ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

Research on 3D Intelligent Generation Method of Cyberpunk Costumes of Hui Culture Based on Cooperative Optimization of Big Data and Semantic Analysis

Zihan Ma

Anhui Vocational and Technical College, Hefei, 230011, China

Abstract: This study focuses on the use of big data and semantic analysis collaborative optimization technology to achieve 3D intelligent generation of cyberpunk costumes of Hui culture. In view of the dilemma of Hui culture inheritance and the limitations of cyberpunk costume design, data related to Hui culture architecture, costumes, patterns and cyberpunk style are widely collected through web crawlers, cooperative collection and other means, and then cleaned and annotated to construct element feature vectors. An innovative collaborative optimization algorithm based on big data and semantic analysis is designed, in which the cultural gene genetic algorithm encodes Hui culture elements into gene fragments, and realizes design evolution through operations such as selection, crossover and mutation. In the experimental stage, a comparative experiment is designed to compare with traditional hand-painted design and 3D design methods based on single style generation. In terms of design innovation, the professional designers' scores show that the proposed method scored an average of 8 points (out of 10 points), traditional hand-painted 6 points, and single-style generation 7 points; in terms of cultural element integration, the proposed method reached 85%, far exceeding the 60% of traditional hand-painted and 70% of single-style generation; the visual effect was measured by PSNR and SSIM indicators, and the PSNR value of the proposed method was 35dB and the SSIM value was 0.9. The experimental results show that this method significantly improves the design innovation and cultural integration, and has important theoretical and practical significance in the field of clothing design.

Keywords: *Big data; semantic analysis; Hui culture; cyberpunk clothing; 3D intelligent generation*

1. Introduction

As a treasure of Chinese traditional culture, Hui culture has a profound historical heritage and unique artistic charm, but in modern society, its inheritance faces difficulties. The number of traditional craftsmen has decreased, and many exquisite skills are on the verge of being lost. In the field of modern design, the application of Hui culture elements is relatively limited, and most of them remain on the surface, failing to fully explore its deep connotation and achieve innovative transformation. At the same time, cyberpunk clothing design has gradually emerged in the fashion trend, but the current design focuses on shaping the future sense of technology, and there are deficiencies in cultural integration, especially the lack of organic integration with traditional culture. How to integrate Hui culture into cyberpunk clothing design has become an urgent problem to be solved.

The development of big data technology provides a possibility to solve this problem. It can efficiently collect, store and process massive design data, quickly screen and analyze various cultural databases and fashion design materials, and extract valuable information [1]. Semantic analysis technology can accurately interpret the semantics of cultural elements and design styles through natural language processing and image semantic understanding. Combining big data with semantic analysis technology is expected to break the barriers between Hui culture and cyberpunk clothing design, innovate design methods, and promote the deep integration of cultural heritage and fashion design.

Looking back on the development of clothing 3D generation technology, it mainly relied on simple geometric modeling in the early days, and the generated models were rough and lacked realism. With the advancement of deep learning technology, complex and sophisticated 3D clothing models can now be constructed, but there are still deficiencies in style innovation and cultural integration, which makes it difficult to meet diversified design needs [2]. In the field of digitization of Hui culture, although the

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

construction of digital museums and the establishment of cultural element databases have achieved certain results, these digital achievements have not been effectively transformed into innovative design power in actual design applications, and there is a "data island" phenomenon [3]. Semantic analysis technology has been widely used in design style recognition and element extraction in the fields of images and texts, but in the multi-style fusion scenario of clothing design, especially in the application of integrating traditional culture with modern trendy styles, it is still in a blank stage.

