio information transmission [1]. However, this method has a poor suppression effect on burst interference, and it is difficult to eliminate the sampling value deviation caused by it, which will waste RAM, and this algorithm has lag, which is not conducive to the spread of information. Qi Z proposed a variable fidelity meta-modeling (VFM) method based on RBF, which can integrate and make full use of different levels of fidelity information [2]. In the VFM method proposed by Qi Z, the overall design of the micro-course is reformed while ensuring the quality of online education. Among them, it is calculated by the information fusion algorithm, and satisfactory results are obtained. But this method is too cumbersome and difficult to apply in practice. [3]. Liao W believes that fast, accurate, and complete information is needed to support strategically influential military operations (MO) decisions to shorten the decision-making cycle and minimize losses. To this end, he proposed, designed and implemented a multi-agent-based decision support hierarchical information fusion system (MAIFS-DMS). By observing the graphics generated by the information fusion, the commander will have situational awareness and knowledge in order to make the most accurate strategic decisions as soon as possible [4]. This technology is undoubtedly excellent, but its implementation and operation will generate a huge amount of calculation, which is not suitable for online teaching. Meliones A believes that the process of detecting the position, direction and speed of the aircraft in radar measurement to identify possible threats belongs to the field of data fusion, especially the field of tracking [5]. However, because the spatial information of different scales is processed separately in MSIF, the information collection of MSF is more difficult and time-consuming.

The innovation of this article is (1) In the process of integrating network teaching resources,

through data fusion technology, the teaching resources are analyzed based on certain rules, and the non-scientific and false information sources are filtered out to improve the use of users. Experience. (2) This article uses information fusion technology to fuse multiple sensor information to correlate data and information obtained from single and multiple information sources, analyze user behavior and habits in the network, to obtain accurate location and identity estimates. Correct the wrong information so that the final result meets the user's expectations.

2. Information Fusion Technology Enhances the Micro-Course Design Method

2.1. Wisdom Education

(1) Development of smart education

Wisdom education has promoted tremendous changes in the forms of education and learning methods. It has had a great impact on the content, methods, concepts, and models of traditional education. It is an important part of national informatization. To change the concept of ideology is very important. The comprehensive deepening of educational reform and training of innovative talents is of broad importance and is an inevitable way to achieve and promote the leap-forward development of education.

Smart education uses advanced technology to create new educational conditions, deepen educational reform, innovation, and development, and promote the overall popularization of compulsory education in an orderly manner. This is an important symbol of educational modernization and an important requirement for domestic educational development. "Smart education" is based on batch processing of new information technology represented by the Internet of Things and cloud computing. Big data is one of the signs of smart education.

In recent years, the term intelligent application has become more and more active in the field of vision of ordinary people, and at the same time it is gradually approaching human work and life. The development of artificial intelligence education is a necessary means of focusing. The development needs of the times. This is a huge change in the history of education. The problems of backward education equipment, shortage of teachers, and extremely unbalanced educational resources, big data, cloud computing, Internet of Things and other problems, the rapid development of education and labor intelligence fields have made up for their shortcomings. Open educational networks, such as micro-classes and online education, ensure people's continuous learning and increase the opportunities for all citizens to receive education. The overall development of smart education is very important to improve the quality of all citizens.

(2) Smart campus

The campus under Wisdom Education is shown in Figure 1. Compared with the original traditional campus, it is more humane. Many tasks that required manpower and material resources have been replaced by a series of computer codes and data streams. Students' lives are more convenient, commuting time is effectively reduced, and learning efficiency is greatly improved. This is all due to the continuous development of network information technology, advanced computer algorithms, and efficient information fusion technology.

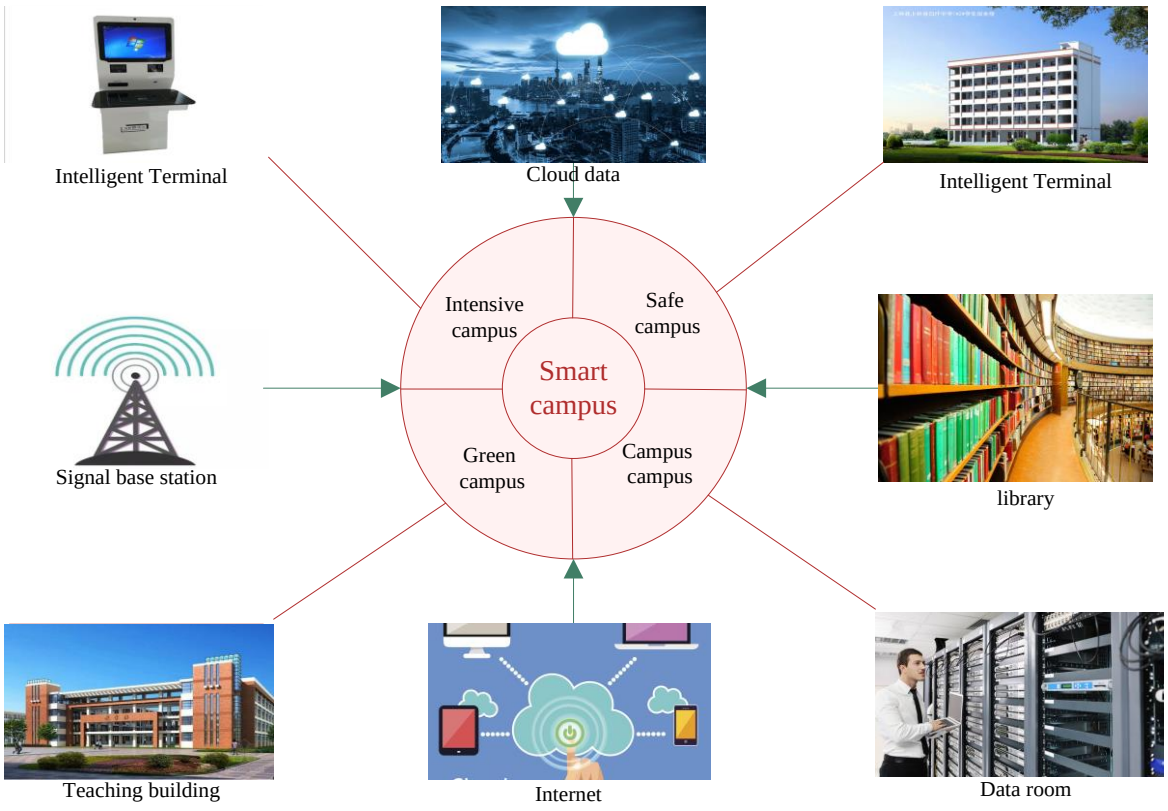

Figure 1. Campus under smart education

2.2. Information Fusion Technology

(1) Data fusion

This article will use the quantile map method to find a group of sensor groups that can support each other and have consistent data [6]. Among them, suppose the median is (P), the elimination point is (α), quartiles (A), dispersion (dk) and other measures reflect the structure and distribution of the data, and find the collected data is less reliable the divorced value.

