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Research on Visual Tracking Method for Students' Browsing Data in Art Literacy online Education

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Abstract. *In order to improve the quality of student online education associated to the area of art literacy, it is necessary to track and identify their browsing data processes in real time. A visual tracking method for such activity, based on Hilbert's spectrum analysis, is proposed. A data mining model, a platform for online education that supports art literacy, has been constructed. The approach utilizes the spectral feature extraction method for data visualization pattern recognition, and Hilbert's spectrum feature extraction algorithm. By using information fusion and feature matching, students in the same time period are scanned for spectral feature fusion and adaptive matching, and the features of Hilbert's spectrum are extracted by segmentation. The extracted information is processed by visual spectral feature recognition, information recovery is realized, and visual tracking of browsing data for the cohort completed. The simulation results show that this method can effectively realize visual tracking and recognition of the students' browsing data and improve the ability of data mining and information analysis. The research aims to show that the quality of online education of artistic literacy is improved through such practice.*
Keywords: Art literacy; Online education; Spectrum analysis; Visual tracking; Data mining

1. **Introduction.** As an organic part of quality education, art education is becoming more and more important. As to the importance of art education, people have reached a consensus that culture without art is incomplete culture, education without art is incomplete education, art education with technique education is incomplete art education. People with only professional knowledge and no artistic literacy are unqualified talents in

the era of a knowledge economy. Art literacy curriculum is an important carrier and realistic form of education. Its reform and innovation are directly related to the realization of expected learning standards and the acquisition of knowledge and experience of the educated[1]. Under this background, the reform of art curriculum in primary and secondary schools is in full swing, and the principle of "comprehensiveness", which is a distinctive feature of art courses, has been paid special attention to. The implementation of art curriculum is a systematic engineering, which involves the change of teaching system in many directions. It is not only a problem of cognition, but also a problem of concept, because of the lag and distortion of teaching idea[2]. As a result, a series of teaching activities cannot be carried out healthily. In order to improve the quality of online education of art 48 literacy, it is necessary to track and identify the students' browsing data in real time [3].

The research and development of such education for students to browse data visualization tracking method has become a hot topic in the field of computer network experts and scholars. The process of accessing browsing data is, in the final analysis and in order to extract useful features and useful data from mass data information, students of online art literacy can browse data at high 53 speed by using an effective data visualization tracking algorithm. This paper presents a visual tracking method for students browsing data based on Hilbert's spectrum analysis. The online art literacy education platform that is constructed utilizes the spectral feature extraction method for data visualization pattern recognition, and Hilbert spectrum feature extraction algorithm is designed. By using information fusion and feature matching, students in the same time period are scanned for spectral feature fusion and adaptive matching, and Hilbert's spectrum features are extracted by segmentation. The extracted feature information is processed by visual spectral 60 feature recognition, and the information recovery and visual tracking recognition are realized. Finally, the performance is tested through simulation experiments. It shows the superior performance of this method in improving the ability of visual tracking of browsing data in online art literacy education.

2. **Distributed architecture of art literacy online education platform.**

2.1. **Overall framework and process of online art literacy education platform.**

Art literacy online education platform is a distributed computing framework developed by Apache open source organization. This distributed computing framework can run applications on a large number of cheap hardware clusters and provide a stable and reliable interface for applications[4]. As an open source framework, platform has the following advantages: (1) strong expansibility: because it is open source, it faces a wide range of objects. This is why the art literacy online education platform is very scalable; (2) cheap economy: because it can run on a less expensive PC, so it does not need a large server to complete the operation; (3) stable and reliable: because the platform adopts the distributed processing method, its risk is decomposed, when one or several of the devices malfunction. Other devices can be replaced immediately without affecting work, so on this level the approach is very stable and reliable; (4) the distributed file system of art literacy online education platform guarantees the high speed of data interaction. The process of browsing data and big data set of art literacy online education students by mining art literacy online education platform is shown in figure 1.

The platform designed in figure 1 is a persistent resource configuration tool between the data mining task and the database reading to schedule and modify the resource during the process of data mining. Through the art literacy online education students browse the distributed database of the data existence, realize the sharing of the public data,