This study aims to generate high-quality 3D clothing models with both Hui culture characteristics and cyberpunk style. In the data collection stage, data from databases such as Hui culture architecture, clothing, and patterns will be widely collected, and relevant materials from cyberpunk-style clothing and science fiction works will be collected [4]. Through web crawler technology and cooperation with relevant institutions, the comprehensiveness and accuracy of the data are ensured. In terms of algorithm design, a collaborative optimization framework of big data and semantic analysis is constructed, and a cultural gene genetic algorithm is innovatively designed to integrate Hui culture elements into the design evolution process in the form of genes [5]. In order to verify the effectiveness of the research results, a comparative experiment was designed to compare with traditional design methods and existing single-style 3D generation methods, and the algorithm performance was comprehensively evaluated, including key indicators such as operating efficiency, design innovation, and cultural element integration, providing a new technical path for the inheritance and innovation of Hui culture in modern fashion design.

2. Data collection and preprocessing of Hui culture and cyberpunk elements

2.1 Data collection sources and methods

The database of well-known Hui culture research institutions is an important source for obtaining Hui culture elements. Institutions such as the Anhui Hui Culture Research Center and the Huizhou Culture Research Institute of Huangshan University have long been committed to the research and compilation of Hui culture [6]. Their databases cover Hui style architectural drawings, Huizhou traditional clothing styles, and Huizhou folk craft patterns. By obtaining data usage rights through cooperation, these precious elements can be included in the research scope. Web crawler technology plays a key role in collecting cyberpunk style clothing data. Fashion information websites such as VOGUE and ELLE, and design forums such as Behance and Dribble gather many designer works. The web crawler program written in Python can accurately capture cyberpunk clothing images and related text information, and follow the website robots' protocol to ensure legality. Cooperation with museums and cultural protection organizations is an effective way to obtain first-hand scanning data of Huizhou cultural objects [7]. For example, the China Huizhou Cultural Museum has a large collection of Huizhou cultural objects. Through negotiation, it uses high-precision 3D scanners to scan Huizhou architectural components, traditional clothing objects, etc., to obtain accurate three-dimensional model data. These data truly restore the details of the objects and provide high-value original data for research, as shown in *Figure* 1-2.

Figure 1 Huizhou Architecture - Horse-head Wall

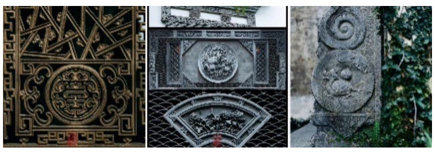

Figure 2 Huizhou Craftsmanship - "The Three Carvings of Huizhou"

2.2 Constructing element feature vectors

In order to enable the collected and annotated data to be effectively processed by computer algorithms, element feature vectors need to be constructed. For image data, image processing technology is used to extract key features [8]. Color features are quantified through models such as RGB color space and HSV color space, and statistics such as color histogram and color moment of the image are calculated. Texture

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

features are extracted using methods such as gray-level co-occurrence matrix (GLCM) and local binary pattern (LBP), reflecting information such as the thickness and direction of the texture in the image. Shape features use edge detection algorithms such as the Canny algorithm to obtain image edges, and then calculate shape descriptors such as Hu moments.

For text data, natural language processing technology is used to extract keywords and semantic vectors. The word frequency-inverse document frequency (TF-IDF) algorithm is used to extract keywords in the text to highlight the core content of the text. The semantic vector is obtained with the help of pre-trained language models, such as the BERT model. The text is input into the model to obtain the corresponding semantic vector representation, which contains the semantic information of the text.

Finally, the features extracted from the image and text are integrated. For Hui culture and cyberpunk elements, image features such as color, texture, and shape are spliced with text features such as keywords and semantic vectors in a certain order to form a unified feature vector [9]. These feature vectors, as the basic data for subsequent algorithm analysis, can comprehensively and effectively characterize the properties and characteristics of Hui culture and cyberpunk elements, and provide strong support for the collaborative optimization algorithm based on big data and semantic analysis.

3. Design of collaborative optimization algorithm based on big data and semantic analysis

3.1 Overall framework design of the algorithm

This algorithm aims to realize the 3D intelligent generation of cyberpunk clothing of Hui culture, and is composed of multiple closely related modules. The data input module is responsible for receiving the collected and preprocessed data of Hui culture and cyberpunk elements, including images, texts, etc. Suppose the input data set is $D = \{d_1, d_2, \cdots, d_n\}$, where d_i represents the i data sample.