Assuming that there are N sensor measurement values in this article, X_1, X_2...X_N are p-dimensional vectors, and the corresponding norm Y1 is defined as:

$$Y_1 = \|X_1\| = \left(\sum_{b}^{p} X_y^2 \right)^{1/2}, i = 1,2,\ldots, N \tag{1}$$

Arrange the Y_1 norm in descending order, then Y_1 and Y_N represent the upper and lower limit values, and the median is:

$$P = \begin{cases} Y_{\frac{N+1}{2}} \\ \left(Y_{\frac{N}{2}+1} + Y_{\frac{N}{2}} \right) \Big/ N \end{cases} \tag{2}$$

In the same way, the median of [P, YN], [Y_1, P] is obtained, then the quartile dispersion is:

$$dA = A_u - A_1 \tag{3}$$

Assuming that the median distance is greater than βdk, it is the gross error, that is, the deviation value.

If it is determined that Y1 is invalid data at $|Y_1 - P| > \beta dk$, the relevant elimination points are:

$$\alpha_1 = A_1 - \frac{\beta}{2} dA$$

$$\alpha_2 = A_u + \frac{\beta}{2} dA \tag{4}$$

Where β is a constant, all data in the interval [α1, α2] can be considered as valid data and will be fused.

Through the quantile map, 50% of the information interference can be eliminated, and finally an accurate value can be obtained.

(1) Convolution theory

Convolution theory is the basis of frequency domain technology. Let the convolution result of the function q (u, v) and the linear bit-invariant operator p (u, v) be g (u, v),

which is:

$$g(u, v) = p(u, v) * q(u, v) \tag{5}$$

Then according to this formula:

$$G(p, q) = P(p, q) * Q(p, q) \tag{6}$$

In the frequency domain space, the image is enhanced and processed. At this time, the corresponding enhancement can be expressed as:

$$g(u, v) = T^{-1}\{EH[T[f(u, v)]]\} \tag{7}$$

(2) System model

The motion law of the data source [7] is given by a state equation, which represents the transition relationship between the state at the two moments before and after. Assuming that the target is moving approximately at a constant speed on a two-dimensional plane, then this vector is:

$$X(l) = [x(l), \dot{x}(l), y(l), \dot{y}(l)]' \tag{8}$$

Where $(x(l), y(l))$ represents the location of the target at time k, $(\dot{x}(l), \dot{y}(l))$ represents the speed of the target at time l, and the equation is:

$$X(l+1) = F(l)X(l) + \Gamma(l)v(l) \tag{9}$$

Where $v(l) = [v_x, v_y]'$ is the process noise, and $P(l)$ is the state transition matrix?

$$P(l)=\begin{bmatrix}1 & T & 0 & 0\\ 0 & 1 & 0 & 0\\ 0 & 0 & 1 & T\\ 1 & 0 & 0 & 1\end{bmatrix} \tag{10}$$

$\Gamma(l)$ is the subdivision matrix of $v(l)=[v_x, v_y]'$:

$$\Gamma(l)=\begin{bmatrix}0.5T^2 & 0\\ T & 0\\ 0 & 0.5T^2\\ 0 & T\end{bmatrix} \tag{11}$$

The measurement equation representing the relationship between the measurement and the target state is:

$$\begin{aligned}Z(l)&=h\left(g, X(l)\right)+W(l)\\ &=\begin{bmatrix}r(l)\\ \theta(l)\end{bmatrix}=\begin{bmatrix}\sqrt{x(l)^2+y(l)^2}\\ \arctan\left(\dfrac{y(l)}{x(l)}\right)\end{bmatrix}+w(l)\end{aligned} \tag{12}$$

Among them, $Z(l)$ represents the measured vector, $h(X(l))$ represents the measurement function, $r(l)$ is the radial distance information of $Z(l)$, $\theta(l)$ is the angle information of the measurement vector, and $W(l)$ is the zero-mean $P(l)$ Gaussian white noise of the covariance. From this, the relationship between the target state and the measurement can be obtained.

(3) Batch processing method

Assume that nz observations are received at l, which constitute a combination of observation data:

$$Z(l)=\begin{bmatrix}Z^1(l)\\ \mathrm{M}\\ Z^{n_z}(l)\end{bmatrix} \tag{13}$$

The corresponding observation equation is:

$$\begin{aligned}Z(l)&=h\left(X(l)\right)+(l)\\ &=\begin{bmatrix}h_1\left(X(l)\right)\\ \mathrm{M}\\ h_{n_z}\left(X(l)\right)\end{bmatrix}+\begin{bmatrix}w_1(l)\\ \mathrm{M}\\ w_{n_z}(l)\end{bmatrix}\end{aligned} \tag{14}$$

Where $w(l)=\left[w_1(l),\cdots w_{n_z}(l)\right]$ is the noise corresponding to each observation data? Assuming that they are not correlated with each other, the observation noise covariance matrix is:

$$P(k)=E\left[w(k)w(k)'\right]=diag\left[R_1(k),\cdots,R_{n_z}(k)\right] \tag{15}$$

$R_i(l)$ is the noise covariance matrix. Use the *UKF* method to filter the observation data combination to complete the current update of the target state.

(4) Sequential processing method

The prediction target state and the prediction state error covariance matrix:

$$\begin{aligned} \hat{X}(l \mid l,0) &\stackrel{\Delta}{=} \hat{X}(l \mid l-1) \\ P(l \mid l,0) &\stackrel{\Delta}{=} P(l \mid l-1) \end{aligned} \tag{16}$$

The information matrix is:

$$S(l,i) = h_i(l)P(l \mid l,i-1)h_i(l)' + R_i(l) \tag{17}$$

The Kalman gain is:

$$K(l,i) = P(l \mid l,i-1)h_i(l)S^{-1}(l,i) \tag{18}$$

Update the target state and covariance matrix:

$$\begin{aligned} \hat{X}(l,\mid l,i) &= \hat{X}(l \mid l,i-1) + K(l,i)\left(Z_i(l) - h_i(l)'\hat{X}(l \mid l,i-1)\right) \\ P(l,\mid l,i) &= P(l,\mid l,i-1) - K(l,i)h_i(l)'P(l \mid l,i-1) \end{aligned} \tag{19}$$

Engrave the final target state and the estimated value of the error covariance matrix:

$$\begin{aligned} \hat{X}(l \mid l) &\stackrel{\Delta}{=} \hat{X}(l \mid l,n_z) \\ P(l \mid l) &\stackrel{\Delta}{=} P(l \mid l,n_z) \end{aligned} \tag{20}$$

Combining the above operations, the sequential filtering processing of the data set can be realized.

