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Optimization Analysis of Two-Dimensional Animation Special Effects Design by Style Transfer Algorithm

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Abstract

The application of 5G communication technology and ultra-wideband technology in animation design has gradually improved the level of animation special effects design, and made the style transfer algorithm a research hotspot. The original two-dimensional animation special effects design cannot solve the problem of special effects optimization, and the special effects after optimization are poor. Therefore, this paper proposes a style transfer algorithm based on 5G communication to optimize and analyze the design of two-dimensional animation special effects. Firstly, ultra-wideband communication technology and animation technology are used to obtain the design parameters of animation special effects, and the design scheme is transformed through style transfer , and judge the special effects scheme according to the animation characteristics, and discard irrelevant 3D information. Then, according to the ultra-wide communication technology, the change rate and display effect of the special effect are analyzed, and compared with the actual reception effect, and adjusted Parameters and indicators for 2D animation special effects design. The special effect design results show that under the conditions of 5G network and ultra-wide communication, the style transfer algorithm can improve the realization effect of animation special effects. The lifting rate is greater than the actual design requirements, which can meet the needs of special effects design.

Keywords: 2D Animation, Style Transfer, Algorithms, Ultra-Wide Networks, Special Effects Design.

1. Introduction

The introduction of 5G networks and ultra-wideband wireless technologies has brought about a revolution in data transmission speeds and bandwidth capacities [1].

In the realm of two-dimensional animation special effects, this means that larger amounts of data can be transmitted more quickly and efficiently.According to Xing and Jamaludin, The frame rate of animation effects and the latency of actions are both related to the transmission rate of special effects [2]. As a result, animations that are richer in detail and complexity can be streamed or downloaded faster than ever before. However, while the transmission efficiency has improved, challenges remain. The rate at which some special effects are transmitted and the way they are displayed can sometimes be inconsistent or inaccurate. This inconsistency can lead to a suboptimal viewing experience, emphasizing the need for further refinement in the design and transmission of these special effects [3].

The survey results show that in 2010, the application depth of ultra-wideband communication technology in the digital field [4] and two-dimensional animation design has reached 25 per cent, rising to 5 5.3 per cent in2021, an increase of 200 percent, also indirectly shows that the application of ultra-wideband communication technology in animation special effects is relatively deep, and the results are shown in Figure 1.

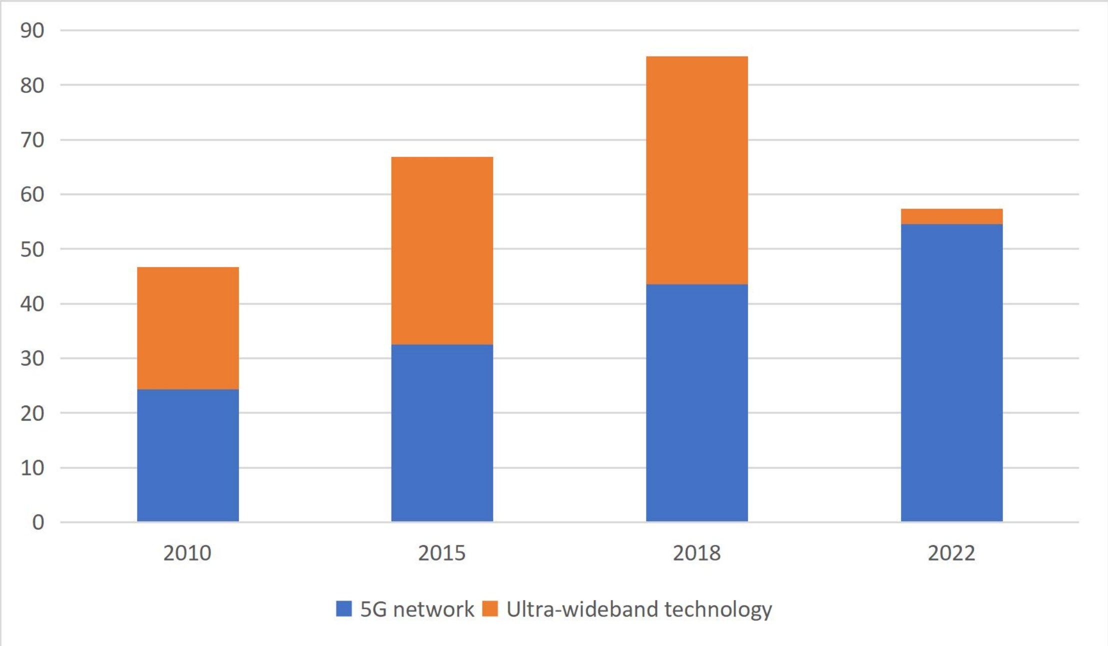

Figure 1. Application of Ultra-Wideband and 5G Technology in the Animation Field (unit: %)

Ultra-wideband is a wireless carrier communication technology, which uses nanoscale non-sine wave narrow pulse transmission data [5], with low power of the transmitted signal, fast transmission speed and high accuracy [6], suitable for the massive transmission of two-dimensional animation. Based on this, this paper proposes an animation special effects transmission method based on style transfer algorithm [7], which is paired in the ultra-wideband, 5G network environment Animation effect data is simplified by signal, data encryption, and precise positioning of animation characteristics to achieve accurate transmission of animation effects the specific transmission process is shown in Figure 2.