The semantic understanding module uses a deep learning model to perform semantic analysis on the input data. The semantic feature set output by this module is recorded as $S = \{s_1, s_2, \cdots, s_n\}$ and passed to the big data analysis module. The big data analysis module uses cluster analysis, association rule mining and other technologies to conduct in-depth analysis of semantic features, explore the potential relationship and combination rules between elements, and its analysis result A is used to guide the parameter optimization module.

The parameter optimization module adjusts the parameters of clothing design, such as size, material, and decoration position, based on the results of big data analysis. Suppose the design parameter set is $P = \{p_1, p_2, \cdots, p_m\}$, and adjust P through the optimization algorithm to generate a parameter combination that better meets the design requirements [10]. Finally, the model generation module generates a 3D model of the cyberpunk clothing of Hui culture based on the optimized parameters using 3D modeling technology. The data flow between the modules is clear, and they cooperate with each other to jointly realize the transformation from raw data to the final 3D model.

3.2 Semantic understanding module design

The semantic understanding module adopts a deep learning model that combines convolutional neural network (CNN) and recurrent neural network (RNN). For image data, CNN is first used for feature extraction. Suppose the input image is I, and after a series of convolutional layers C_l and pooling layers P_l, the image feature map F_{CNN} is obtained. Its calculation process can be expressed as:

$$F_{CNN} = P_L\left(C_L\left(\cdots P_2\left(C_2\left(P_1(C_1(I))\right)\right)\right)\right) \tag{1}$$

Where L is the total number of convolution and pooling layers.

For text data, RNN is used for processing. Assume that the input text sequence is $T = \{t_1, t_2, \cdots, t_k\}$, and the hidden layer state h_t of RNN is calculated by the following formula:

$$h_t = \sigma(W_{hh}h_{t-1} + W_{xh}t_t + b_h) \tag{2}$$

Where σ is the activation function, W_{hh}, W_{xh} are weight matrices, and b_h is the bias vector.

The feature representations of the image and text are fused to obtain a unified semantic feature vector s. In the model training process, the labeled Hui culture and cyberpunk element data are selected as the training data set D_{train} . Set the training parameters, such as the learning rate α, the number of iterations

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

N, etc. The model parameters are optimized by minimizing the loss function L. The loss function can use the cross-entropy loss function:

$$L = -\sum_{i=1}^{n} \sum_{j=1}^{m} y_{ij} \log(\hat{y}_{ij}) \tag{3}$$

Where y_{ij} is the true label and $\hat{y}_{ij}$ is the model prediction value. Model performance is evaluated using indicators such as accuracy and recall.

3.3 Design parameter optimization module driven by big data

Use clustering analysis technology to group elements after semantic understanding. Suppose the element set is $E = \{e_1, e_2, \cdots, e_s\}$, and the K-means clustering algorithm is used to divide the elements into K clusters $C = \{C_1, C_2, \cdots, C_K\}$, and its objective function is:

$$J = \sum_{k=1}^{K} \sum_{e_i \in C_k} \|e_i - \mu_k\|^2 \tag{4}$$

Where μ_k is the centroid of the k cluster.

Through association rule mining, find the association relationship between elements. Let the element item set be $I = \{i_1, i_2, \cdots, i_t\}$, and the association rule can be expressed as $X \to Y$, where $X, Y \subseteq I$ and $X \cap Y = \emptyset$. The strength of the rule is measured by calculating $\mathrm{support}(X \to Y)$ and confidence $(X \to Y)$:

$$\begin{aligned} \mathrm{support}(X \to Y) &= \frac{|X \cup Y|}{|I|} \\ \mathrm{confidence}(X \to Y) &= \frac{\mathrm{support}(X \cup Y)}{\mathrm{support}(X)} \end{aligned} \tag{5}$$

According to the combination rules of these elements, optimize the clothing design parameters. For example, according to the correlation between the elements, determine the matching ratio of Hui culture elements and cyberpunk elements in clothing, set the proportion of Hui culture elements to r_H, the proportion of cyberpunk elements tor_C, and $r_H + r_C = 1$. By adjusting the values ofr_H and r_C, optimize the cultural integration effect of clothing.