Using information fusion technology [8] this article can carry out reliable information collection, analysis and resource protection security technology, parallel processing technology in data fusion application research, methods to improve system efficiency.

(5) Information fusion level

According to different fusion objects, multi-sensor information fusion is divided into data-level fusion that directly fusions raw data, feature-level fusion that fusions feature vectors, and decision-level fusion that fusions decision-making. These three levels of fusion are hierarchically Progressive relationship [9], as shown in Figure 2.

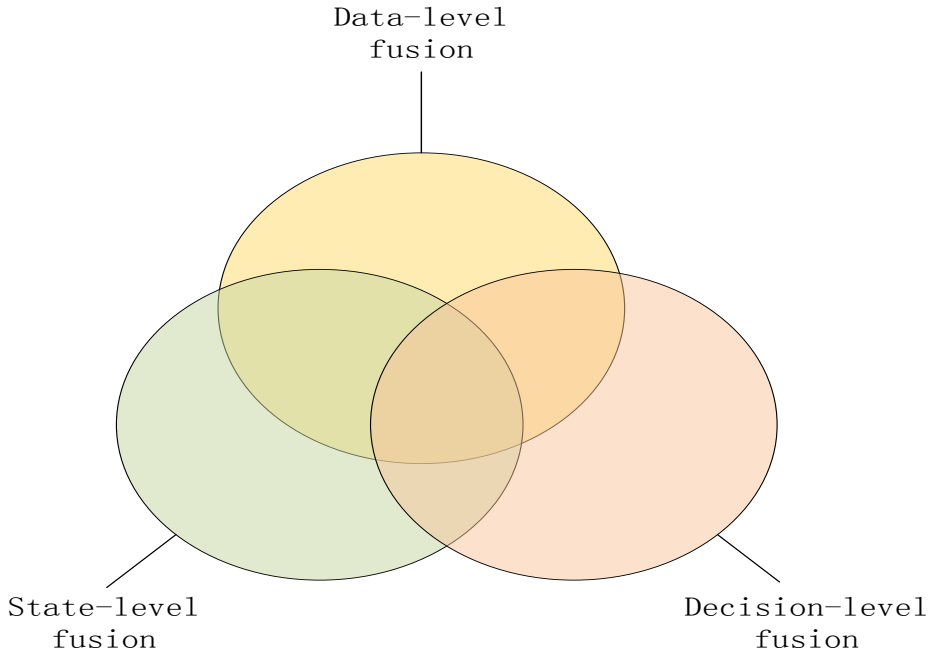

Figure 2. Information fusion level

1) Data-level fusion

The fusion object of data-level fusion is the raw data of each sensor [10]. After the fusion is completed, feature extraction and identity recognition are performed. The basic structure is shown in Figure 3. Taking the track data as an example, the fusion center associates and fuses the local track detected by each sensor, and finally forms a more complete and accurate track data [11].

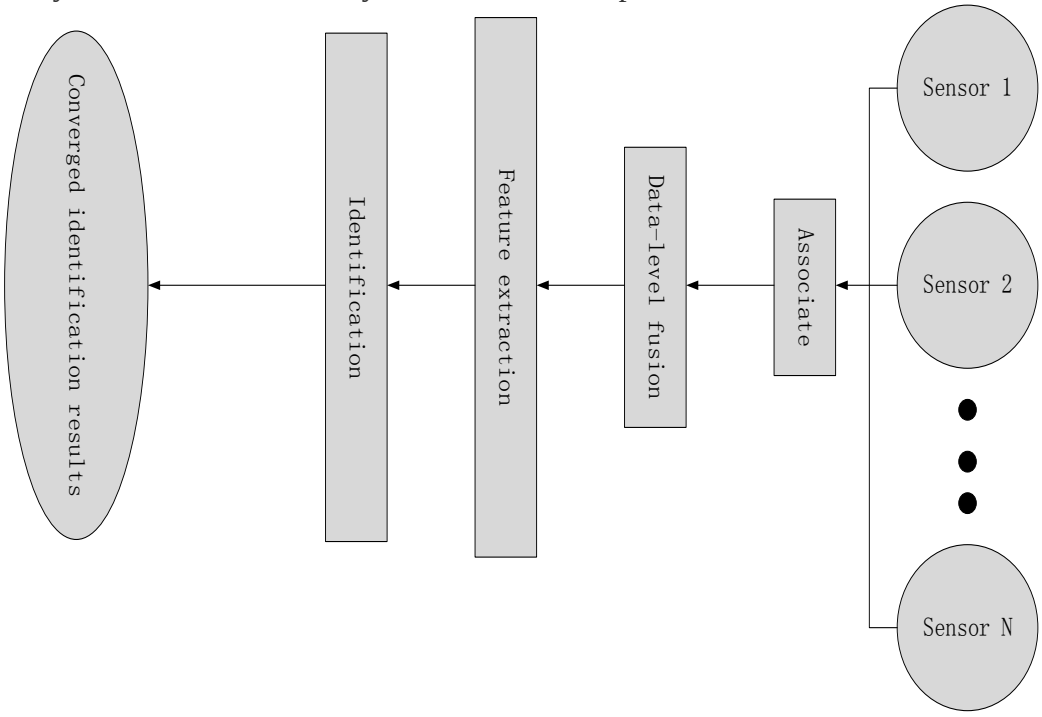

Figure 3. Data set fusion

The data set fusion topology structure can be divided into three structures from complex to simple according to the distribution of each sensor: hybrid, parallel and serial structures. Due to the detection level fusion of its own advantages, it can effectively improve the reaction speed and life rate of the sensor in the detection process, and it can also expand the area covered by it and increase the number of detection targets, and only under the action of a single sensor. Improve system reliability [12].

2) State-level fusion

State-level fusion, as the name implies, is used to estimate the state information of the observed object, such as the distance of the observed object, the speed and acceleration during movement and other parameters [13]. According to its different structure, state-level fusion can be divided into three structures: centralized, decentralized and hierarchical. Its structure is shown in Figure 4.

