Hindawi

Retraction

Retracted: Research on the Architecture of Digital Song and Dance Costume Design System Based on Intelligent Deep Learning Algorithm

Journal of Sensors

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] W. Wang, "Research on the Architecture of Digital Song and Dance Costume Design System Based on Intelligent Deep Learning Algorithm," *Journal of Sensors*, vol. 2022, Article ID 1545334, 10 pages, 2022.

Research Article

Research on the Architecture of Digital Song and Dance Costume Design System Based on Intelligent Deep Learning Algorithm

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In order to improve the intelligence and reliability of song and dance costume design, this article combines the intelligent deep learning algorithm to improve the digital costume design process. In order to solve the problem of minimizing the energy of image deformation, this paper proposes to transform it into a sparse matrix to solve the problem, which is solved by constructing a coefficient matrix and multiple iterations. After the algorithm is improved, this article combines the digital intelligence method to construct the digital song and dance costume design system structure based on the intelligent deep learning algorithm and analyzes its work flow. Finally, this paper verifies the method in this paper through feasibility analysis and system performance test. From the experimental results, it can be seen that the digital song and dance costume design system based on the intelligent deep learning algorithm proposed in this article has a good effect in the song and dance costume design.

1. Introduction

The three-dimensional clothing virtual deformation display system is to summarize the successful design historical materials and design experience accumulated by clothing designers and display personnel over the years and establish a digital clothing sampling system in the computer. The operator can perform a three-dimensional panoramic view of the selected clothing and adjust the deformation of its specific parts according to the needs. The computer simulates the dressing effect of the sample according to the selected size, thereby completing the generation process from style design to clothing design display adjustment. The ideal state of the intelligent clothing virtual deformation display system is "zero tool" and "dumb" operation. The former refers to the style design of clothing that does not use traditional paper and pen. It only needs software to model and adjust the clothing, and many related different styles can be derived. The latter is simple to operate and can be used by professionals and nonprofessionals. It is as convenient and quick to operate as point-and-shoot cameras on the market [1]. The intelligent clothing deformation system must be based on scientific and reasonable "design knowledge" as a platform to enable its intelligent design module to operate normally. To truly realize the intelligent display of three-dimensional clothing, there are still many problems that need to be solved. Ensuring the rationality of "design knowledge," how to transform "design knowledge" into computer-recognizable mathematical codes, how to use computer programming language to realize clothing deformation, etc., will all become high-end technologies for clothing three-dimensional virtual deformation display [2]. The digital realization and transformation of clothing models are the key to the development of its intelligent technology [3].

All human progress is a linear movement from shallow to deep, from simple to complex, from extensive to detailed, stone axes and choppers of the Paleolithic era, bone needles and spinning wheels of the Neolithic era, and today's CNC machine tools and electronic collider, the same helper who works for humans. Perhaps there are similar appearances and internal performances in similar times, while qualitative and conceptual drastic changes will occur in distant times. This is why today's design is different from the original design. The development of clothing design has generally

gone through this process, using primitive animal skins and leaves to simply drape. The emergence of cotton and linen fabrics in thousands of years of development and evolution gradually determined the garment shape of Chinese upper garments and lower garments. After thousands of years to the Ming and Qing dynasties, the princes and nobles' clothing embroidery overlaps, and they are extremely complicated and inexhaustible, which seems to indicate that feudal society is at its extreme. After the human history entered the modern society, clothing design has gone from simple tailoring and sewing, sheltering the body from the cold, through many revolutionary changes, and more and more infiltration of rational elements, from daily wear to fashion, from underwear to outerwear, classification strict, and the production process is more precise and perfect. Due to the intervention of high technology, clothing has undergone a qualitative leap from design to craftsmanship and fabrics. All this shows that the development of clothing also shows a linear movement. Due to this phenomenon of development, in musicals, according to the needs of the repertoire or the choreographer, the costume design will also be handled appropriately from the style and color, complicated or simple, until a satisfactory costume positioning is found.

This article combines the deep learning algorithm to improve the digital algorithm, builds a song and dance costume design system, improves the effect of song and dance costume design, and improves the intelligence of the song and dance costume design process.

