Research on CAD system design of intelligent clothing accessories based on interactive network

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Abstract. Clothing CAD technology is a bridge that combines clothing design and high technology, and is one of the important fields of computer science and technology in the art kingdom. The style-based intelligent clothing style structure design system studied in this paper is mainly for users or design lovers who are not major in clothing design, so that they can realize the intelligent design of a certain style and style series in the friendly human-computer interaction, thereby replacing the Traditional designer hand creation process. This paper presents the system architecture, designs and completes the interactive interface, analyzes and implements the automatic splicing and adjustment functions of style components provided by the system, and explores and implements style-based style retrieval. Through the overall analysis of the intelligent clothing style structure design system, this paper develops a very good clothing design interface with VC. The author innovatively proposes the idea of "primitive structure" and "function simulation", and realizes the process of using computer to draw clothing accessories, so that the generated accessories can be accurately fitted along the given curve during clothing design, and provides the interface parameters make clothing accessories adjustable and controllable, which better realizes intelligence and facilitates the use of the client.

Keywords: Algorithm, AD, interaction design, style retrieval.

1. Introduction

1.1 Development and Status Quo of Garment CAD System

Computer-aided design (CAD) is an emerging comprehensive computer application system technology that has developed rapidly in the past 50 years. It uses the powerful computing function and high-efficiency graphics processing capabilities of computers to assist in the completion of calculation, analysis, and simulation in design. It is a specialized technology for computer to help designers realize product design and engineering design[1].

At present, in some developed countries in Europe, clothing CAD technology has been basically popularized. Whether to use computer to draw clothing model diagram has become an important symbol to measure the design level and product quality of enterprises. The fitting system is still in the field of two-dimensional fitting. Due to the bottleneck of 3D technology, even a few systems with 3D technology have not very high content of 3D technology, which is still a long way from practical application, which needs to be further explored. The main research includes the conversion of 2D template and 3D effect[2]. There are many studies in Japan, the United States, Switzerland and other countries. Most of them are based on particle systems, and the finite element method is also used. Simulation of dynamic effects of clothing: such as the University of Geneva in Switzerland. Virtual interaction system research, clothing design and effect simulation research of Zhejiang University; human 3D modeling, such as NURBS surface method, particle system theory and the use of intelligent algorithms for parameter acquisition, etc. In addition, neural networks are used for exploration of free-form surfaces and genetic Algorithms are applied to clothing design, etc[3].

1.2 Subject development background

With the advent of the information age, clothing design plays an increasingly important role in product sales and enterprise development. The style-based intelligent clothing style structure CAD system developed in response to the application needs of China's domestic clothing production market realizes an intelligent clothing style structure CAD system guided by artificial intelligence, knowledge engineering and other theories, targeting clothing style designers, especially non-professional designers. The design system is designed for the purpose of easy and intuitive operation. Finally, a flat structure diagram of clothing styles that is satisfactory to users is obtained, which forms a closer connection with the subsequent process system of clothing, and provides the possibility for the electronic integration of clothing technology in the future[4].

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2. Overall design of the system

2.1 System Scheme Analysis

Establishing a style design system based on borrowing thinking is what we will study in the next step. From the structural composition of clothing to explore the laws of clothing, clothing can be divided into several parts. Considering that the segmentation is too fine, it is not conducive to the computer realization of the splicing of style parts, we use the former new segmentation method for reference[5]. As shown in Figure 1 below.

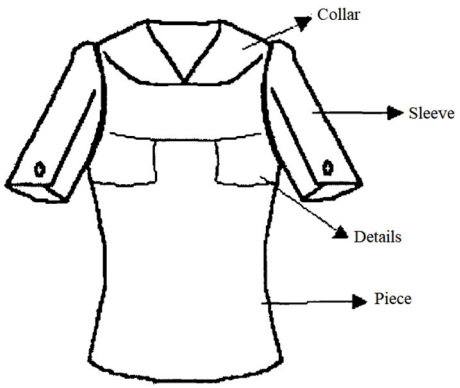


Figure 1 Elements that make up the bodywork

The preservation of a large number of typical clothing styles, user styles and various parts data must rely on database technology[6]. A database is a software tool that saves and manages a large amount of complex data and information by means of a computer. The engineering database is a key part in the product and engineering field to organize and manage the various data file objects required and generated in the product and design process[7].

2.2 System Development Environment

The development platform of the system is Windows 2040a.

The main development language is Visual C++, and the database uses SQL Server a Visual C++[8]. It integrates MFC (Microsoft Foundation Class) library, MFC encapsulates Windows APi functions and messages, so that programmers can use MFC to efficiently develop various applications[9]. It provides MFC-based CIassW izard, through which the use and maintenance of various MFC classes can be easily completed; it includes a full range of support for developing database applications, and it provides a variety of database access technologies, forming a powerful Integrated development environment for database applications. Provides OLE technology and Active technology[10].