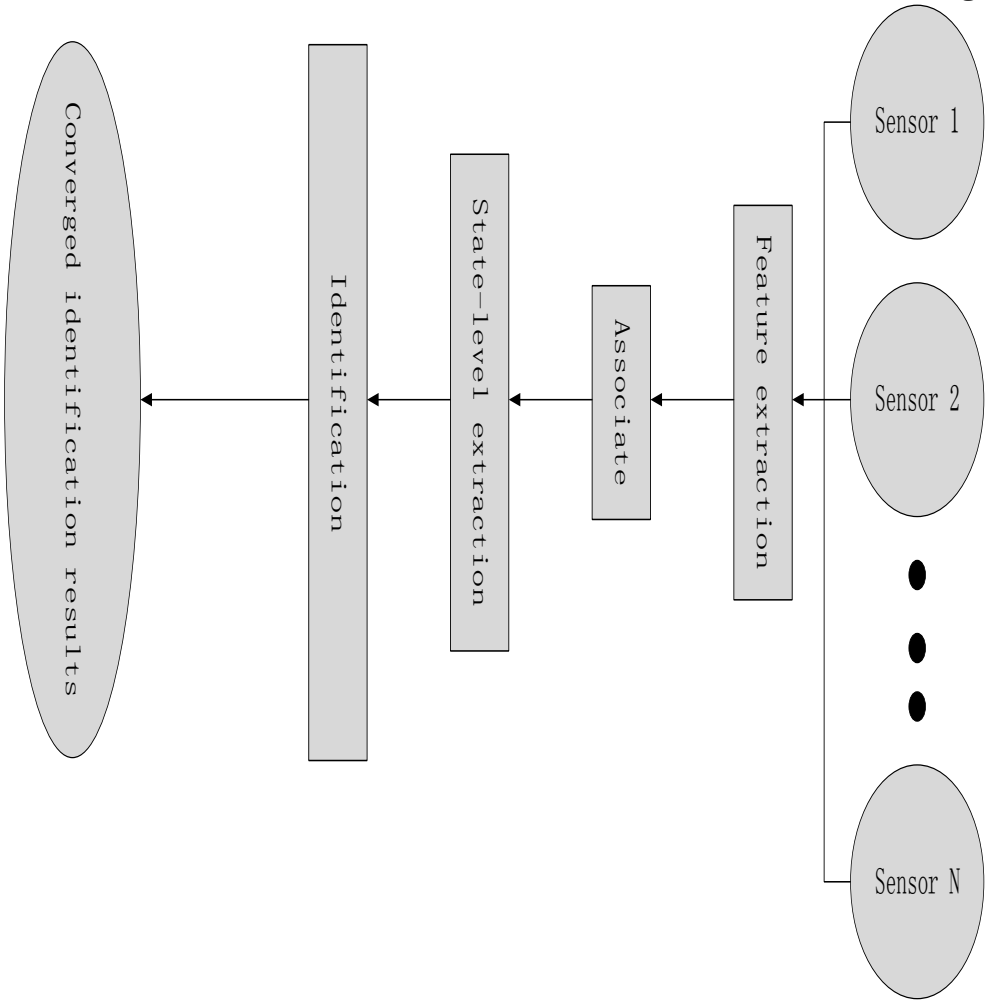

Figure 4. State-level fusion

3) Decision-level fusion

The fusion object of decision-level fusion is the decision result of each sensor [14], and the specific structure is shown in Figure 5. Different from the previous two levels of fusion, each sensor independently obtains its own pre-decision result, and then fusion is performed in the fusion center