2. Related Work

With the improvement of virtual technology, the development of virtual fitting technology abroad is very rapid. The Russian company AR Door has innovatively launched a "virtual fitting room" solution and conducted an application test in a Moscow store. This solution is in cooperation with Topshop, a British fashion brand company. It uses the Kinect, a somatosensory device launched by Microsoft, as the sensor. When using it, consumers do not have to actually try on clothes. They can try it virtually through simple gestures. Wear all the clothes built into the system [4]. NDP has customized a virtual fitting system for Japanese clothing company Uniqlo. This system consists of a peripheral camera, a large screen, and a tablet terminal. The system will recognize the type and color of the clothes selected by the user and can display the effect of the clothes on the user on the large screen through augmented reality technology [5]. The user can intuitively see the effect of the selected clothing on the model. The system proposed in [6] also has the function of helping users interact with their friends. Users can use the system to send virtual images of their clothes after trying on them to relatives and friends in the form of MMS or e-mail for them to comment. Virtual fitting has gradually developed in my country. In literature [7], the fitting software of the pot lift successfully realized the online virtual fitting of customers. Consumers can log on to their website and enter their height, weight, chest circumference, waist circumference, and other key body dimensions, and the system will soon be able to generate a three-dimensional virtual

model with consumers' own body shape characteristics. The "online fitting room" proposed in literature [8] provides a variety of body models. Users can choose models that are similar to their own body types and wear their selected clothing, shoes, and hats on the model to roughly simulate these models and the effect of clothing on yourself. Literature [9] proposes "3D interactive virtual fitting room." In foreign countries, virtual reality technology has long been used in many areas of business activities, such as art, education, entertainment, medicine, and sales. Virtual reality technology is applied to the education industry. As a new teaching medium, its superiority is obvious. It can be a vivid and intuitive display of complex and boring theories to learners, and it also makes more theoretical knowledge available. The possibility of experimentation has greatly improved the learning efficiency [10].

At present, the basic research in this field in the United States mainly focuses on four aspects: perception, background software, user interface, and hardware. Japan is also one of the leading countries in the current research and development of virtual reality technology, and it is mainly dedicated to the research of establishing a large-scale knowledge base [11]. In addition, a lot of work has been done in the research of virtual reality games. However, most of Japan's virtual reality hardware is imported from the United States [12].

Literature [13] uses the repeated textile block (Lumislice) to realize the simulation and rendering of knitted fabrics at the same time and achieves a very fine effect. Literature [14] studies the internal structure of cloth to simulate gloss, but this method uses a highly simplified cloth model, and the result is also lack of verification. Literature [15] used ray tracing geometric models of small-scale cloth to calculate the BRDF of velvet and nylon fibers. Literature [16] used CT scan cloth surface structure to perform volume rendering. This method provides high-quality and close-range rendering, but this method requires the use of complex measuring equipment to measure samples; otherwise, it cannot be directly extended to other types of cloth. Literature [17] established a complete model that can regenerate the appearance of fabric cloth, using the bidirectional texture function (BTF) at short distances and the bilinear reflection distribution function (BRDF) at long distances. This is the most advanced method that can reproduce the appearance of various fabrics. It is an empirical model established by simulating the interaction of light on the fiber. Literature [18] established an anisotropic model based on the yarn's bidirectional scattering distribution function (BSDF) model and the yarn weaving method. This model mainly determines the optical properties of the cloth by the scattering properties of the yarn and the tangent direction of the yarn.

3. Digital Algorithm Based on Intelligent Deep Learning

The global optimization problem of image distortion in this paper is essentially a convex optimization problem. How to solve this convex optimization problem most efficiently is a problem that needs to be solved. First, we first abstract the

specific problem into a minimization problem of finding a generic function. For an unconstrained problem as described in [19]

$$\min f(x), \quad x \in R^n. \tag{1}$$

Among them, the function $f(x)$ has a first-order continuous partial derivative.

To solve such problems, we always hope to find the fastest path to the minimum.

The steepest descent method assumes that the rate of change of the function $f(x)$ along the direction d at the point x can be expressed by the directional derivative. For a differentiable function, the directional derivative is equal to the inner product of the gradient and the direction, that is,

$$Df(x\,;d) = \nabla f(x)^T d. \tag{2}$$

Therefore, finding the fastest declining direction of the function $f(x)$ at point x can be attributed to solving the following nonlinear programming [20]:

$$\begin{aligned} \min \quad & \nabla f(x)^T d \\ \text{s.t.} \quad & \|d\| \le 1. \end{aligned} \tag{3}$$

From the Cauchy-Schwarz inequality, we can get

$$\left| \nabla f(x)^T d \right| \le \left\| \nabla f(x)^T \right\| \|d\| \le \|\nabla f(x)\|. \tag{4}$$

By removing the absolute value sign, we can get

$$\nabla f(x)^T d \ge -\|\nabla f(x)\|. \tag{5}$$

Then, we know when

$$d = -\frac{\nabla f(x)}{\|\nabla f(x)\|}. \tag{6}$$

The equal sign holds, and the rate of change along the direction defined by the above formula is the smallest at point x, that is, the negative gradient direction. In this design, $f(x)$ corresponds to the image deformation energy, and x corresponds to the corresponding pixel coordinate value. The multidimensional convex optimization problem can be expressed as

$$\min \|E(x)\|_0. \tag{7}$$

Among them,

$$E(x) = \lambda_d E_d + \lambda_h E_h + \lambda_v E_v. \tag{8}$$

From the above derivation, it can be known that in order to minimize the objective function, it should be along the x negative gradient direction. This topic is aimed at the independent variables of 2D coordinate pixels, and the gradient direction is the xy direction differential.