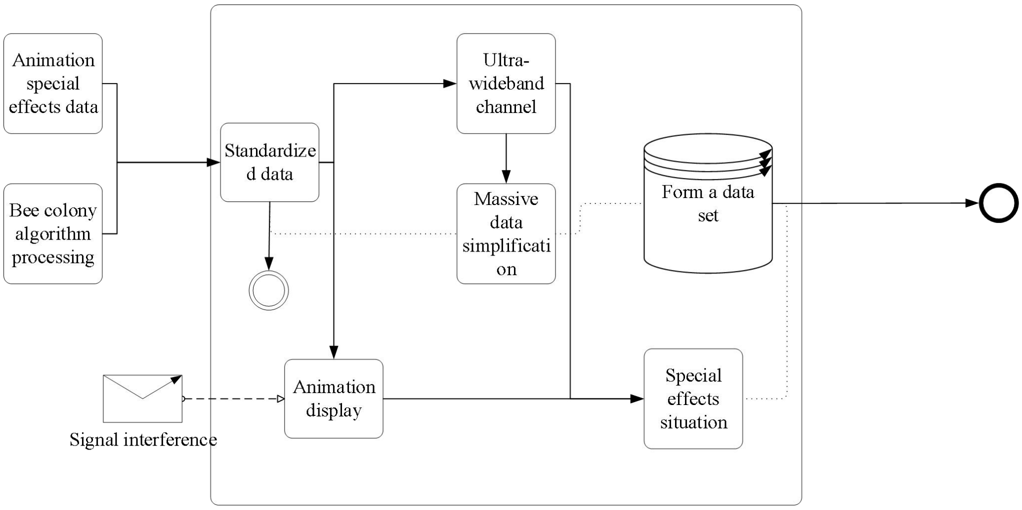

Figure 2. Transmission of Animation Effect Data Under Ultra-Wideband Conditions

Ultra-wideband technology has the advantages of fast transmission and sea quantification, and can realize two-dimensional animation content and special effects design Fast transmission, and combined with the swarm algorithm, optimize and integrate the special effect data to achieve the effective dissemination of two-dimensional animation.At the same time, we dig deeper into animation effects [8], compare two-dimensional animation content, effects, and other than different transmission methods Integrity of Information. Some scholars combine ultra-wideband technology with intelligent methods, and apply it to the special effects analysis of two-dimensional animation, and try to adjust transmission parameters [9]. The results show that this method can improve the speed of animation effect data transmission, but there is a problem of special effect data loss during the transmission process. To apply ultra-wideband transmission and intelligent algorithms to animation special effects, it is necessary to integrate style transfer algorithms to complete the scheme optimization of two-dimensional animation special effects design. Ultra-wideband transmission offers the advantage of transmitting large amounts of data at high speeds, which is crucial for delivering high-quality animation special effects that often consist of intricate details and complex sequences. However, simply transmitting data quickly doesn't guarantee the desired visual outcome in the realm of animation. This is where intelligent algorithms, specifically style transfer algorithms, come into play. Style transfer algorithms allow for the transformation of one image's style to match the style of another image. In the context of animation special effects, this means that artists and designers can achieve a specific visual aesthetic or emulate a particular artistic style across different animation sequences or scenes.

Under the conditions of clarifying the 2D animation design requirements, 2D animation content, and 2D animation form, different methods need to be used to improve the animation special effects and the efficiency of digital design. At the same time, it is necessary to combine the form of animation and select different ultra-wideband transmission technologies. The "form of animation" refers to the specific style, technique, or medium used in creating the animation. This can range from traditional hand-drawn animations to computer-generated imagery (CGI), stop-motion, 2D vector-based animations, and more. Each form of animation has its unique characteristics, data requirements, and complexities.

For instance:

Traditional Hand-Drawn Animations: These require the transmission of individual frames, which can be numerous for even a short sequence.

CGI Animations: These might involve transmitting complex 3D models, textures, lighting data, and more.

Stop-Motion: This involves transmitting high-resolution images for each frame, which can be data-intensive.

Among them, the advantages of ultra-wideband transmission are compared as shown in Table 1.

Table 1. Advantages Of Ultra-Wideband Transmission

Content	Advantage	Inferior Position
Comparison with other design results	The transmission speed is fast, and the two-dimensional animation content and two-dimensional animation form are quantified, and the influence of external interference and spatial factors is less [8].	The system is complex, the complexity of two-dimensional animation design is high, there are many feature points involved, and ultra-wideband technology cannot optimize special effect data and unstructured data, and needs to be integrated with intelligent algorithms
Integration with other display methods	Realize two-dimensional animation content quantification and massive data optimization	The transmission of small amounts of data is not satisfactory
Transfer the result	Improve the accuracy and rationality of ultra-wideband transmission, and improve the effect of two-dimensional animation special effect design	Complex special effects data transmission requires many parameters

From the description in Table 1, although the ultra-wideband transmission method in the past can initially screen the two-dimensional animation special effect data, the transmission is garbled. The rapid evolution of technology, especially in the fields of 5G networks and ultra-wideband wireless technologies, has significantly impacted various domains, including two-dimensional animation special effects. However, while transmission efficiency has seen improvements, there are still challenges in achieving optimal special effects design.