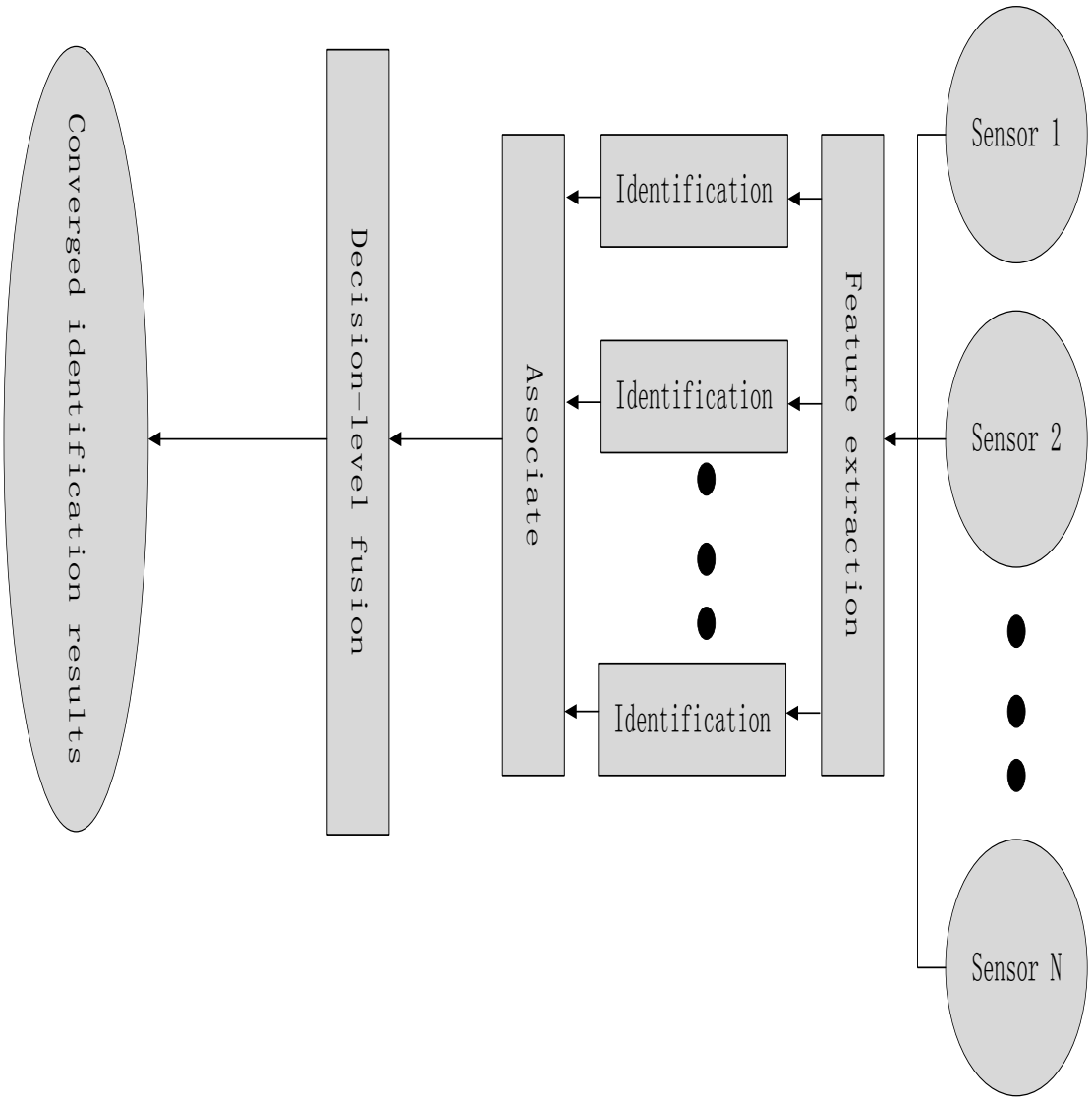

Figure 5. Decision-level fusion

2.3 Micro Course Design

Micro-class [15] refers to the process of using information technology in accordance with the laws of cognition to fragment, focus, and personalize the professional knowledge of the previous long-form discussions. With the development and innovation of modern education and teaching theories, teaching methods and methods, and types of micro-classes are not static. In addition to technical support, the improvement of micro-classes requires continuous development and improvement by teachers in teaching practice, as shown in Figure 6. To design the platform framework.

(1) The design framework of the micro-class

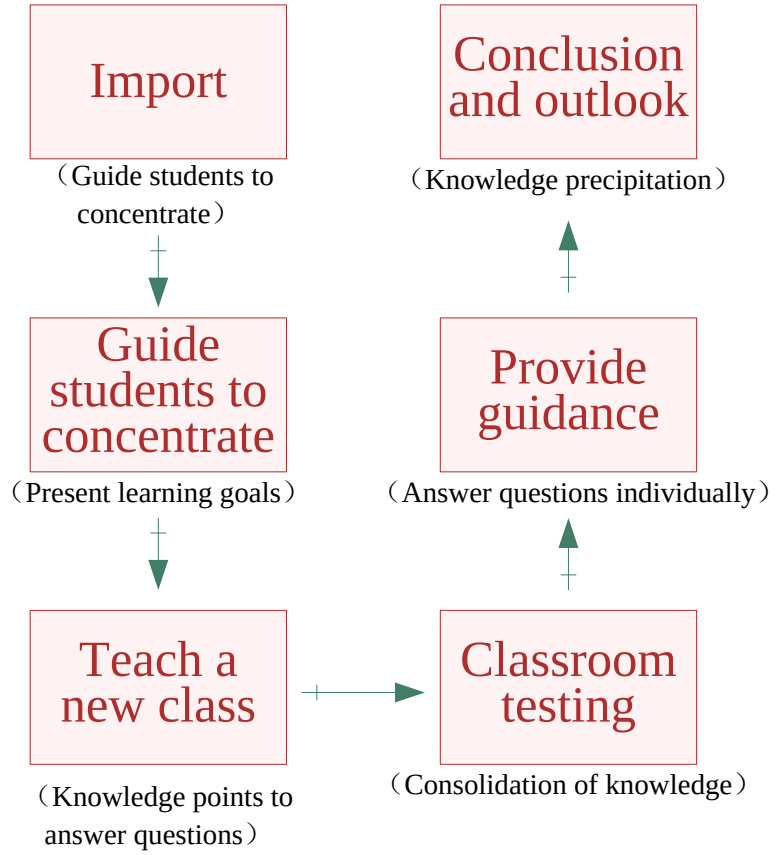

Figure 6. The framework of micro-course design

It can be seen from the text in Figure 6 that compared with traditional teaching, micro-class teaching has shorter content, clear process, and very organized [16]. In addition, in the design process of micro-classes, multimedia technology is used more for expression, and colorful pictures, videos, and animations are added to capture students' attention, which is conducive to students' concentration and improving classroom efficiency.

(2) Fundamentals of micro-course resource development

1) Course content:

The course content of the micro course has its own system and norms [17] to avoid duplication and disorderly development of the content, and organize the heads of the discipline to develop the courses in an orderly manner according to the educational needs.

2) Platform construction:

An excellent platform is the cornerstone of the creation, dissemination, and application of micro-course resources [18]. The platform should meet the learning needs of users and serve as a two-way feedback link between the server and the client to form the construction, management, application and research of micro-courses. "One-stop" service.

3) Course development

The content development of micro-course is a difficult system engineering, which requires information fusion technology and network technology to assist development [19]. Through data fusion, the course is automatically analyzed, comprehensively processed, and reasonably filtered to complete the required decisions and tasks. Information processing, optimizing industry models,

improving client experience, and assisting in the comprehensive promotion of smart education construction.

4) Course application

The application and communication of courses are the purpose of micro-course design [20]. Through big data and cloud computing, relevant content will be invested in a targeted manner to achieve the in-depth development of regional communication, and recommend and show excellent award-winning micro-courses to teachers and students. work;

2.4. Online Education

In the documents issued by relevant departments, online education is also called distance education, which is a symptom of adult education. This is different from the traditional education model of students who break through the boundaries of time and space and study in school Generally, online education is the best choice for amateur learners. There is no need to go to a specific place to join the class, you can go to any place to join the class at any time. This is a new concept that has emerged after modern network technology has matured day by day. The trainees are not limited by status and age, and provide opportunities for the public to improve their knowledge. Online education, like micro-classes, needs to be attached to the blueprint of network information technology, through TV broadcasting, the Internet, tutoring dedicated line, lesson research agency, and other channels to help each other learn. Its operating framework is shown in Figure 7.