After formula (8) is differentiated in xy direction and set to O, formula (9) can be obtained [21]:

$$\lambda_d \frac{\partial E_d}{\partial_{x,y}} + \lambda_d \frac{\partial E_v}{\partial_{x,y}} + \lambda_d \frac{\partial E_h}{\partial_{x,y}}, x, y \in \{\text{All block nodes}\}. \tag{9}$$

In the formula, the items E_h and E_v are the f subitems of the above structural item E_s, which represent the energy subitems in the vertical and horizontal directions, respectively. The three component calculation formulas will be derived in detail below.

For the disparity term, each piece of energy is produced by a feature point (x, y):

$$E_d = \sum S(X_{\text{old}} - X_{\text{new}} - d)^2, \quad x \in \{\text{All matching feature points}\}. \tag{10}$$

Among them, the S term is the attention degree weight, X_{old} is the corresponding coordinate in the original image, and X_{new} is the corresponding coordinate in the virtual view point image.

For convenience, the abscissa of the vertices of each block is

$$\frac{\partial E_d}{\partial x_p} = \frac{\partial E_d}{\partial x_{\text{new}}} \frac{\partial x_{\text{new}}}{\partial x_p} = 2S(X_{\text{old}} - X_{\text{new}} - d) \frac{\partial x_{\text{new}}}{\partial x_v}, \tag{11}$$

$$\frac{\partial x_{\text{new}}}{\partial x_p} = \frac{\partial x_{\text{new}}}{\partial x_1} + \frac{\partial x_{\text{new}}}{\partial x_2} + \frac{\partial x_{\text{new}}}{\partial x_3} + \frac{\partial x_{\text{new}}}{\partial x_4}. \tag{12}$$

Based on the above formula, the following formula can be obtained:

$$\begin{aligned} \frac{\partial E_d}{\partial x_1} &= 2Sk_1(k_1 x_1 + k_2 x_2 + k_3 x_3 + k_4 x_4) - 2Sk_1(x_{\text{new}} + d), \\ \frac{\partial E_d}{\partial x_2} &= 2Sk_2(k_1 x_1 + k_2 x_2 + k_3 x_3 + k_4 x_4) - 2Sk_2(x_{\text{new}} + d), \\ \frac{\partial E_d}{\partial x_3} &= 2Sk_3(k_1 x_1 + k_2 x_2 + k_3 x_3 + k_4 x_4) - 2Sk_3(x_{\text{new}} + d), \\ \frac{\partial E_d}{\partial x_4} &= 2Sk_4(k_1 x_1 + k_2 x_2 + k_3 x_3 + k_4 x_4) - 2Sk_4(x_{\text{new}} + d). \end{aligned} \tag{13}$$

Among them, k_1, k_2, k_3, k_4 represents the current feature point and the ratio coefficient of the four vertices, respectively.

The energy constraint in the horizontal direction is generated by the horizontal edge of each block. Similarly, for convenience, t and j are used to indicate the position of the current block in the entire image. The specific expression is as follows:

$$E_h = \sum S_{i,j}(x_{i+1,j} - x_{i,j} - w)^2. \tag{14}$$

It takes the partial derivative of all the block vertices x_{ij}:

$$\begin{cases} \dfrac{\partial E_h}{\partial x_{ij}} = -2S_{i,j}\left(x_{i+1,j} - x_{i,j} - w\right), \\[2mm] \dfrac{\partial E_h}{\partial x_{i+1,j}} = 2S_{i,j}\left(x_{i+1,j} - x_{i,j} - w\right). \end{cases} \quad (15)$$

It can be found from the formula that the periodicity of the horizontal energy item is mainly manifested between two adjacent blocks. In other words, for the horizontal item, only the horizontal adjacent block coefficient is not zero, and the rest are zero.