3.4 Algorithm core steps

1) Encoding

Huizhou cultural elements such as horse head wall shape and Huizhou embroidery pattern are encoded as gene fragments. Using binary encoding, let the gene fragment length be l. For a Huizhou cultural element e, its encoding is represented by $g = \{g_1, g_2, \cdots, g_l\}$, where $g_i \in \{0,1\}$. For some continuous features, such as the size ratio of elements, real number encoding is used. Let the size ratio range of the element be $[a, b]$, and the encoded real number r is mapped to this range through the following formula:

$$r = a + (b - a) \times \frac{\sum_{i=1}^{l} g_2 2^{-(i-1)}}{2^l - 1} \tag{6}$$

2) Selection

The roulette wheel selection method is used to select excellent individuals to enter the next generation based on individual fitness. Assume that the set of individuals in the population is $P = \{p_1, p_2, \cdots, p_q\}$, and the fitness of individual $p_i$is $f(p_i)$, then the probability $P(p_i)$ of individual p_i being selected is:

$$P(p_i) = \frac{f(p_i)}{\sum_{j=1}^{q} f(p_j)} \tag{7}$$

3) Crossover

Using the single-point crossover method, assume that two parent individuals $p_a = \{a_1, a_2, \cdots, a_l\}$ and $p_b = \{b_1, b_2, \cdots, b_l\}$, randomly select a crossover point c, and the offspring individuals $p_{a'}$ and $p_{b'}$ generated after crossover are:

$$\begin{aligned} p_{a'} &= \{a_1, a_2, \cdots, a_c, b_{c+1}, b_{c+2}, \cdots, b_l\} \\ p_{b'} &= \{b_1, b_2, \cdots, b_c, a_{c+1}, a_{c+2}, \cdots, a_l\} \end{aligned} \tag{8}$$

The crossover probability is set to P_c to control the frequency of crossover operation.

4) Mutation

The mutation operator performs mutation operations on gene fragments. For binary coding, the mutation probability is set to P_m. If the gene position g_i mutates, then $g_i = 1 - g_i$. For real number coding, let the variable step length be δ, and the real number r' after mutation is:

$$r' = r + \delta \times (\mathrm{rand(p)} - 0.5) \tag{9}$$

Where $\mathrm{rand}()$ is a function that generates random numbers between 0 and 1. Mutation operations help increase the diversity of the population and prevent the algorithm from falling into a local optimal solution. Through the above series of algorithm steps, the design and optimization of the 3D intelligent generation algorithm of Hui culture cyberpunk clothing based on big data and semantic analysis are realized.

4. Implementation of 3D Intelligent Generation System of Cyberpunk Clothing of Hui Culture

4.1 System Architecture Design

The data layer bears the key responsibility of storing, collecting and preprocessing data. MySQL database is selected as the data storage tool because it has strong relational data management capabilities, good stability and wide application support. In the design of data storage structure, multiple data tables are constructed according to the categories and characteristics of Hui culture elements and cyberpunk elements. For example, the "Hui Culture Element Table" is set up to store detailed information of elements such as Hui style architectural components and Huizhou traditional clothing patterns, including fields such as element name, description, image path, feature vector, etc.; the "Cyberpunk Element Table" stores relevant data such as cyber technology decoration and futuristic materials. Through reasonable data table association, the integrity and consistency of the data are ensured, which facilitates subsequent data query and call [11]. The algorithm layer is the core of the system and is responsible for running the collaborative optimization algorithm based on big data and semantic analysis. Python has become an ideal choice for algorithm implementation with its concise and easy-to-read syntax, rich third-party libraries, and powerful data analysis and machine learning capabilities. With the help of TensorFlow framework, deep learning models are built to achieve functions such as semantic understanding, big data analysis, and parameter optimization. The TensorFlow framework provides an efficient computational graph mechanism that can accelerate the model training and reasoning process, while supporting distributed computing to meet the needs of processing large-scale data. The algorithm layer calls the data stored in the data layer, and after a series of complex calculations and analyses, it passes the optimized design parameters to the application layer. The application layer provides users with interactive interfaces and model display functions. Web development technologies such as HTML, CSS, and JavaScript are used to build intuitive and easy-to-use user interfaces. Through front-end frameworks such as Vue.js, dynamic interactive effects of the interface are achieved to improve user experience. Users can easily interact with the system at the application layer, submit design requirements, and obtain generated 3D clothing models.