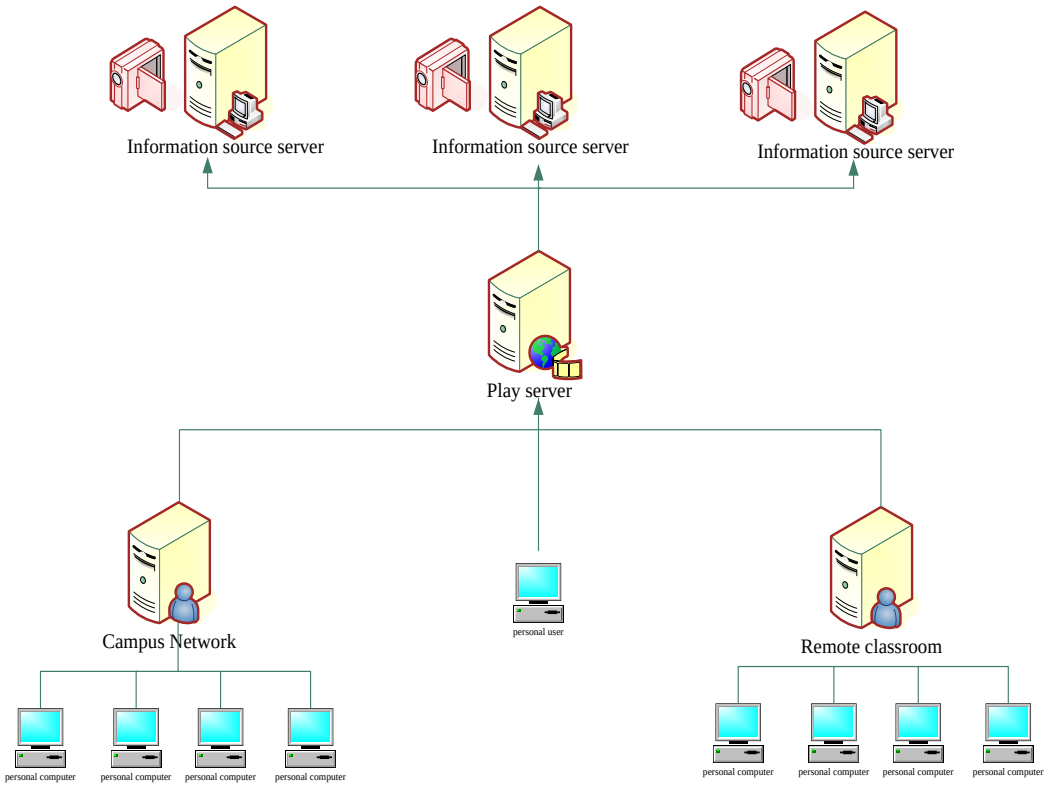

Figure 7. Operating framework of online education

Figure 7 is the basic mode of online education operation. A specific educational institution or individual integrates various information technologies, completes curriculum design through the

collection, design, and development of resources, builds a good educational environment, and promotes the spread of knowledge on the Internet. Due to the shortage of talents who understand both the network and the teaching, it is difficult to improve the quality of the production of courseware as the interface between teaching and learning in the process of network teaching, which greatly affects the further development of network teaching. At the same time, how to use information technology to optimize the system is also the most important thing to promote the modern education model.

3. Experimental Design and Result Analysis

3.1. The Design of the Software Framework of The Smart Education Cloud Service.

(1) Cloud service

What is cloud service, the mode of increase, use, and interaction of cloud services based on Internet-based services, which refers to the provision of dynamic, scalable and virtualized digital resources through the Internet. At the same time, the cloud is a metaphor for the network and the Internet. The traditional education information system has shortcomings such as heterogeneity and unity. Only a single service can be provided. This article should optimize the education information system through the use of information fusion technology and build it into a multi-in-one smart education cloud platform, as shown in Figure 8.

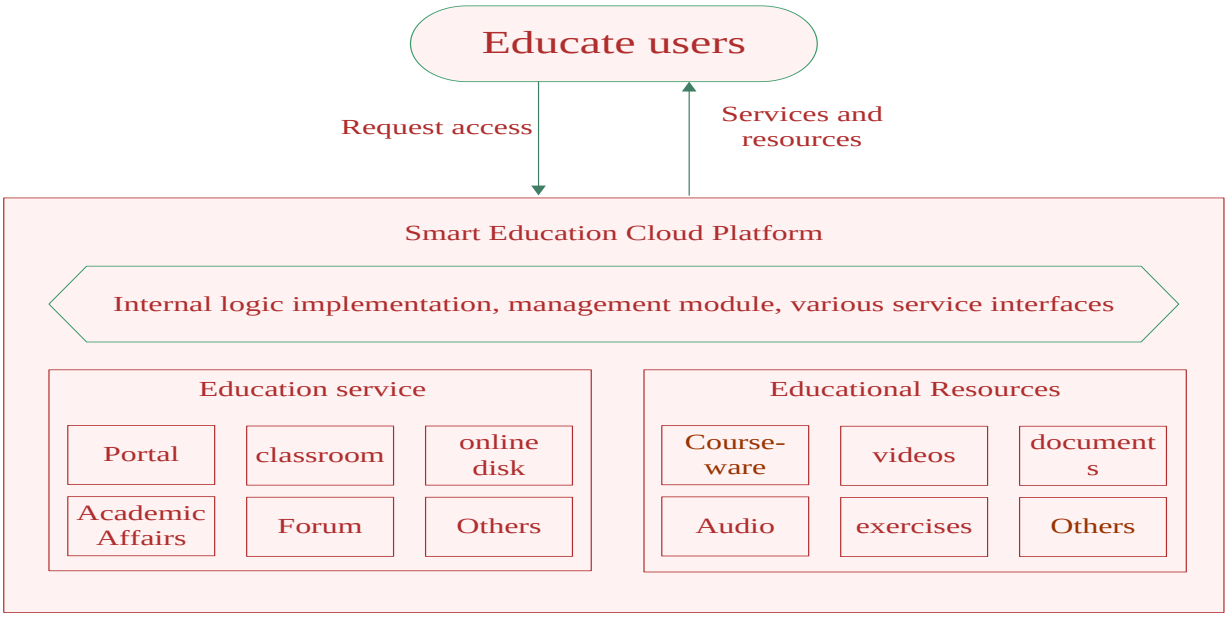

Figure 8. Smart service cloud platform

As shown in Figure 8, the platform is different from the previous information platforms and forums. Users only need to send requests to the smart education cloud platform through the terminal, and the platform undergoes information calculations, such as analysis requests, connection service ports, and related the data is calculated, filtered, and encapsulated, and finally the adapted educational services and resources are returned to the user through the client.

(2) SOA

SOA system is a common enterprise architecture. It is a concept proposed by Garnter Company in 1996. It describes a recommended software architecture scheme in a distributed environment to

make various loose service applications form a well-organized, stable and reliable organic whole. With the wave of globalization, the SOA architecture will bring huge changes to informatization. The smart education cloud service platform proposed in this article needs to be completed by relying on the SOA system.

3.2. Information Fusion Technology Algorithm

(1) Simulation results

Taking tracking target dynamics as an example, this paper chooses to use each sensor as a fusion node, and the structure of points is used for simulation experiments. The following three algorithms are used to calculate and compare data: (1) data association algorithm based on residuals, (2) data association algorithm based on line-of-sight distance) (3) data association algorithm based on angle redundant information.