For the vertical term, each piece of energy is produced by a longitudinal edge of a block:

$$E_h = \sum S_{i,j}\left(x_{i,j+1} - x_{i,j}\right)^2. \quad (16)$$

It takes the partial derivative of all the block vertices $x_{i,j}$:

$$\begin{cases} \dfrac{\partial E_v}{\partial x_{ij}} = -2S_{i,j}\left(x_{i,j+1} - x_{i,j}\right), \\[2mm] \dfrac{\partial E_v}{\partial x_{i,j+1}} = 2S_{i,j}\left(x_{i,j+1} - x_{i,j}\right). \end{cases} \quad (17)$$

Similarly, the periodicity of the vertical term is mainly manifested between two adjacent blocks in the vertical direction, and its corresponding coefficient is nonzero.

By combining the above formulas into one, we can get the total $\partial E_v/\partial x_{ij}$. When we set it equal to 0, it can then be transformed into a multidimensional linear equation:

$$Ax = b. \quad (18)$$

This topic takes $640 * 360$ resolution as an example, the block size is $16 * 16$, and then A is a 861-order sparse square matrix with 7749 nonzero values. Through the analysis in this section, we have transformed a multidimensional convex optimization problem into a sparse matrix solution problem, thus bypassing the computationally intensive differential operation and QP solution algorithm implementation.

A convex optimization problem is transformed into a sparse matrix solution problem. Usually, the common method for solving linear matrix equations is to solve the linear equation coefficient matrix by matrix decomposition, mainly including triangular decomposition, singular value decomposition, and QR decomposition. The triangular decomposition method is also called LU decomposition, which is mainly solved directly after decomposing a matrix into an upper triangular matrix or a lower triangular matrix. QR decomposition is to decompose the matrix into a normal orthogonal matrix and upper triangular matrix. Singular value decomposition is an orthogonal matrix decomposition method, but it is an unavoidable problem that involves the amount of calculation after orthogonalization. Therefore, solving the energy equation by matrix decomposition is not a good choice. It is not only a matter of the amount of calculation but also some other reasons that the coefficient matrix in the energy equation is not suitable for matrix decomposition. The reason is that the dimension of the coefficient matrix is very large. Taking a 640×480 resolution image as an example, if the block size is 16×16, the number of unknowns is $640 + 1480 + 1 = 1271$, that is, the A matrix is a large matrix of 1271×1271.

If the matrix decomposition method is used to solve the problem, it is necessary to store the coefficients of the relevant upper triangular or orthogonal matrix. For a $1271 * 1271$ matrix, it takes several millions to store the coefficients in 32 bits. This hardware resource consumption is obviously unacceptable. Since it is a specific engineering problem in this design, the solution can be analyzed in detail according to the specific situation.

Similarly, we take a 640×480 image as an example, the block size is 16×16, and the coefficient matrix is shown in Figure 1. Among them, (a) is a schematic diagram of the coefficient matrix, each pixel corresponds to a value in the coefficient matrix, the white dots are the nonzero points of the coefficient matrix, and the black dots are the zero-value points; (b) is an enlarged view of the red frame area in (a), and a small white block in (b) is a pixel, and the dashed line indicates periodicity.

It can be seen that the coefficient matrix is a matrix with block cyclicality, and there are also side-to-corner blocks of the same size on the top, bottom, left, and right sides of the main diagonal block. The size of the block is $(M + 1) \times (M + 1)$, which is partly different from the general strip diagonal matrix. Among them, although the main diagonal blocks are all a periodic three-diagonal matrix, the two adjacent main diagonal blocks are completely separated. The side-to-corner block is also a diagonal matrix, but there will be nonzero values on some diagonal neighboring pixels. These are generated by the disparity term, so the distribution is random. It can be observed from the figure that the coefficient matrix is a sparse band matrix. It can be seen from the formulae deduced above that the coefficient matrix has a certain periodicity. We can make full use of this periodicity to access data and use Gaussian iteration to solve approximate solutions.

Gaussian iterative solution is an improvement of Jacobian iterative solution. In each round of iterative process, a new solution is added to the iterative sequence in time, thereby accelerating the convergence speed of the iteration. During operation, it only needs to store one row of corresponding coefficients and solutions for vector multiplication. At the same time, there are many zero values in the matrix that do not need to be stored, and the magnitude of the required storage is on the order of 3 diagonals, which is reduced by more than 60% compared with the matrix decomposition, which greatly reduces the storage resources. The Gaussian iteration formula is as follows:

$$\begin{cases} x_i^{k+1} = \dfrac{\left(b_i - \sum_{j=1}^{i-1} a_{ij} x_j^{k+1} - \sum_{j=i=1}^{in} a_{ij} x_j^{k}\right)}{a_{ii}}, \\[3mm] i = 1, 2, \cdots, n \,;\; k = 0, 1, 2, \cdots \end{cases} \quad (19)$$
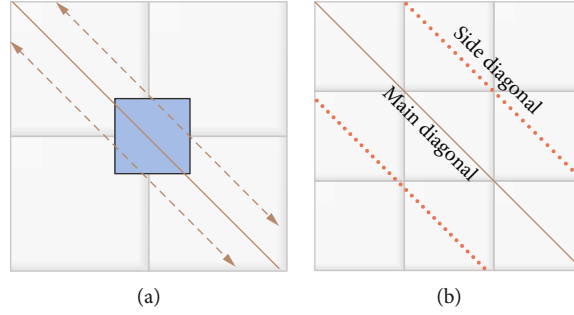
Figure 1: Coefficient matrix of the energy equation.

Among them, k is the number of iterations, and a_{ij} is the coefficient value. It can be seen from formulas (13), (15), and (17) that the coefficient matrix A satisfies

$$|a_{kk}| \geq \sum_{\substack{j=1 \\ j \neq k}}^{n} |a_{kj}|, \quad (k = 1, \cdots, n). \tag{20}$$

Obviously, the coefficient matrix A is a strictly diagonally dominant matrix, so the Gaussian iteration method is used to solve the convergence. As shown in Figure 2, the algorithm flow is described in detail below.

In the circle 2 flowchart, the system first reads in the data, that is, the input coefficient matrix A, constant vector b, initial value, stop condition, and the maximum number of cycles N. In the flowchart, k is the number of iterations and N is the maximum number of cycles. According to the input data, the system performs the first round of iteration according to formulas (4)–(18), judges whether the output data meets the termination condition, and outputs the result if it meets the termination condition; otherwise, it continues to iterate. If the iterative process has not met the termination condition, it is judged whether the number of iterations has exceeded the preset number of iterations, and a failure flag is output if it exceeds.

In the software implementation, the coefficient matrix generated by the horizontal term and the vertical term can be directly superimposed to form a part of the matrix coefficients, and the disparity term generated by the feature points is the equation coefficient matrix to be calculated. In the hardware implementation process, the stored data is only for nonzero coefficients, and there is no need to process a large amount of zero-valued data. It is necessary to use storage resources as much as possible to avoid processing a large amount of zero-valued data. We divide the coefficient matrix into two parts as shown in Figure 3: predictability data and randomness data. The predictability data is also the coefficient matrix generated by the previous structure item, and the randomness data comes from the disparity item of the feature point.

The predictability part can be divided into 5 categories according to the position of the unknown solution order in the grid: (1) four vertices of the grid, (2) vertical edges of the grid, (3) horizontal edges of the grid, (4) periodic edges of the grid, and (5) arbitrary edges of the grid. Module input
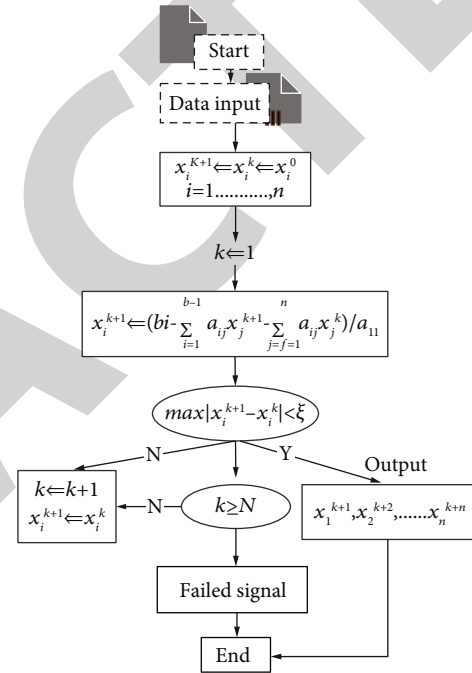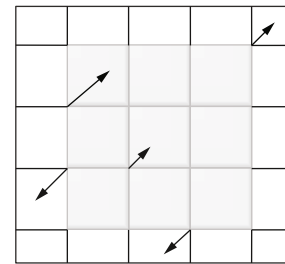

Figure 2: Iterative flowchart.

Figure 3: Schematic diagram of the predictable part of the coefficient matrix classification.

signals include system clock, enable signal, attention information, disparity information, and matching feature point coordinates, and output includes read and write address signals, predictable coefficients, and unpredictable coefficients.