Research Objectives:

1.Integration of Algorithms: This research aims to integrate the style transfer algorithm with the bee swarm algorithm. The primary goal of this integration is to optimize various aspects of two-dimensional animation special effects, including color, brightness, and attitude.

2.Ultra-wideband Transmission Data Collection: Another objective is to establish an effective method for ultra-wideband transmission data collection. This will ensure that data related to two-dimensional animation special effects is gathered efficiently.

3.Transfer Parameter Tuning: The paper also seeks to fine-tune transfer parameters, ensuring that the transmission of two-dimensional animation special effects is optimized and aligns with the desired output.

By addressing these objectives, this research aims to bridge the existing gaps in the field and contribute to the enhancement of two-dimensional animation special effects in the era of 5G networks.

2. Related Concepts

2.1 Ultra-Wideband Transmission of Animation Special Effects Data

The style transfer algorithm can optimize the two-dimensional animation content, while the swarm algorithm maps the ultra-wideband transmission data and the two-dimensional animation special effect data [10] to analyze different data Correlation, transfer rate, security. The combination of style transfer algorithm and decision tree method can filter out key two-dimensional animation digital values from massive transmitted data and construct a preliminary collection of network data. The style transfer algorithm can optimize the transmission scheme data and special effects, and build two-dimensional animation content. The data class of the design scheme, the specific results are shown in Figure 3.

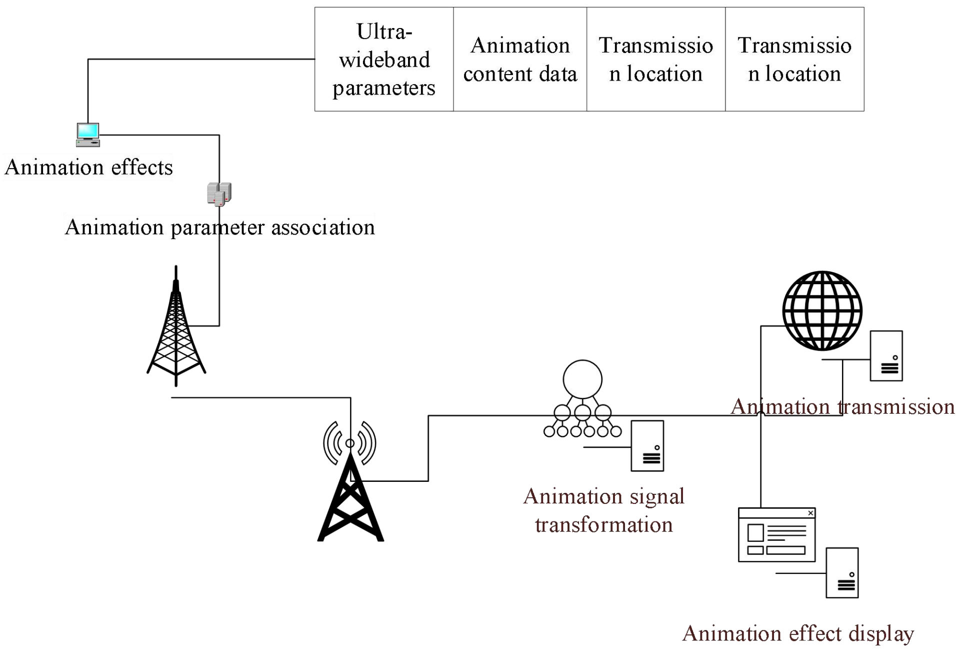

Figure 3. The Transmission Process of Animation Data

In order to analyze more accurately, it is necessary to filter the data in ultra-wideband transmission, set the 5G network environment, and animation effect standards [11], the result is as follows.

Collection of animation effect data: animation content is $\sum x_{ij}$, special effect is $y_{ij} \updownarrow$, ultra-wideband frequency is p , ultra-wideband transmission function is $chaok(d_i \Rightarrow x_j)$, The degree of optimization is ϕ_i ,the transmission of animation effect data is shown in Equation (1):

$$set(k) = \{x_{i-1j} \to k \cdot y_{i-1j} \cdot \phi, \cdots x_{ij} \to k \cdot y_{ij}\} \tag{1}$$

The ultra-wideband program writing process is as follows:

```
for{set flag;
set x =1;
while{set bdata<sta}
do{set  x = x^6;
set  k = y;
sum set set  k, set x;}}
```

Style transfer algorithm: The function of the style transfer algorithm is $f(y_i \Rightarrow x_i)$, the best effect of the special effect is $\min f(\sum x \cdot y)$, the number of ultra-wideband transmission interruptions is A , and the implementation process of the style transfer algorithm is shown in Equation (2):

$$f(y_i \Rightarrow x_i) = A \cdot \overline{y_{ij}^n} \cdot x_i \tag{2}$$

The specific code writing process is as follows:

```
While {void init_io(void)
{
 Do{x = 0;
   y = 1;
   f(y_i => x_i) = 0;
 y = 2;
   } }
```

The processing of animation effects by the bee swarm algorithm: the amount of special effect data is $\sum x_{it}$, the swarm function is $swar(x)$, the animation effect fitting function is $f(x)$ and the animation effect processing process is shown in Equation (3):

$$swar(y_{ij}, f(x)) = \lim(A^2 \cdot y_{ij}) \tag{3}$$

In all, it provides a comprehensive understanding of the intricate interplay between advanced algorithms and ultra-wideband transmission in enhancing animation quality.It also delves into the technical aspects, detailing the ultra-wideband programming, style transfer algorithm functions, and the bee swarm algorithm's role in processing animation effects.