3. Mathematical foundations of design systems

3.1 Curve Theory

Assuming given the value of the function f(x) at two different points x1 and x2, use a linear function: Y=a*x+b, which approximates to replace f(x), is called the linear interpolation function of f(x). The coefficients a and b of the linear function are determined by the conditions Φ (x1) = y1 and Φ (x21) = y2.

Computer-generated curves can have parametric and nonparametric representations. Because non-parametric equations are inconvenient to calculate and program, parametric equations are often used to represent curves[11]. A polynomial, trigonometric or exponential function fy(u) can be used as the equation for approximating the curve, or you can choose the reason for choosing the parametric equation is that the three-dimensional function only needs to add an fz component to the two-dimensional function, and the parametric equation treats the components in the three directions equally. In addition, it can express multivalued functions, that is, there can be multiple y values for a given x value, so the curve can intersect itself back and forth.

$$\begin{aligned} x(t)&=a_{3x}t^3+a_{2x}t^2+a_{1x}t+a_{0x}\\ y(t)&=a_{3y}t^3+a_{2y}t^2+a_{1y}t+a_{0y} \qquad t\in[0,1]\\ z(t)&=a_{3z}t^3+a_{2z}t^2+a_{1z}t+a_{0z} \end{aligned} \tag{1}$$

a_{3x}: These algebraic coefficients determine the shape and location of a parametric curve. If two identical parametric curves have different coefficients, it means that the spatial positions of the two parametric curves are out of phase[12].

3.2 Cubic B-splines

Considering that most of the curves in the clothing style plane structure diagram are irregular curves, in order to ensure the unity of the system, we use the same curve generation method to construct the style and component outlines. Since the cubic B-spline curve can achieve quadratic continuity and has good continuity, it has become the first choice for the design of this system.

The matrix representation of the cubic B-spline curve expression is:

$$P(t)=\sum_{i=0}^{3}Bi\cdot F_{i,3}(t)=\frac{1}{6}\begin{bmatrix}t^3 & t^2 & t & 1\end{bmatrix}\begin{bmatrix}-1 & 3 & -3 & 1\\ 3 & -6 & 3 & 0\\ -3 & 0 & 3 & 0\\ 1 & 4 & 1 & 0\end{bmatrix}\begin{bmatrix}B_{0i}\\ B_1\\ B_2\\ B_3\end{bmatrix} \tag{2}$$

The situation at the endpoint is:

$$P(0)=\frac{1}{6}(B_0+4B_1+B_2)=\frac{1}{3}\frac{B_0+B_1}{2}+\frac{2}{3}B_1=\frac{1}{3}M_1+\frac{2}{3}B_1 \tag{3}$$

$$P(1)=\frac{1}{6}(B_1+4B_2+B_3)=\frac{1}{3}\frac{B_1+B_2}{2}+\frac{2}{3}B_2=\frac{1}{3}M_2+\frac{2}{3}B_2 \tag{4}$$

When u=0, it can be seen that the use is the starting point of the curve, and when u=1 is the end point of the curve. The curve obtained from the B-3 degree spline function in Figure 2 below.

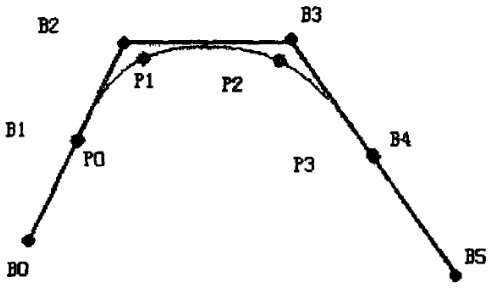


Fig. 2 Curve segment obtained by B-3 degree spline function

For a B-3 degree spline, there is a relationship between the shape point and the position vector of the control point:

$$B_i(0)=\frac{1}{6}(B_i+4B_{i+1}+B_{i+2})=P_i j=0,1,2,3,\ldots,n \quad (5)$$

Formula (5) has n equations, but there are n+2 unknowns, and two boundary conditions need to be added. Pass P with the first and last two o'clock. And the non-periodic B-3 spline curve of Pn-1 is taken as an example to solve[13]. At this time, it should be: B1=Po, Bn=Pn-1; then the linear equation system to solve the control point is:

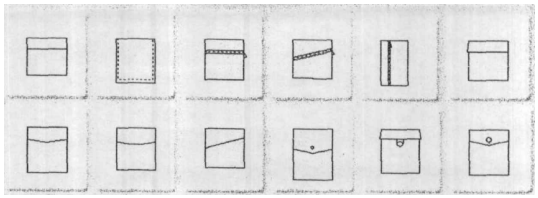
$$\begin{bmatrix} 6 & 0 & & & & \\ 1 & 4 & 1 & & 0 & \\ & 1 & 4 & 1 & & \\ \cdots & & & & & \\ & 0 & & & 1 & 4 & 1 \\ & & & & 0 & 6 \end{bmatrix} \begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_{n-1} \\ B_n \end{bmatrix} = 6 \begin{bmatrix} P_0 \\ P_1 \\ \vdots \\ P_{n-2} \\ P_{n-1} \end{bmatrix} \quad (6)$$

It can be seen that by using the inverse calculation of B-3 degree spline curve and B-3 degree spline curve algorithm, the system can well fit the shape curve of the style parts, and can be modified locally, so as to achieve the ideal effect pattern[14].