4.2 Module Function Implementation

The data management module implements data addition, deletion, modification, and query, as well as data backup and recovery functions. In terms of data addition, a data entry interface is provided to support manual input and batch import. When there is new Hui culture or cyberpunk element data, users can enter the data into the system in the specified format, and the system automatically stores the data in the corresponding data table. The data deletion function allows users to delete data records that are no longer needed based on specific conditions, such as element name, category, etc. The data modification function supports editing the attributes of existing data to ensure the accuracy and timeliness of the data. To ensure data security, the data backup and recovery function regularly backs up the data in the database to an external storage device. In the event of data loss or damage, the backup data can be used for recovery to ensure the integrity of the system data.

The semantic analysis module performs element semantic understanding by calling the trained deep learning model. When the system is initialized, the model combining the pre-trained convolutional neural network and the recurrent neural network is loaded into the memory. When the user submits image or text data containing Hui culture and cyberpunk elements, the semantic analysis module inputs the data into the model. The model performs semantic analysis on the data based on the features and patterns

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

learned through training, and outputs the semantic feature vectors of the elements. These semantic feature vectors will serve as an important basis for subsequent big data analysis and parameter optimization.

The 3D model generation module generates 3D clothing models based on optimized parameters. By calling the interfaces of professional modeling software such as Blender and Maya, the conversion from design parameters to 3D models is realized. The parameters such as clothing size, material, and decoration position optimized by the algorithm layer are passed to the modeling software, and the modeling tools and rendering engine of the modeling software are used to generate a realistic 3D model of Anhui culture cyberpunk clothing. During the generation process, the details of the model can be adjusted according to user needs, such as the glossiness of the material and the clarity of the texture, to meet different design requirements.

4.3 System interface design

The main interface of the system has a clear layout, which is mainly divided into element selection area, design parameter adjustment area, and model display area. In the element selection area, Anhui culture and cyberpunk elements are displayed in the form of a classified list, and users can select by clicking the element icon. When the mouse hovers over the element icon, the pop-up window of the element description is displayed through JavaScript scripts, providing users with a detailed introduction of the element, including cultural background, design inspiration and other information.

The design parameter adjustment area provides a series of interactive components such as sliders and drop-down menus. Users can adjust the size, color, material and other parameters of clothing according to design requirements. For example, adjust the length and width of clothing through sliders, and select the material type through drop-down menus, such as silk, leather, and metallic fabrics.

The model display area occupies a large part of the interface and is used to display the generated 3D clothing model in real time. After selecting elements and adjusting parameters, the user clicks the "Generate Model" button, and the system starts the algorithm operation and model generation process in the background, and displays the progress bar of the generation process in real time in the model display area. After the generation is completed, the user can rotate and zoom the model through mouse operations and observe the model effect from different angles. Through the carefully designed interactive process and interface layout, users can easily use the system to realize the creative design and 3D model generation of Anhui culture cyberpunk clothing.

5. Experimental simulation and result analysis

5.1 Experimental design and data set preparation

In order to accurately evaluate the 3D intelligent generation method of cyberpunk clothing of Huizhou culture based on the collaborative optimization of big data and semantic analysis, a comparative experiment is designed. The method in this paper is compared with traditional hand-painted design and 3D design method based on single style generation. Traditional hand-painted design relies on the experience and creativity of designers, while 3D design methods based on single style generation only focus on the single style of Huizhou culture or cyberpunk. The experimental data set is extremely rich. Huizhou cultural elements include Huizhou architectural components (300 samples of horse head wall and 250 samples of archway), Huizhou traditional clothing patterns (400 samples of Huizhou embroidery and 350 samples of button styles), and Huizhou folk craft elements (320 samples of wood carving, 280 samples of stone carving, and 260 samples of brick carving). Cyberpunk elements include cyber technology decoration (280 samples of luminous circuit lines, 250 samples of mechanical gears), futuristic materials (300 samples of metal texture fabrics, 270 samples of transparent plastic materials). The data set is divided into 70% training set, 20% validation set, and 10% test set, and each type of element is evenly distributed to ensure the scientific and reliability of the experiment.