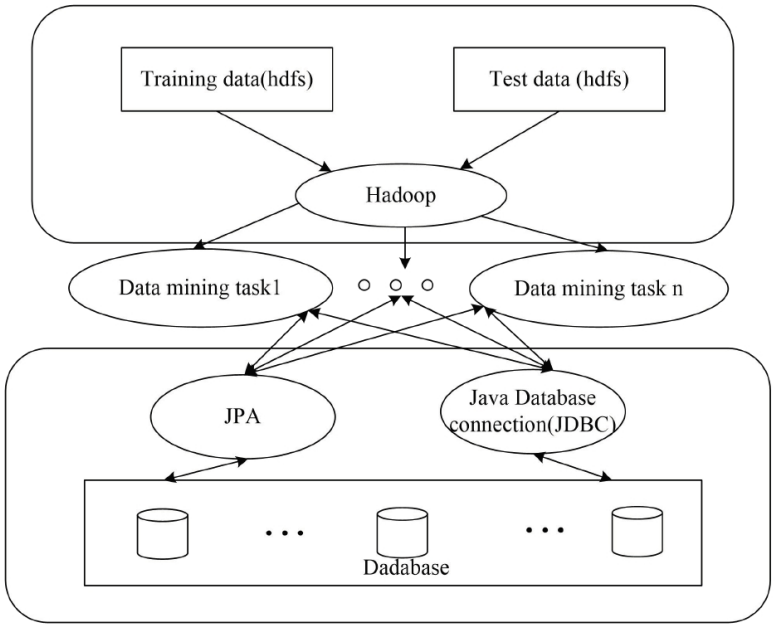

FIGURE 1. Structural model of visual tracking of browsing data for art literacy students in online education

and correspond to the feature extraction algorithm of the art literacy online education platform. The data mining task is generally not a single task. Instead of multi-thread operation, multi-thread feature extraction is carried out, which is represented as data mining task 1 to task 1 in the frame diagram. In this paper, the art literacy online education platform is used to mine the network resource data flow. The raw data may exist in local database and an art literacy online education students browsing database[5]. It is necessary to use cloud storage ORM (Object relation mapping) to make the data model persistent in cloud database. The schematic diagram of the read and write operation of the performing data in the art literacy online education platform is shown in figure 2.

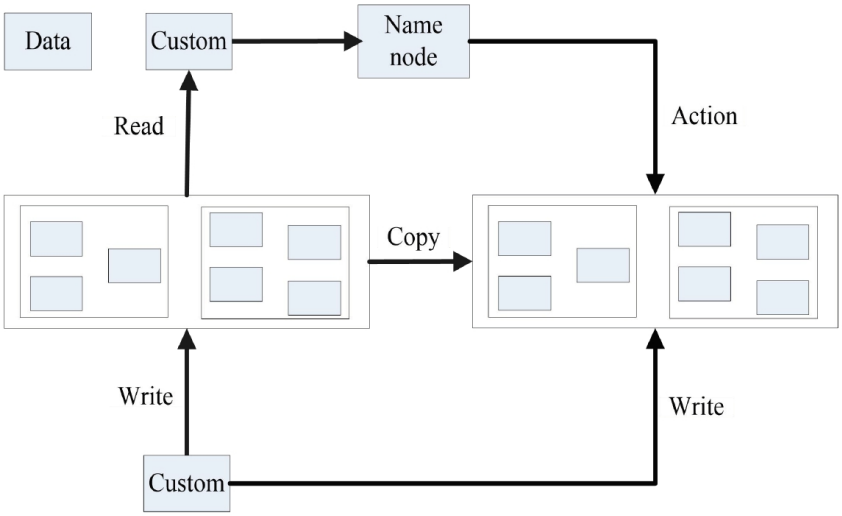

FIGURE 2. Reading and writing of execution data in online Education platform for Art Literacy

2.2. **Spectral feature extraction of data.** The data mining model of art literacy online education platform is constructed. In the platform, the spectral feature extraction method is used for data visualization pattern recognition[6-9], and Hilbert spectrum feature extraction algorithm is designed. Assume that art literacy online education students browse data expressions as follows:

$$z(t) = x(t) + iy(t) = a(t)e^{i\theta(t)} \tag{1}$$

Where

$$a(t) = \sqrt{x^2(t) + y^2(t)}, \theta(t) = \arctan\frac{y(t)}{x(t)} \tag{2}$$

Where, $a(t)$ and $\theta(t)$ are the envelope and phase of online education students' browsing data, $a(t)$ and $\theta(t)$ are both time series functions of online education students' browsing data. The analytic expression of art literacy online education students browsing data $z(t)$ is the convolution of $z(t)$ and $\frac{1}{t}$, as follows:

$$WD_x(t,f) = \int x(t+\frac{\tau}{2})x^*(t-\frac{\tau}{2})e^{-j2\pi ft}d\tau \tag{3}$$

This paper combines the time domain and frequency domain of art literacy online education students' browsing data, and describes the relationship between each frequency component of art literacy online education students' browsing data with time[10-11]. A time-frequency joint distribution $P(t,f)$, which can reflect this time-varying characteristic, is constructed. By continuous sliding window on the time axis, the students can browse the data segment smoothly and use a narrow time-domain window. Students who get art literacy online education browse the data $x(t)$ short time Fourier transform as follows:

$$STFT(t,f) = \int_{-\infty}^{\infty} x(\tau)h^*(\tau - t)e^{-j2\pi ft}d\tau \tag{4}$$

The energy density spectrum of art literacy online education students browsing data is:

$$SPED(t,f) = |STFT(t,f)|^2 \tag{5}$$

On the basis of short time Fourier transform (STFT) and energy density spectrum 123 processing, the time-frequency relationship in time window is preserved by adding windows, and the internal characteristics of browsing data of art literacy online education students are revealed. The model of student browsing data analysis is obtained, which provides the data basis for the visualization tracking of the students' browser data[12].