3. Methodology

3.1 Ultra-Wideband Signal Processing for Two-Dimensional Animation Special Effects Design

There is a certain correlation between the two-dimensional animation data, and the two-dimensional animation form and two-dimensional animation content show cross-changes, so the signal conversion of the special effect data should be carried out [12] to determine the two-dimensional animation frequency value and the correlation between the frequency value and ultra-wideband. In addition, network congestion and delay affect the effectiveness analysis results of 2D animation [13], so it is necessary to use the correlation of the special effect is analyzed to realize the signal processing process of the special effect data, and the specific acquisition process is shown in Figure 4 .

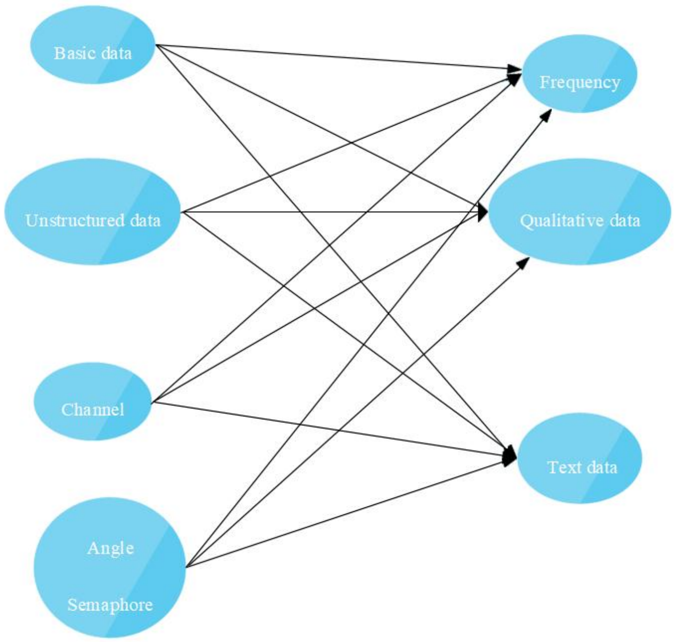

Figure 4. Acquisition Process of Animation Special Effects Technical Data

It can be seen from the data in Figure 4 that in the process of two-dimensional animation frequency value analysis [14], the special effect data should be classified and the corresponding processing method should be selected to correspond to the channel and transmission range of this frequency [15], and the application effect of the bee colony algorithm, the processing results are shown in Table 2.

Table 2. Data Signal Processing for 2D Animation

Type / Effect Extraction Points	Two-Dimensional Mapping	Frequency Value	Channel	Special Effects Classification	Transmission Integrity
31	0.32	44.73	4	1	95.05
14	0.24	45.87	0	1	92.43
24	0.02	45.59	3	2	93.22
49	0.49	42.75	1	3	88.93
60	0.58	43.01	0	2	88.12
13	0.73	43.06	4	1	89.63
34	0.50	44.47	3	3	88.75
24	0.33	44.77	0	3	86.66

51	0.27	47.42	1	2	85.66
6	0.02	44.37	2	3	92.96
5	0.37	45.71	0	3	89.36
15	0.81	43.88	2	3	92.88
0	0.53	45.87	2	2	92.90
32	0.86	43.18	1	2	94.05

From the analysis of the two-dimensional special effect points in Table 2, it can be seen that the mapping, frequency value, channel [16], special effect classification, transmission integrity, and the integrity of the signal data are good, and the conversion process of the two-dimensional animation special effect data is verified. The statistical rows of the data in Table 2 are analyzed and standardized, and the results are shown in Table 3.

Table 3. Processing Results of Animation Effects

2D Animation Effects		**Display Effects**		**Delay**
Port Data	**Channel Data**	**Pixel**	**Color**	
1	0.46	0.49	0.58	-0.34
2	0.40	0.44	0.54	1.13
2	0.50	0.32	0.58	0.10
1	0.47	0.35	0.51	0.65
2	0.53	0.57	0.51	-1.61
1	0.68	0.41	0.35	2.41
2	0.51	0.65	0.60	-0.51
1	0.33	0.47	0.56	0.22
2	0.25	0.47	0.55	0.02
1	0.47	0.54	0.73	0.56
1	0.59	0.50	0.31	-1.66
1	0.37	0.66	0.58	-1.76
2	0.73	0.42	0.43	-1.49

According to the data in Table 3, the channel, pixels, and color of ultra-wideband data receiving data are relatively good, and the delay is less than 3 seconds. Among them, the data values received under ultra-wideband conditions and the data stability of special effect classification are good, indicating that the data of the entire ultra-wideband receiving animation special effects meets the requirements. There is also a small difference between the color rendering and special effects expression of the animation special effect data, indicating that the difference between data transmission and reception is relatively small, and the security of the entire ultra-wideband state is high. In addition, the delay of the data is assigned to further indicate that the ultra-wideband received data meets the normal requirement.