Table 1. Horizontal formation simulation results

accuracy rate Target distanstan	(1) Algorithm	(2) Algorithm	(3) Algorithm	Improved algorithm
10m	0.1998	0.2	0.2022	0.2051
50m	0.2133	0.213	0.2132	0.2103
100m	0.2275	0.2352	0.2312	0.2481
200m	0.2741	0.2933	0.2986	0.3276
300m	0.3225	0.3323	0.3742	0.4096
500m	0.4352	0.4253	0.5544	0.5745
1000m	0.6283	0.628	0.8655	0.8759
2000m	0.7485	0.7761	0.9979	0.9953

Table 2. Cross formation simulation results

accuracy rate Target distanstan	(1) Algorithm	(2) Algorithm	(3) Algorithm	Improved algorithm
10m	0.2033	0.2032	0.252	0.2673
50m	0.2060	0.2083	0.2042	0.2217
100m	0.2116	0.2120	0.2187	0.2251
200m	0.2163	0.2264	0.2359	0.2497
300m	0.2505	0.2610	0.2742	0.2984
500m	0.3398	0.3480	0.3709	0.3923
1000m	0.5120	0.5119	0.5515	0.5899
2000m	0.6389	0.6389	0.7743	0.7981

When the target separation d is 10m, 50m, 100m, 200m, 300m, 500m, 1000m, 2000m, 2000 Monte Carlo experiments are carried out. The simulation results of cross formation and horizontal formation are shown in Table 1 and Table 2. Figure 9 is a comparison of the line graphs of the simulation results, which can more intuitively see the changing trend of each set of data, and find an optimal data for in-depth research.

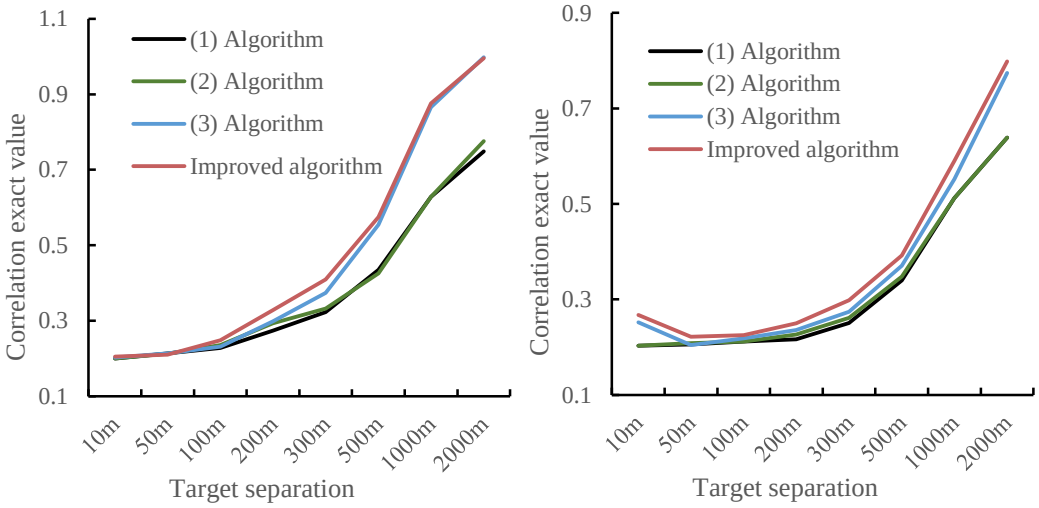

Figure 9. Comparison of simulation results with line graphs

(2) Data analysis

After data analysis of the two formation calculation results, it can be seen that the target separation d increases, and the correlation accuracy rate of the improved algorithm proposed in this paper will also increase. And when d is much larger than the measurement error, the correlation accuracy rate will tend to 1 or equal to 1 indefinitely.

The overall average estimation error and average consistency estimation error of the three algorithms are compared. The target makes a circular motion, and the error tends to be stable. The result is shown in Figure 10:

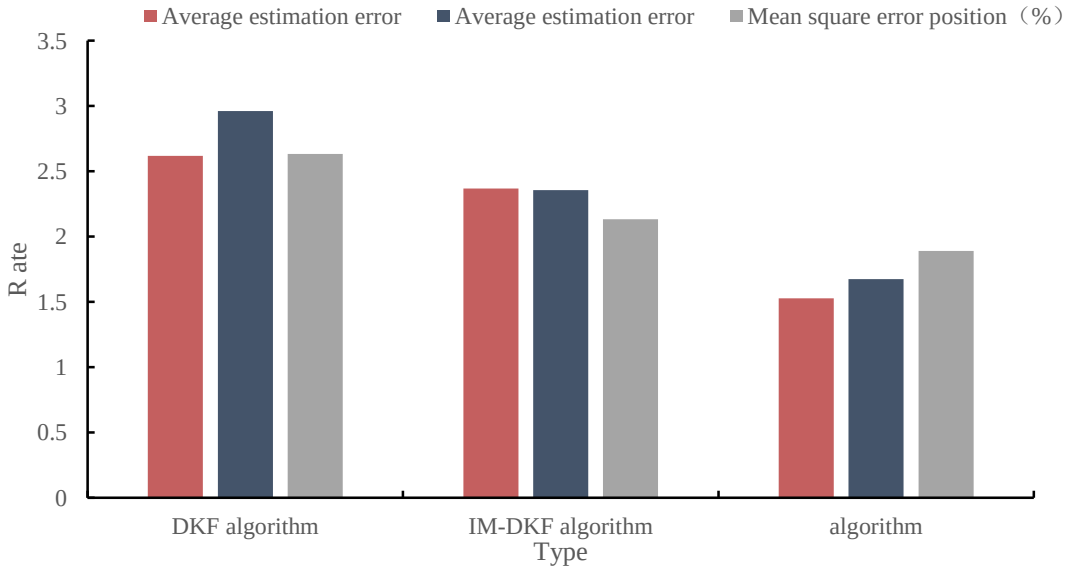

Figure 10. Average consensus estimation error

It can be seen intuitively from Figure 10 that the two errors of the three algorithms have increased, but the algorithm proposed in this paper is still better than the other two algorithms in terms of tracking effect. Further verify the effectiveness of the optimization method.