5.2 Experimental environment and parameter settings

The experiment was carried out in a high-performance computing environment. In terms of hardware, the CPU uses Intel Xeon Platinum 8380, and its powerful multi-core performance accelerates complex algorithm calculations; the memory is equipped with 128GB DDR4 to ensure smooth data processing and model calculations; the graphics card uses NVIDIA GeForce RTX 3090, which significantly improves the efficiency of deep learning model training and 3D model rendering. The software

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

environment is the Ubuntu 20.04 LTS operating system, which is stable and compatible with various development tools. The programming language uses Python 3.8, combined with a rich scientific computing and machine learning library. The key library and framework versions are: TensorFlow 2.6 for building deep learning models, PyTorch 1.9 for assisting some algorithms, NumPy 1.21 for efficient numerical calculations, and Pandas 1.3 for processing and analyzing data. The key parameters of the algorithm were determined after multiple debugging: the learning rate of the semantic understanding model was set to 0.001 to balance the model convergence speed and prevent overfitting; the crossover probability of the cultural gene genetic algorithm was 0.8, and the mutation probability was 0.05, which maintained population diversity while prompting the algorithm to converge to the optimal solution.

5.3 Comparative analysis of experimental results

The results show that the integration degree of this method is 85%, traditional hand-painting is 60%, and single-style generation is 70%. This method is based on precise semantic understanding and big data optimization to achieve better integration of elements. The visual effect is measured by PSNR (peak signal-to-noise ratio) and SSIM (structural similarity index). The data is shown in Table 1:

Table 1 PSNR and SSIM indicator evaluation table

Design method	PSNR (dB)	SSIM
This method	35	0.9
Traditional hand-painting	30	0.8
Single style generation	32	0.85

Figure 3 shows that the line of this paper's method has a high starting point of about 7 points. As the number of iterations increases, it rises steadily and basically stabilizes at about 8 points after 50 iterations. The line of traditional hand-drawn design fluctuates less and always hovers around 6 points. The line of the 3D design method generated based on a single style starts at 6.5 points. Although it rises, the amplitude is limited. It only reaches about 7.2 points after 100 iterations. This method has obvious advantages in improving design innovation. As the algorithm continues to learn and optimize the data, it can continue to explore new design ideas.

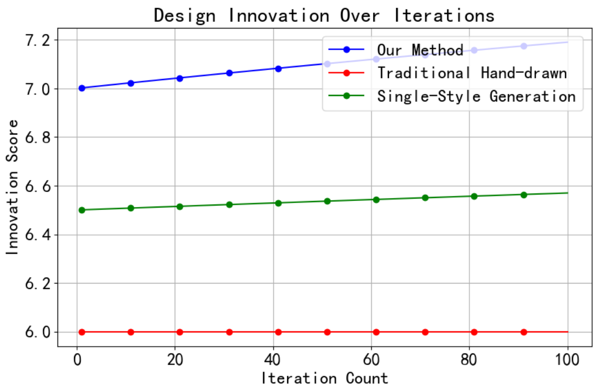

Figure 3. Design Innovation Line Chart.