3.2 Special Effect Processing Analysis Based on Style Transfer Algorithm

There are three main types of data processing for style transfer algorithms, namely special effects optimization, two-dimensional animation content optimization, and two-dimensional animation structure optimization. The mathematical description of the above three treatments is as follows.

The special effect processing of the data optimization of the style transfer algorithm is shown in Equation (4):

$$lev(x)\begin{cases} \int_{i=1}^{n} \max \sum \overline{x}_{ij}, color \\ \sum x_{ij}, pixel \\ x_{ij} \cdot \xi_{ij}, sturcture \\ 0, other \end{cases} \quad (4)$$

From Equation (4), the data optimization results of the style transfer algorithm can be obtained as shown in Table 4.

Table 4. Effect Data Optimization of Style Transfer Algorithm

Extract Points	Content Optimization Requirements	Structural Optimization Requirements	Optimize Frequency
1	58.48	64.74	1
2	60.96	59.87	4
1	58.30	59.00	7
2	57.45	59.61	2
2	61.18	58.69	6
1	59.89	55.40	5
2	58.74	52.58	9
1	57.85	66.00	9
1	63.67	64.67	6
1	56.57	61.29	1
2	62.06	58.08	4
2	62.11	61.22	2
1	62.26	57.17	3

From the optimization analysis of the style transfer algorithm in Table 4, the data content and structure optimization requirements of random sampling are greater than 50%, indicating that the special effect requirements under the whole ultra-wideband condition are high. The optimization frequency of the data is less than 10, indicating that there is a problem with the animation data, no feature values and outliers, and the data status meets the requirements, which also indirectly indicates that the ultra-broadband network environment is safe.

4. Results and Discussion

4.1 Ultra-Wide Network Environment for Data Transmission

This paper uses ultra-wide network as the basis, combined with the two-dimensional animation special effects required bandwidth of 1~10M, the transmission technology adopts ultra-wide transmission, and the animation software is photo, flash and other two-dimensional animations. Among them, there are 3 servers, 8 wireless transmitters, LED animation playback screen, using TCP/IP protocol, and the client is a wind system, testing the amount is 72g, and the specific conditions are shown in Table 5.

Table 5. Ultra-Wideband Hardware Conditions

Parameter	Hardware Condition	Software Conditions	Bandwidth (M).
Color	IBM server, Bluetooth, LED Plane	Wind System, Firewall	512M
Structure	IBM server, Bluetooth, LED Plane	Wind System, SQ Database	512M
Number of fps	IBM Server, LED plane	Wind System, Flash Software	64M
Pixel	IBM Server, 1024bt, LED Plane	Wind System, Firewall	512M
Brightness	IBM Server, LED Plane	Wind System	128M

The data in the above table is processed to obtain the corresponding special effects, as shown in Figure 5.

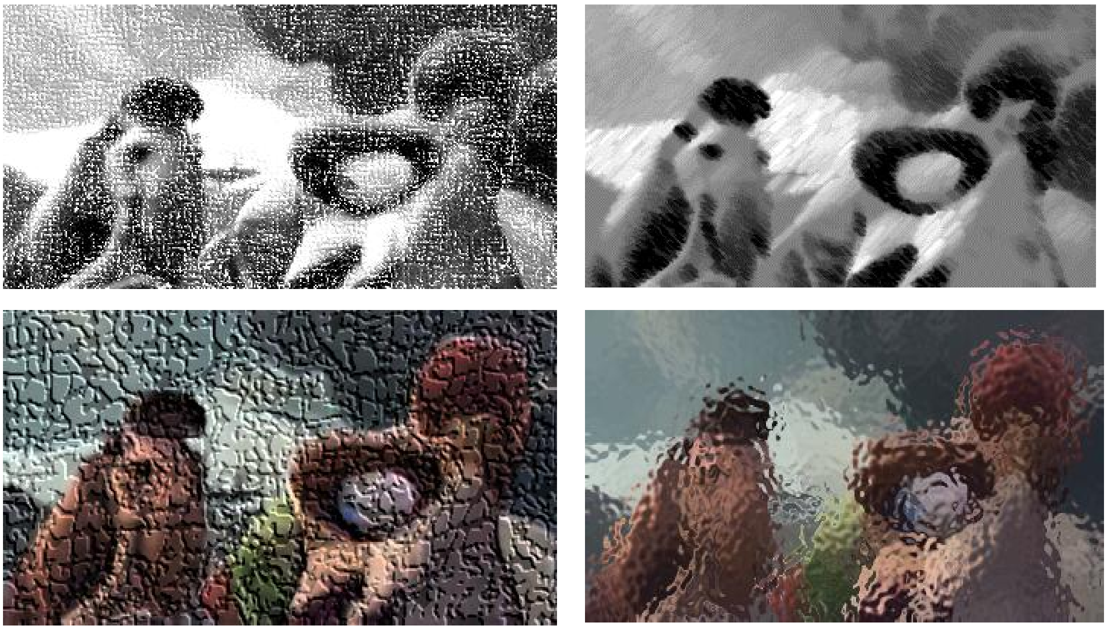

Figure 5. Special Effect Design Results With Different Parameters

As can be seen from Figure 5, under different requirements, the ultra-wideband network can fully demonstrate the effect, indicating that the hardware design meets the requirements and can be tested later, and the specific data overview is shown in Table 6.