3. **Visual tracking and recognition algorithm for data.** By adopting the information fusion and feature matching, the visual art accomplishment of the same time period is subjected to spectral characteristic fusion and adaptive matching[13], and the Hilbert spectrum characteristic is extracted by segmentation.

$$y(t) = \frac{1}{\pi}P\int\frac{x(\tau)}{t-\tau}d\tau = x(t) * \frac{1}{\pi t} \tag{6}$$

According to the Hilbert phase derivation definition, the instantaneous frequency of students browsing data generated art literacy online education is obtained as follows:

$$f(t) = \frac{1}{2\pi} \times \frac{d\theta(t)}{dt} \tag{7}$$

It can be seen that the instantaneous frequency of art literacy online education students browsing data is not the frequency in the spectrum, and for a narrow band autoregressive system, the students browse the data to limit the bandwidth[14], and get its instantaneous

frequency beyond the frequency band. However, when the students browse the data without linear stationary and normal distribution, the Hilbert spectrum energy characteristic is non-uniform distribution. The phase scales are completely divorced from the fact that they change with time, both in amplitude and frequency. Therefore, the characteristic scale parameters based on extremum are used in this paper. This paper improves the traditional method of time-frequency analysis of students browsing data in Hilbert art literacy online education[15]. The Hilbert-Huang transform is composed of empirical mode decomposition and Hilbert spectrum analysis. Decomposing complex art literacy online education student browsing data into a number of moving average sampling components, and using the local maximum and local minimum to the art literacy online education students browse the characteristic time scale of the data of the art literacy online education students browse data envelope link, the average value under the envelope is :

$$SD = \sum_{t=0}^{T} \left[\frac{\left| h_{1(k-1)}(t) - h_{1k}(t) \right|^2}{h_{1(k-1)}^2(t)} \right] \tag{8}$$

Through the art literacy online education students to browse the data envelopment? amplitude modulation, the first IMF component of the online education students' online browsing data is obtained as:

$$r_1 = x(t) - c_1 \tag{9}$$

The original art literacy online to educate students to browse the information of the IMF component amplitude modulation of the data, the IMF component $x(t)$ of the browsing data n is obtained[16], which is expressed as:

$$\begin{aligned} r_1 - c_2 &= r_2 \\ &\cdots \\ r_{n-1} - c_n &= r_n \end{aligned} \tag{10}$$

By introducing the theory of multiple regression, the empirical mode decomposition energy information of online art literacy education students' browsing data is obtained as follows:

$$H(\omega, t) = \mathrm{Re} \sum_{i=1}^{n} a_i(t) e^{j \int \omega_i(t) dt} \tag{11}$$

In order to ensure that the harmonics of IMF component of students browsing data in online education of art literacy can be accurately resolved[17], the time-frequency analysis is carried out by using Hilbert-Huang transform to produce the dynamic response statistical characteristics of students browsing data in online education of art literacy. The improved Hilbert spectrum features are expressed as follows:

$$H(\omega, t) = \mathrm{Re} \sum_{i=1}^{n} a_i(t) e^{j \int \omega_i(t) dt} \tag{12}$$

The Hilbert-Huang transform is used in each IMF to extract Hilbert spectrum features of the students' browsing data, and the students' browsing data feature extraction and visual tracking are completed.

4. **Simulation experiment and result analysis.** In order to test the application performance of this method in realizing visual tracking of students' browsing data in online art literacy education, the simulation experiment is carried out. The experimental environment is Inter (R) Core (TM) 2 duo 2.93 GHz RAM 2GB, hard disk 160 GB / 100MB network bandwidth. Based on the simulated experimental environment, the quality of the

access result is returned from the database access request of the online education platform of art literacy, and the visual tracking and identification of the student browsing data is carried out. The original browse data distribution features are shown in figure 3.