The performance evaluation indicators of the three algorithms are shown in Figure 11:

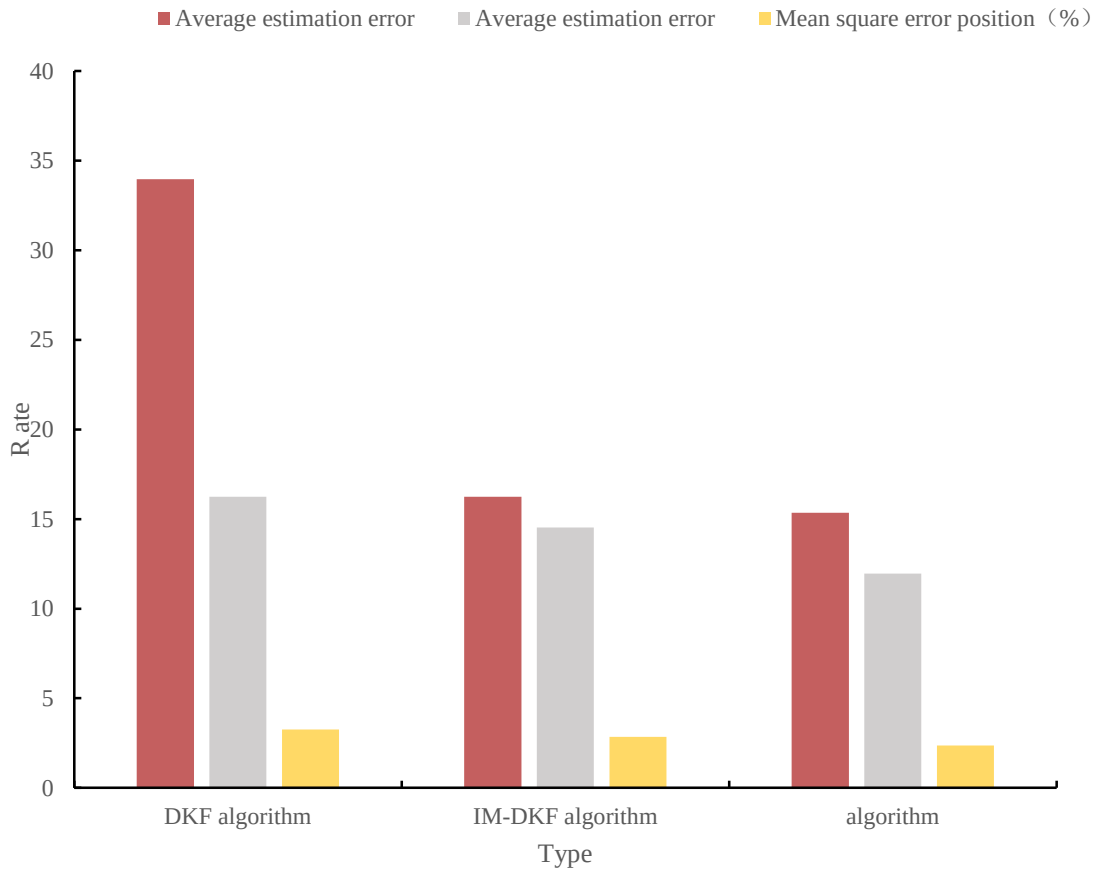

Figure 11. Comparison of simulation results with line graphs

Through Figure 11, this article sees that when the variance of the observation noise increases, the tracking error of the three algorithms also increases, but the algorithm proposed in this article can still achieve a stable tracking effect. The algorithm in this paper is still better than the tracking effect of the IM-DKF algorithm.

4. Discuss

This article is dedicated to research on the strategy research of information fusion technology to improve micro-course design and online education, and apply it to smart education, to provide a solid technical guarantee for modern education, through the verification and research of multiple algorithms in order to find the most efficient model, in the future, information fusion technology will be used as an important tool for studying system complexity. In the fusion stage of the multimedia information processing process, this paper proposes an improved fusion algorithm, which is used for fusion analysis after multimedia information classification, and conducts verification experiments on it. The experimental results are shown in Figure 12.

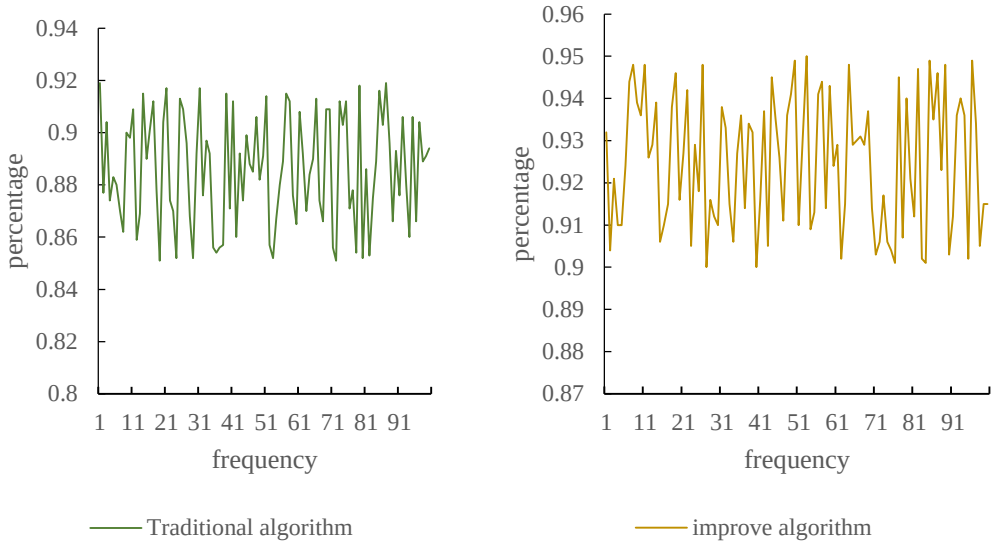

Figure 12. Comparison of accuracy based on improved fusion algorithm and traditional

It can be seen from the figure that the accuracy rate of the traditional algorithm is only 85%-92%, while the accuracy rate of the improved fusion algorithm is as high as 90%-95%. There are also huge improvements in lesson design and online education.

5. Conclusion

This article mainly studies the application of information fusion technology in micro-course design and online education. This paper designs an improved smart service cloud platform by studying the fusion algorithm in the information fusion technology, and then combining the relevant knowledge of the smart classroom. And this article also validates its error rate and performance through simulation experiments and data analysis. Finally, by comparing the improved fusion algorithm with traditional algorithms, experiments show that the accuracy rate of the smart service teaching cloud platform based on the improved fusion algorithm design is as high as 90 %-95%, which is much higher than the traditional 85%-92%, which also shows that information fusion algorithms can effectively improve the quality and accuracy of micro-course design and online education.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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