Table 6. Overview Of Animation Effects Based On Style Transfer Algorithm

2D Animated Content	**Design Content**	**Form of Transmission**	**Standardish**
Content	Image	Ultra-wideband, WIFI	70.06
	animation	Ultra-wideband, WIFI	70.47
Structure	Layout	Ultra-wideband, WIFI	69.29
	Color Matching	Ultra-wideband, WIFI	69.66
	Content collocation	Ultra-wideband, WIFI	66.88
Color	Light	Ultra-wideband, WIFI	73.19
	Dark	Ultra-wideband, WIFI	67.54
Form	Projection	Ultra-wideband, WIFI	73.00
	Screen	Ultra-wideband, WIFI	65.73

4.2 Optimization Degree of Two-Dimensional Animation Special Effects Design

The degree of optimization is an important indicator of special effects design, and the effect of animation effects can be analyzed in depth, and the specific analysis results are shown in Table 7.

Table 7. Effects Optimization Based on Style Transfer Algorithm

Analysis Method	Content	Index	The Degree of Special Effects Optimization	The Number of Frame Increases
Style Transfer Algorithm	Effect Structure	Single Action	76.87	71.22
		Compound Action	76.66	71.06
		Comprehensive Color	70.67	67.26
	Effect Time	12 fps	75.66	71.56
		24 fps	79.32	76.53
		48 fps	72.44	70.95
	Effect Level	Visual Effects Level I	72.91	78.28
		Visual Effects Level I	73.94	76.39
		Visual Effects I Level I	75.15	69.89
		Action Effects Level I	75.86	80.49
		Action Effects Level II	71.86	65.35
Animation Effect Model Based on Style Transfer Algorithm	Effect structure	Single Action	77.59	85.36
		Compound Action	69.73	71.26
		Comprehensive Color	74.45	81.27
	Effect Time	12 fps	70.79	74.45
		24 fps	76.00	68.96
		48 fps	76.68	67.66
	Effect Level	Visual Effects Level I	72.39	79.38
		Visual Effects Level II	74.68	70.60
		Visual Effects Level III	75.41	74.60
		Action Effects Level I	76.25	80.64
		Action Effects Level II	81.80	70.51

The optimization rate determination process in Table 7 is shown in Figure 6.

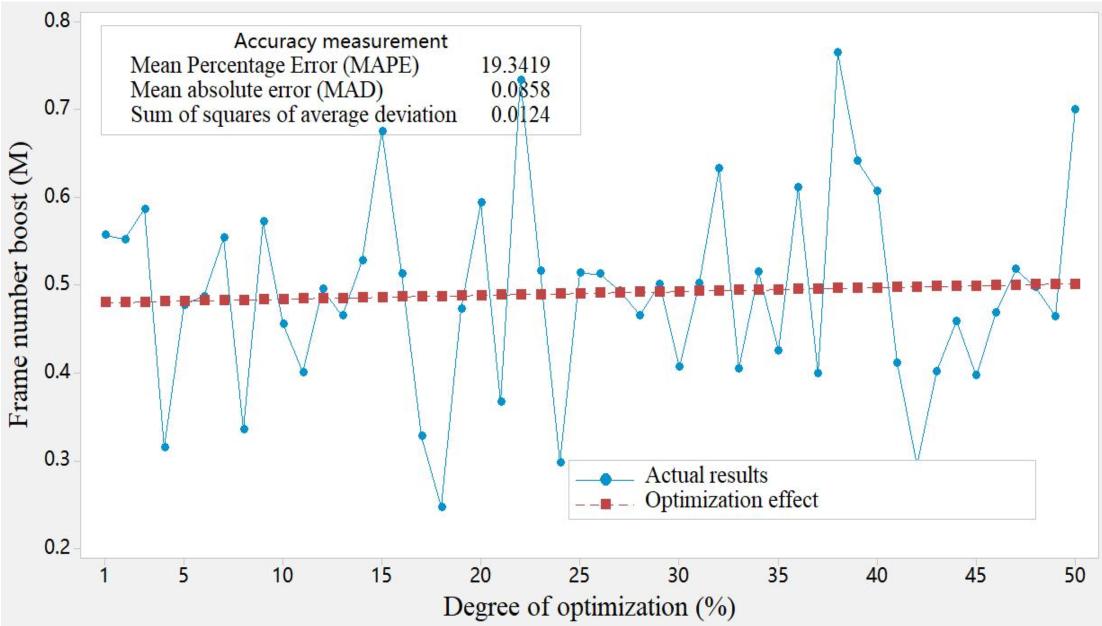

Figure 6. The Judgment Process of The Optimization Rate of Two-Dimensional Animation

It can be seen from Figure 6 that the method proposed in this paper has a high optimization rate for data transmission, and the data optimization rate can reach more than 70% in the process of animation effect transmission, and the data continues to increase. The main reason for the above problems is that the bee swarm algorithm is integrated, the transmission number of special effects is optimized, the occupancy rate of the server is reduced, and the utilization rate of ultra-wide channels is improved, to realize the data transmission of two-dimensional animation special effect design.

4.3 The Effect of Two-Dimensional Animation Special Effect Design

The design effect judgment based on the style transfer algorithm includes color presentation, novelty, wireless transmission port compatibility, wireless transmission rate, and channel utilization, and analyzes the factual results of different indicators, and the specific results are shown in Table 8.