4. Design and implementation of CAD system for intelligent clothing style structure

4.1 System interface design and implementation

In this project, professional designers convert flat styles into digital forms and store them in the database, and establish an intelligent clothing splicing system platform for non-professional users. The latter can use the resources provided by designers to design on this platform. It's the design process. Since there are many operation steps and methods of the clothing splicing system, they directly affect the design of the interface. Therefore, it is necessary to clarify the operation of each step first, and then correspondingly obtain an interface design scheme that reflects the intelligence and good interactivity of the system[15].



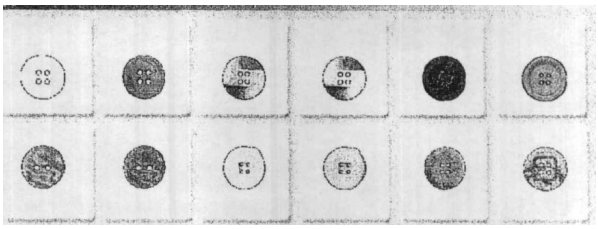


Figure 3 Schematic diagram of the thumbnail dialog box

4.2 Design and implementation of intelligent splicing module

4.2.1 Concatenation algorithm

Transformation algorithms are commonly used in stitching, mainly translation, scale, and rotation[16].

(1) Translation transformation

$$[x' \ y' \ 1]=[x \ y \ 1]\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ T_x & T_y & 1 \end{bmatrix}=[x+T_x \ y+T_y \ 1] \quad (7)$$

(2) Scale transformation

$$[x' \ y \ 1]=[x \ y \ 1]\begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix}=[S_x x \ S_y y \ 1] \quad (8)$$

(3) Rotation transformation

$$[x' \ y' \ 1]=[x \ y \ 1]\begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (9)$$

4.3 B3 Spline Approximate Intersection

Considering that most of the curves in the clothing style plane structure diagram are irregular curves, in order to ensure the unity of the system, we use the same curve generation method to construct the style and component outlines[17]. Since the cubic B-spline curve can achieve quadratic continuity, the continuity is good, so the B3-spline becomes the first choice for the design of this system[18]. The curve segment obtained by the B-3 degree spline function is shown in Figure 4.

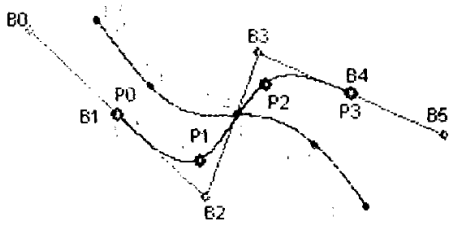


Fig. 4 Curve segment obtained by B-3 degree spline function

4.4 Digital realization of clothing style accessories

In the external design of clothing, the arrangement of structural lines and the layout of decorative patterns not only determine the aesthetics of the form, but also reflect the overall style of the clothing. The curve of the clothing parts in the design is fitted by the cubic B-spline curve. The so-called accessory pattern paste means that the

drawn primitives are pasted one by one according to the position on the given B-spline curve, in order to achieve. To achieve the overall effect of the accessories pattern. The basic primitive cycle is shown in Figure 5

Figure 5 Basic primitive cycle diagram

5. Conclusion and prospects

The intelligent style structure design is an attempt to use the support of computer technology to enable non-professionals to complete the traditional designer's creative process through less human-computer interaction. The research in this paper is mainly innovative in the following aspects: The system is aimed at non-professional designers, starting from the big concept and feeling in the mind, and gradually refines it to every link of clothing, step by step into the process of intelligent design, by the system The automatically generated styles are modified by human-computer interaction to complete the design. The B3 spline is used to simulate the clothing modeling curve, and it is proposed to describe it formally and formulate corresponding rules, which establishes the foundation for the automatic generation of intelligent styles and the independent design of computers. At the same time, the methods of "primitive construction" and "function simulation" are used for accessories such as lace and shirring on clothing styles, breaking through the unadjustable bitmap of accessories in traditional CAD design, making the pattern parameters of clothing accessories controllable, and also It reflects the characteristics of digitalization.

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