In Figure 3, the upper left dashed box calculates the predictable part of the coefficient, and the lower left box calculates the unpredictable part of the coefficient. The STATE_
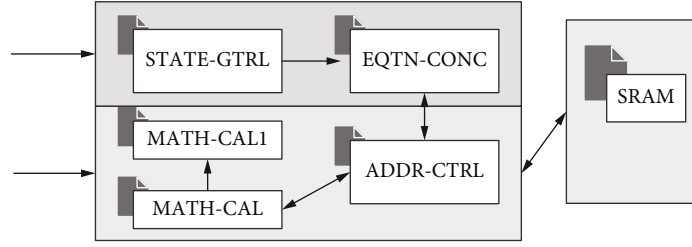
Figure 4: Block diagram of coefficient matrix equation.

CTRL module determines which category position the currently calculated coefficient is in, calculates the coefficient under the current category accordingly, and stores it in SRAM. The unpredictable part is responsible for processing the coefficients of the parallax part, and the input data has parallax, coordinates, and attention degree weights. There are two mathematical operation modules shown in Figure 4. Among them, MATH_CALl is responsible for calculating the precoefficient in the formula, and ADDR_CTRL reads the predictable part of the coefficient that has been stored before from SRAM. MATH_CAL is responsible for superimposing the disparity item on the data and then storing it back into SRAM through ADDR_CTRL.

It is worth noting that although the coefficient matrix has strong regularity and periodicity, it is also random due to the existence of characteristic points. This makes it more difficult for us to read and store correlation coefficient data. Usually, when we do a row of vector multiplication, we first take out the entire row of coefficients and then perform the multiplication in order. Once there are feature points in this row, the coefficient matrix will be very different. As shown in Figure 5, the green dots represent the impact of feature points, usually in 4 locations near them. Taking into account the convenience of storing data, we have adopted a certain margin for each row in the design process to ensure that there will be no overflow in the case of feature points. For the nonzero value of each row in the matrix, 12 storage units are opened up. If there is no coefficient storage at this position, the system skips directly, so as to ensure that the addressing is correct during the next iteration after one iteration.

The most important thing for the iterative method is the number of iterations, which is related to efficiency, resource consumption, and timing stability. Therefore, we need to set a good threshold and maximum number of iterations to ensure that we will not enter an endless loop. The measurement standard is that the accuracy is as close to the real solution as possible. However, considering that decimal points are not supported in FPGAs, we use fixed-point decimals instead of floating-point numbers.

Fixed-point decimal operations assume that x represents an actual number (floating-point number), and q represents its on-type fixed-point decimal number (an integer).

$$
\begin{aligned}
q &= (\text{int})(x * 2^n), \\
x &= (\text{float})\left(\frac{q}{2^n}\right).
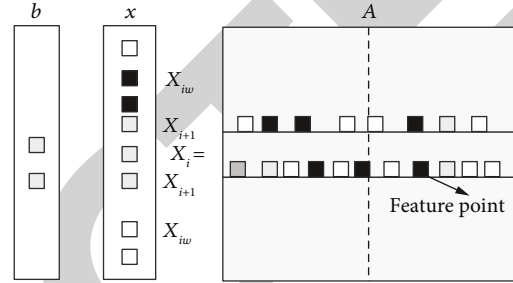\end{aligned}
\tag{21}
$$

Figure 5: Schematic diagram of iterative solution operation.

From the above formula, we can get the "+," "-," and "*" operations for fixed-point decimals.

If it is assumed that the values represented by q_1, q_2, and q_3 are x_1, x_2, x_3, respectively, we can define four arithmetic modes as follows:

$$
\begin{cases}
q_3 = q_1 \pm q_2 \Rightarrow x_3 = x_1 \pm x_2, \\
q_3 = q_1 \times \dfrac{q_2}{2^n} \Rightarrow x_3 = x_1 \times x_2, \\
q_3 = q_1 \times \dfrac{2^n}{q_2} \Rightarrow x_3 = \dfrac{x_1}{x_2}.
\end{cases}
\tag{22}
$$