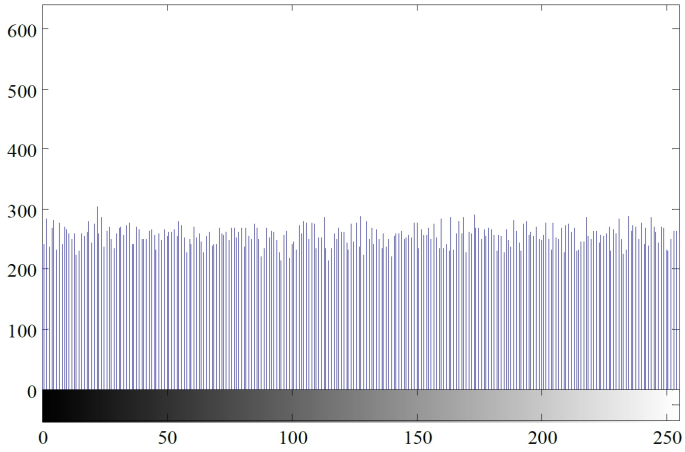

FIGURE 3. Distribution of raw data

The art literacy online education students browse data visual tracking is taken by this method, the visual tracking results are shown in figure 4.

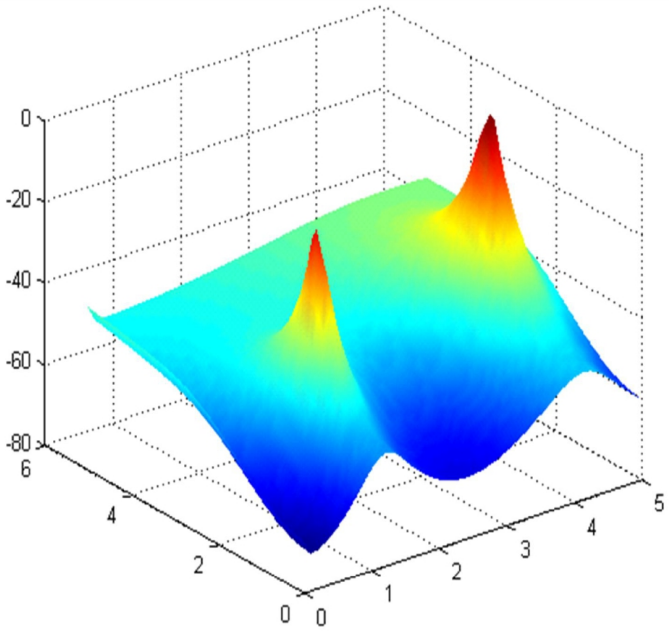

FIGURE 4. Visual tracking results of student browsing data

Figure 4 shows that this method can effectively realize visual tracking and recognition of browsing data and test the accuracy of data tracking. The comparison results are shown in figure 5.

Figure 5 shows that this method can effectively realize visual tracking and recognition of browsing data of the students, improve the ability of data mining and information analysis of online art literacy education, and the accuracy of data tracking is better.

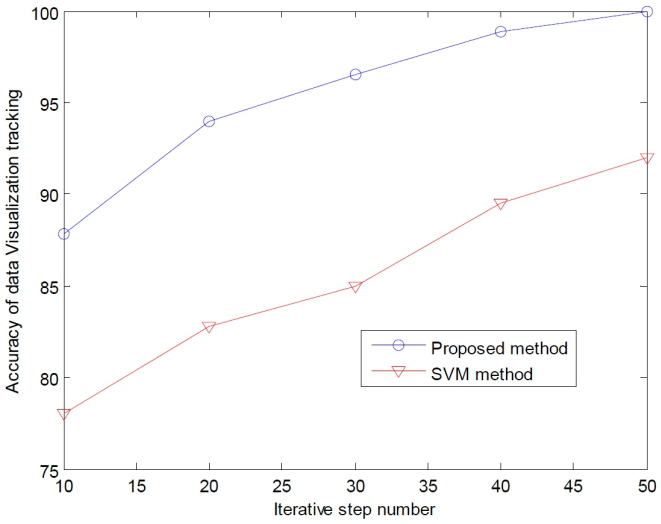

FIGURE 5. Accuracy comparison of data tracking

5. **Conclusions.** In this paper, a visual tracking method for students' browsing data of online education of art literacy based on Hilberts spectrum analysis is proposed. The data mining model of art literacy online education platform is constructed. In the online art literacy education platform, the spectral feature extraction method is used for data visualization pattern recognition, and Hilbert spectrum feature extraction algorithm is designed. By using information fusion and feature matching, the students in online education of visual art literacy in the same time period are scanned for spectral feature fusion and adaptive matching, and Hilbert spectrum features are extracted by segmentation. The extracted feature information is processed by visual spectral feature recognition, information recovery is realized, and visual tracking of browsing data is completed for students of art literacy online education. The simulation results show that this method can effectively realize visual tracking and recognition of browsing data of art literacy online education students, and improve the ability of data mining and information analysis of art literacy online education, so as to improve the quality of online education of artistic literacy. This method has good application value in improving the quality of art literacy online education. Introduction and conclusion appear to be very similar and it is important that the conclusion talks about the research finding that were initially outlined in the introduction.

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