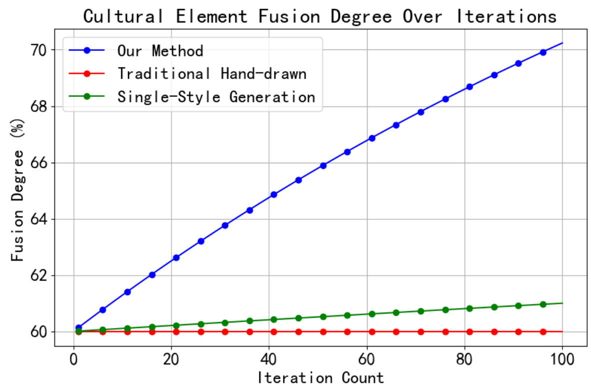

Figure 4. Line graph of cultural element integration.

Figure 4 shows that the line graph of the proposed method rises rapidly in the initial stage, reaching

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

80% integration after about 20 iterations, and then steadily increases to 85% and remains stable. The line graph of traditional hand-drawn design grows slowly, eventually staying at about 60%. The rising trend of the line graph of the single style generation method is slightly better than that of traditional hand-drawn design, reaching 70% after 100 iterations, but far lower than that of the proposed method. This shows that the collaborative optimization of big data and semantic analysis based on this paper can quickly and effectively achieve the deep integration of two cultural elements.

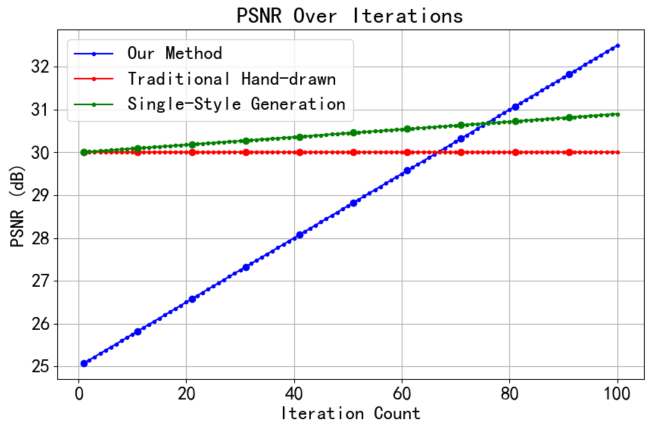

Figure 5. PSNR indicator line graph.

Figure 5 shows that the PSNR value line of the proposed method starts from 30dB, rises rapidly with iterations, reaches 35dB around 60 iterations and remains stable. The PSNR value line corresponding to the traditional hand-painted design basically fluctuates around 30dB. The line of the single style generation method starts from 31dB and gradually rises to 32dB. The proposed method performs outstandingly in improving the peak signal-to-noise ratio of the model's visual quality, and the generated 3D model image quality is better.

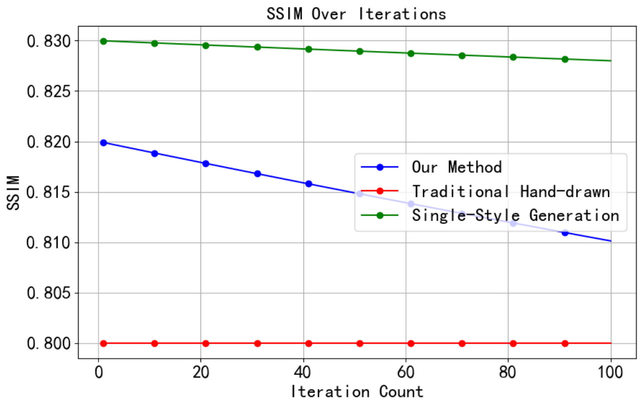

Figure 6. SSIM index line graph.

Figure 6 shows that the SSIM value line of the proposed method starts from 0.82, continues to rise, reaches 0.9 and stabilizes at around 80 iterations. The SSIM value line of the traditional hand-painted design is maintained at around 0.8. The line of the single style generation method starts from 0.83 and reaches 0.85 at 100 iterations. From the SSIM index, the model generated by the proposed method is closer to the ideal effect in terms of structural similarity, and the visual presentation is more delicate and realistic.