We can see that there is no difference between addition and subtraction operations and general addition and subtraction. For multiplication and division, a shift operation is used to keep the position of the decimal point unchanged, which involves rounding. For 32 digits with 10 fixed-point decimals, the accuracy can reach 0.000976. The method used in this paper is compared with the two sets of solutions of the matrix equation direct floating-point number solution. Because of the use of fixed-point decimals in this article, the iterative convergence judgment cannot achieve the same high-precision results as floating-point numbers. Therefore, the solution obtained by the method used in this article has a certain degree of deviation. The higher the fixed-point decimal places, the smaller the deviation. The average deviation for 8-digit fixed-point decimals is 0.89%, the deviation for 9-digit fixed-point decimals is 0.51%, and the deviation for 10-digit fixed-point decimals is 0.23%. For a virtual viewpoint image with a resolution of 640 * 360, an error of 0.89% means that the overall horizontal offset has reached 5 pixels, a deviation of 0.51% has an offset of 3
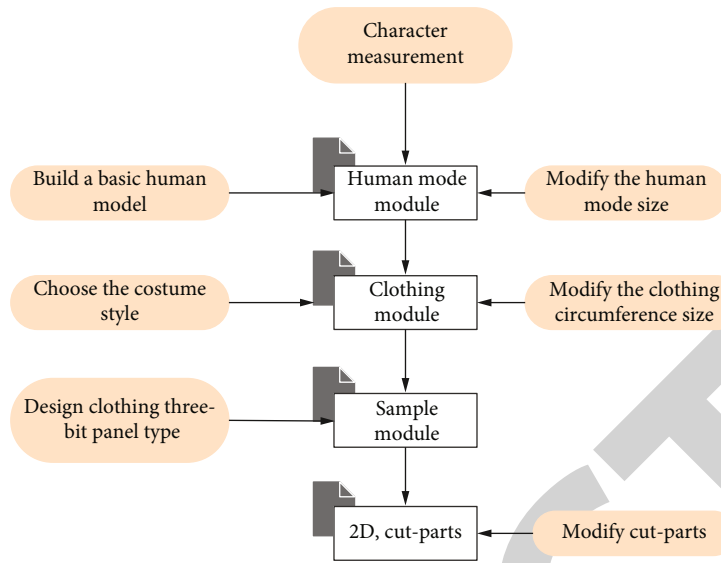
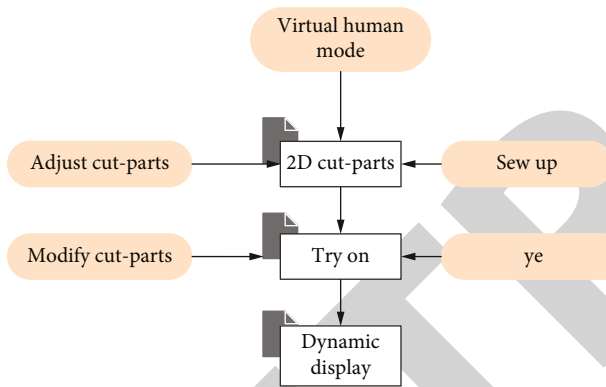FIGURE 6: Operation flowchart of virtual design.

FIGURE 7: Operation flowchart of 3D virtual fitting software.

pixels, and an error of 0.23% as a pixel, the naked eye will not make a strong sensory distinction. When the number of digits is higher, the deviation will be smaller, and higher fixed-point decimals can be used when higher precision is required.

4. Digital Song and Dance Costume Design System Based on Intelligent Deep Learning Algorithm

Three-dimensional cutting software is a form of computer-aided virtual song and dance costume design system development. It integrates the advantages of three-dimensional cutting and plane plate making and adopts a more scientific and reasonable method in the conversion of 3D and 2D in song and dance costume design, which has set off a more time-saving and efficient era of machine electronics industry in the field of song and dance costumes. The operating steps of the three-dimensional virtual three-dimensional cutting software operating system are

FIGURE 8: A case of a mannequin in digital song and dance costume design.

shown in Figure 6, and the operating flowchart of the three-dimensional virtual fitting software is shown in Figure 7.

Based on the support of the above models, the three-dimensional mannequin constructed in this article when designing digital song and dance costumes is shown in Figure 8.

Figure 9: Case of song and dance costume design.

Table 1: Feasibility evaluation of virtual design of song and dance costumes.

No.	Feasibility	No.	Feasibility
1	92.61	17	95.87
2	96.00	18	96.07
3	96.78	19	96.14
4	95.10	20	95.93
5	93.52	21	91.91
6	92.22	22	95.44
7	91.71	23	95.54
8	96.68	24	91.28
9	94.02	25	95.87
10	96.42	26	93.25
11	94.78	27	92.29
12	93.60	28	96.42
13	92.02	29	91.74
14	91.78	30	91.95
15	96.91	31	91.98
16	93.73	32	93.50

Figure 10: Statistical diagram of feasibility evaluation.

Table 2: Evaluation of the design effect of song and dance costumes.