Table 8. Effects of Transferring Data in Animation Effects

Index	Color Data	Novel	Port Compatible	Wireless Transmission Rate	Channel Utilization
Visual Presentation	86.86	89.98	89.18	87.95	89.11
	86.80	88.86	91.64	87.79	92.82
Action Display	86.49	86.55	86.19	91.98	86.72
	90.12	86.34	87.50	87.19	90.58

Table 8 shows the data implementation effect, as shown in Figure 7.

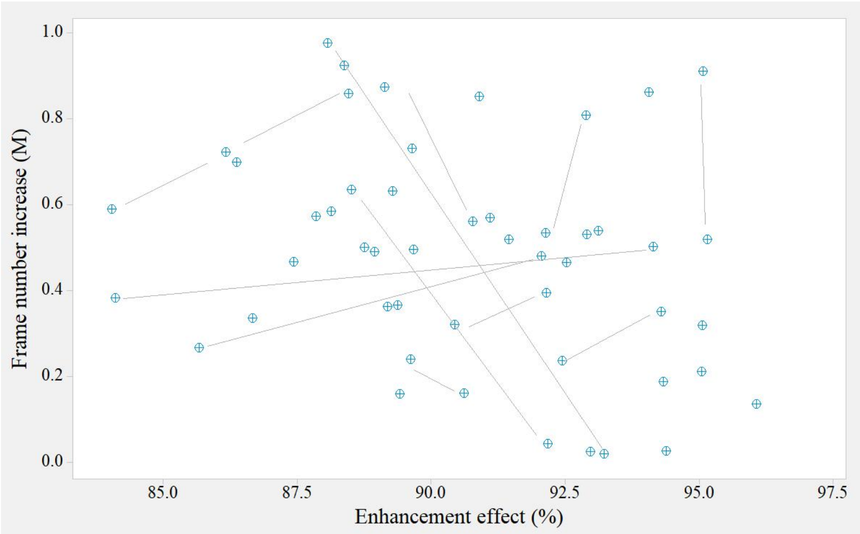

Figure 7. Analysis of Animation Effect Based on Style Transfer Algorithm

It can be seen from Figure 7 that the migration process of different points has no overlapping distribution, indicating that the abnormal data recognition rate of the style transfer algorithm for animation effects is high. In addition, the style transfer algorithm realizes a high degree of optimization of two-dimensional animation special effect data and reduces the complexity of the data to ensure the effective transmission of two-dimensional animation special effect design. The reasons for the above results are mainly the standardized processing of unstructured special effects data and structural data by the style transfer algorithm, and the data transmission effect is improved through ultra-wideband technology, and the narrow frequency is used to reduce external interference and improve the overall effect of special effects.

4.4 Transmission Security for Two-Dimensional Animation Special Effects Design

Security is the main impact of animation effects, and multi-frame analysis of feature points should be carried out and compared with the actual display results, and the specific results are shown in Figure 8.

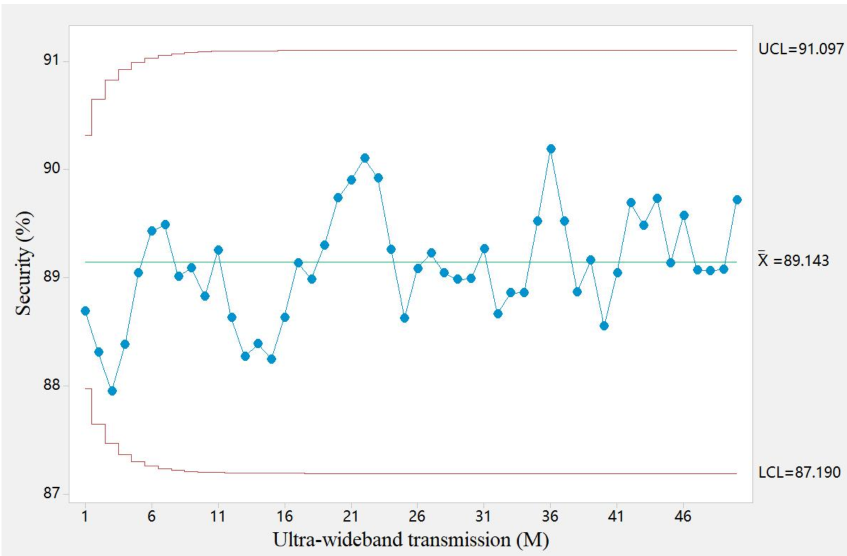

Figure 8. Security of Animation Effect Data

It can be seen from Figure 8 that the concentration of transmission security is 89% remarriage, the optimization of the special effect data in the figure is reversed, and the center point is the key effectiveness of the animation special effect. The upper and lower boundaries represent the centralized requirements for effectiveness. The transition from any point to the center point, and the special effect data is relatively concentrated, indicating that the style transfer algorithm can perform channel analysis and optimize the animation special effect data. For the effect data in Figure 8, a comparison of different methods is performed, and the results are shown in Table 9.