6. Conclusion

This study successfully designed and implemented a 3D intelligent generation system for cyberpunk clothing of Hui culture based on the collaborative optimization of big data and semantic analysis. Combining big data processing capabilities with the precise understanding of cultural and design semantics through semantic analysis, especially the application of cultural gene genetic algorithms, provides a new way for innovation in clothing design. Experiments have verified the significant

ISSN 2616-7433 Vol. 7, Issue 5: 68-76, DOI: 10.25236/FSST.2025.070509

advantages of this method over traditional methods and single style generation methods in terms of design innovation, cultural element integration and visual effects. However, there are still some shortcomings in the research. The efficiency of the algorithm needs to be further improved when processing extremely complex combinations of Hui culture elements, and the system's support for niche cultural elements is not perfect. Future research can improve operating efficiency by optimizing the algorithm structure and using more efficient computing resources; expand the scope of data collection to cover more regional cultures and niche cultural elements; explore the application of the algorithm in other fashion category designs, such as shoes, accessories, etc., further explore the potential of this technology in the fashion design industry, and provide stronger support for the deep integration and development of culture and fashion.

References

[1] Qin Zhen, Ji Tie, Liu Fang, & Liu Yonghong. Product design method based on the extension semantics of ethnic pattern primitives. Journal of Computer-Aided Design & Graphics, vol. 33, pp. 7 1595-1603, October 2021.

[2] Mao Cunli, Hao Pengpeng, Lei Xiongli, Wang Bin, Wang Hongbin, & Zhang Yafei. Cross-border ethnic cultural text retrieval based on entity semantic extension. Journal of Chinese Information Processing, vol. 36, pp. 3 101-109, November 2022.

[3] Li Xiaomin, Wang Hao, Bu Wenru, & Zhou Shu. Research on the association of ancient poetry, allusions and words from the perspective of knowledge reorganization: A method integrating fine-grained co-citation relationship and semantic features. Journal of Information Resources Management, vol. 14, pp. 1 131-142, June 2024.

[4] Ding Ning, Yu Suihuai, Chu Jianjie, Chen Chen, & Liu Huajing. Construction and application of semantic quantification model of ethnic patterns for product design. Journal of Computer-Aided Design and Graphics, vol. 35, pp.6 621-632, April 2023.

[5] Shiv Ram Dubey, Satish Kumar Singh, & Wei - Ta Chu. Vision Transformer Hashing for Image Retrieval. In Proceedings of the IEEE International Conference on Multimedia and Expo (ICME), pp. 123 - 125, 2022.

[6] Bai Yan, & An Xingyu. Analysis and optimization path of projection and perceived image deviation of ancient town scenic spots: A case study of Pingyao Ancient City. Journal of Southwest University (Natural Science Edition), vol. 44, pp.10 101-111, December 2022.

[7] Zhao Guanbo, Zhang Yongbing, Mao Cunli, Gao Shengxiang, & Wang Fengxiao. Generative summarization method of cross-border ethnic culture integrating domain knowledge. Journal of Nanjing University (Natural Science Edition), vol. 59, pp. 6 620-628, April 2023.

[8] Zeng Zhen, Zhang Dan, Lin Runze, Chen Lingyan, He Tianyou, Ye Jing, & Zheng Yushan. Study on the image and perceptual characteristics of tourist destinations based on network text analysis: A case study of Yangzhou Geyuan. Journal of Southwest University (Natural Science Edition), vol. 44, pp. 7 194-201, January 2022.

[9] Yang Zhenping, Mao Cunli, Lei Xiongli, Gao Shengxiang, Lu Shan, & Zhang Yongbing. Cross-border ethnic cultural entity recognition method integrating word set information. Journal of Chinese Information Science, vol. 36, pp. 8 88-96, October 2022.

[10] Xiao Yao, Shao Ming, & Ma Yuan. Study on recreational activities and space of human settlement environment in Beijing during the Qing Dynasty based on semantic analysis of ancient documents. Landscape Architecture, vol. 29, pp. 9 134-139, February 2022.

[11] Zhang Yunzhong, Jiao Fengzhi, & Liu Jialin. Semantic description model and metadata framework for display of Tang Sancai digital cultural resources. Library and Information, vol. 41, pp. 8 87-96, March 2021.