No.	Design effect	No.	Design effect
1	87.20	16	87.76
2	83.17	17	88.50
3	89.23	18	89.92
4	88.69	19	90.03
5	82.94	20	87.71
6	83.26	21	87.53
7	82.99	22	88.54
8	88.86	23	84.27
9	84.16	24	88.07
10	86.68	25	90.35
11	90.18	26	81.84
12	90.72	27	91.02
13	86.96	28	83.31
14	88.25	29	90.77
15	88.95	30	86.41
16	87.76	31	88.98
17	88.50	32	91.00

The costume design of song and dance is carried out in the system model invested and built in this article. Figure 9 shows a case of song and dance costume design.

After the song and dance costume simulation is completed, it needs to be subjectively evaluated to analyze the feasibility of the song and dance costume virtual design. First of all, the model establishes subjective evaluation items and evaluation scales for visual simulation effects based on the virtual evaluation of song and dance costumes, which is convenien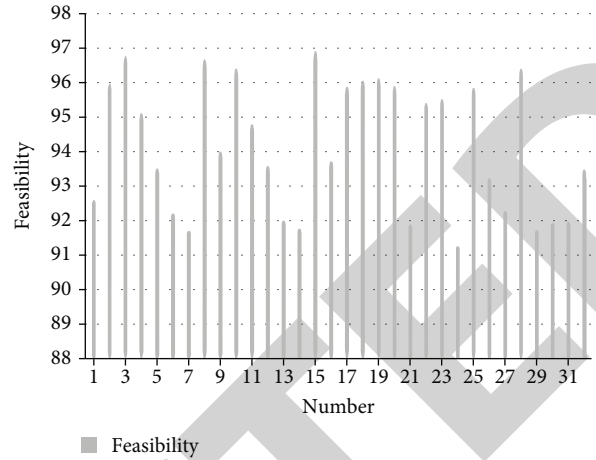t for evaluators to evaluate the similarity between the simulation effects of song and dance costumes and the physical objects. Then, it analyzes the similarity between each song and dance costume simulation and the real object based on each evaluation item. Finally, it analyzes the grade evaluation scores of each evaluation item based on all simulated song and dance costumes and obtains conclusions related to the simulation effect. The feasibility of the system proposed in this paper for virtual design of song and dance costumes is evaluated, and the results are shown in Table 1 and Figure 10.

From the above research, we can see that the digital song and dance costume design system based on intelligent deep learning algorithm proposed in this paper has certain feasibility. Afterwards, the digital song and dance costume design system based on the intelligent deep learning algorithm is
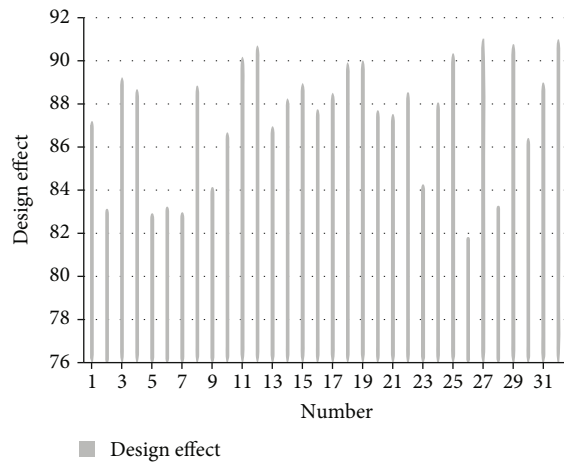
Figure 11: Statistical diagram of the evaluation of the design effect of song and dance costumes.

evaluated for the effect of the song and dance costume design, and the results shown in Table 2 and Figure 11 are obtained.

From the above research, it can be seen that the digital singing and dancing costume design system based on intelligent deep learning algorithm proposed in this article has good effects in the design of singing and dancing costumes.

5. Conclusion

On the stage, general costumes become special, which draw the audience's attention to the role around a certain event, script requirements, and drama creator's ideas. Characters are composed of body, movements, sounds, expressions, costumes, makeup, and other components, and costumes are part of the characters, which exist in the specific theater space and stage scenes. Moreover, it expresses certain drama content through intuitive image packaging. For musicals, it is established that people can look at their faces. Whether the costume is the "trademark" of the protagonist or the "trademark" of the supporting role, it can turn actors into kings or tramps, soldiers or servants, ladies or prostitutes. In musicals, costumes are the most external and common means of determining a character. Whether it is realism or symbolic suggestion, clothing can express gender, age, social class, occupation, nationality, ethnicity, religion, etc. Sometimes, it also reflects the spirit of a particular era. This article combines the deep learning algorithm to improve the digital algorithm, builds a song and dance costume design system to improve the effect of song and dance costume design, and improves the intelligence of the song and dance costume design process.

Data Availability

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

Conflicts of Interest

The author declares no competing interests.

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