Table 9. Comparison of Animation Effects by Different Methods

Method	Content	Test Packet Recycling	Ultra-Wideband Receives Security
2D animation design	Spatial Content	90.72	Class III
	Color Content	96.50	Class III
	2D Animated Content	98.86	Class III
Animation Effect Model Based on Style Transfer Algorithm	Spatial Content	70.61	Class III
	Color Content	69.07	Class II
	2D Animated Content	72.81	Class II

Compared with the 2D animation special effects design, the style transfer algorithm is more effective in analyzing the effectiveness of 2D animation, and it is in the special effects database of the 2D animation special effects design video node The effectiveness analysis method of the style transfer algorithm meets the actual requirements. In terms of effectiveness, the style transfer algorithm simplifies the unstructured special effects data in the animation effects, and the swarm algorithm simplifies the special effect data Perform iterative analysis to reduce the complexity of 2D animation effectiveness analysis.

4.5 Transmission Accuracy of Two-Dimensional Animation Special Effects Data

In order to verify the judgment effect of the style transfer algorithm, the effectiveness of the two-dimensional animation is accurately judged, and the results are shown in Figure 9.

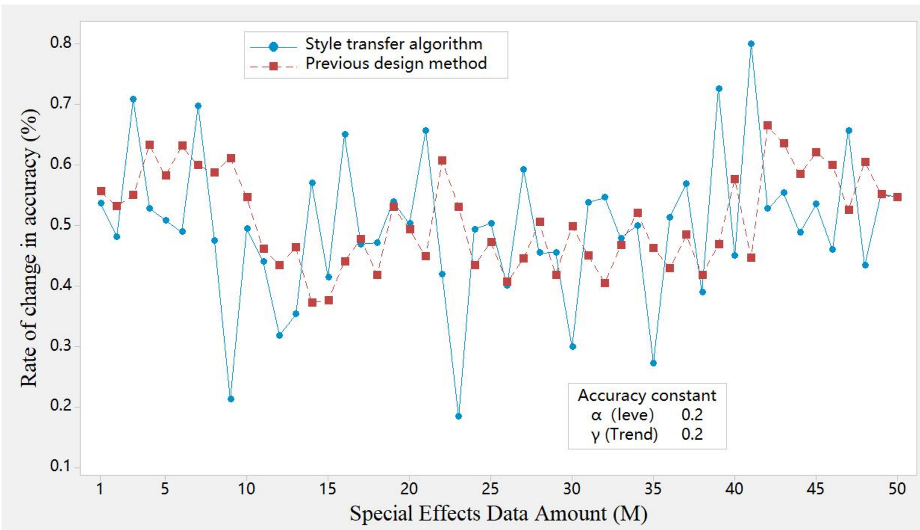

Figure 9. Judgment Accuracy of Two-Dimensional Animation Effectiveness of Different Algorithms

It can be seen from Figure 9 that the accuracy of the analysis of the effectiveness of two-dimensional animation by the style transfer algorithm is higher than that of previous design methods, and the special effects of each animation The degree of influence is relatively high, explains. Among them, the style transfer algorithm can accurately judge the effectiveness of animation effects, and the detailed results are shown in Table 10.

Table 10. Data Transmission Accuracy by Method

Extract Points	Send Content		Ultra-Wideband Content Transmission	
	This article proposes a method	Style transfer algorithm	This article proposes a method	Style transfer algorithm

2	90.33	76.68	91.34	76.18
1	86.11	71.03	86.51	70.70
1	91.01	77.24	88.25	72.97
3	92.28	70.47	90.26	72.20
1	88.66	77.06	90.30	70.30
1	90.72	72.65	87.01	76.39
1	86.74	70.18	86.45	79.63
3	91.35	72.31	90.69	76.31
1	87.04	79.03	92.19	78.07

It can be seen from Table 10 that in terms of process accuracy comparison, the accuracy change of the style transfer algorithm is significantly better than the two-dimensional animation special effects design, and the content, form, connotation and key points are better than the two-dimensional animation special effects design In terms of effectiveness, the style transfer algorithm uses ultra-wideband technology to improve the transmission efficiency of special effect data, and optimizes the special effect data after standardized processing, and ultra-wideband technology reduces the influence of external interference to the transmission result, thereby increasing the quasi-reliability of transmission.

5. Conclusion and Future Work

In this paper, a style transfer algorithm method is proposed for the design of two-dimensional animation special effects, which uses ultra-wideband transmission technology and combines bee swarm algorithm to analyze animation special effect data Animation effect standards are standardized to improve animation effects. The results show that compared with the two-dimensional special effects design method, the accuracy and effectiveness of the style transfer algorithm in judging the effectiveness of two-dimensional animation are compared with the practice The requirements are basically the same. The reasons for the above problems are mainly the use of ultra-wideband technology to reduce the impact of external interference on the design data, and the style transfer algorithm is used to simplify the data, and the bee swarm algorithm is used to optimize the data structure to improve the wireless transmission effect of animation special effect design.

Building on the promising results of this study, several avenues for future research emerge. Firstly, the potential for integrating other advanced algorithms with the style transfer method can be explored to further enhance the quality and efficiency of two-dimensional animation special effects. Given the success of the bee swarm algorithm in optimizing data structures, other nature-inspired algorithms could be investigated for their applicability in this domain. Additionally, as ultra-wideband technology has shown its capability in reducing external interference, future studies can delve into its potential applications in more complex animation environments, such as augmented and virtual reality.

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