



# Visual Reconstruction of Interactive Animation Interface Based on Web Technology

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**Abstract.** The human perception that more than 80% of the external information is visually acquired, therefore, in the interactive animation interface design, the visual effect is very important. In this background, an interactive animation interface visual reconstruction method based on Web technology is proposed. The method is mainly described by two aspects, firstly, the related description is carried out on the Web technology, and then the visual reconstruction of the interactive animation interface is realized by using the technology, and the method comprises the visual feature extraction, the visual feature matching and the visual feature 3D reconstruction. The results show that, after the visual reconstruction, the visual effect of the interactive animation interface is improved, and the visual existence in the design of the interactive animation interface is solved.

**Keywords:** Web technology · Interactive animation interface · Visual reconstruction

## 1 Introduction

In the 1970s, the American futurist Alvin Towler put forward the view that “the service industry will eventually outpace the manufacturing industry and the experience production will surpass the service industry” in “the impact of the Future”. The development of the “Experience Economy”, it is the improvement of the degree of human civilization, how to meet the growing material and cultural needs of people, and to improve the interactive experience is an important research subject of the present designer [1]. Interactive animation participation interface design provides users with a self-help experience, in a more free, natural, friendly, multi-channel information transmission, through the visitors' multi-sensory information transmission. In the present day of information explosion, the information transfer mode is rapidly inserted into the design field with the characteristics of interactivity, nonlinearity, entertainment, accuracy and the like, so as to construct between the person and the person, between the person and the product, between the product and the product, The interaction network between people and the environment increases the effectiveness of product communication. Reflects the design of “people”-oriented concept, around the needs of people, to meet the needs of people. Animation is realized in a variety of ways, such as traditional hand-painting, three-dimensional production, physical animation, and so on. In addition, some network editing software flash, dreamweaver, toombom can achieve

animation effect according to the need. However, the interactive animation interface designed by these techniques is not very good in visual effect, and user experience is poor. Aiming at the above problems, a visual reconstruction method of interactive animation interface based on Web technology is designed in order to enhance the visual characteristics of interactive animation interface design [2]. Methods the application of Web technology was analyzed firstly, and then the visual reconstruction of interactive animation interface was described. Finally, the visual effect of interactive animation interface is improved after visual reconstruction using this method.

## **2 Visual Reconstruction of Interactive Animation Interface based on Web**

Interactive animation refers to an animation that supports event response and interaction in the play of an animated work, that is, a certain control can be accepted when the animation is played. This control may be a certain operation of the animation player or may be an operation prepared in advance at the time of the animation production. This interactivity provides the audience with the means to participate in and control the content of the animation, so that the audience can change from passive acceptance to active selection. Interactive design is the design of the user and the product interaction process, the way, and so on [3]. Interactive media systems are more acceptable to users, more satisfying, easier to learn and master, and more cooperative. Not only can obviously improve the product friendliness. So that the original monotonous, rigid information transfer system interface becomes more gorgeous, has affinity. More importantly, it can increase the efficiency of information transmission, and achieve a better effect of information promotion.

WEB technology refers to the development of Internet application technology, generally including WEB server technology and WEB client technology. The animation produced by web technology has the characteristics of short and small, so it is widely used in the design of web page animation. In order to become the current web page animation design one of the most popular technology.

The visual reconstruction of interactive animation interface is aimed at transmitting visual and natural information through the picture. Therefore, some necessary design principles should be obeyed to ensure the visual display of the interface. They include clarity, simplicity, novelty, beauty, kindness, efficiency, and consistency [4].

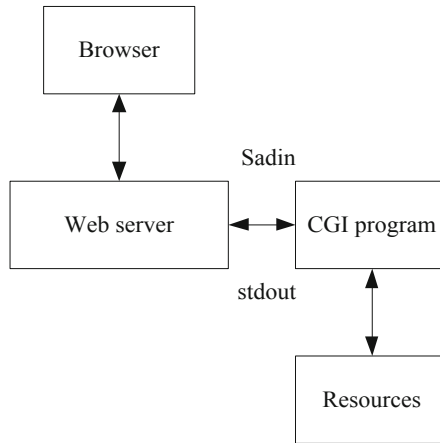
### **2.1 Web Technology**

WWW is the abbreviation for Word Wide Web, also known as Web. And is a network information service based on a TCP/ IP protocol. The Internet is a network connecting the global computer network, which is used to share the resources of the global computer. The Internet and the Web are two different concepts, and the Internet is the basic platform of the Web, and the Web is an application layer service on the Internet platform. It allows computer users to locate and read information resources such as text, graphics, animation, audio and video from all corners of the world. These

resources can be linked through hyperlinks, logically forming a huge “information network” around the world.

So far, there are four techniques available for visual reconstruction of interactive animation interfaces: CGI (Common Gateway Interface), ASP (Active XServerPage), PHP(Personal Home Page) and JSP (Java ServerPage). But if we want to realize the dynamic web page under the existing technology, we can only adopt CGI, because at present, the web technology does not support the visual reconstruction such as ASP, PHP and so on [5].

CGI provides a channel for Web servers to execute external programs, a server-side technology that makes browsers and servers interactive. CGI programs belong to an external program and need to be compiled into executable files to run on the server side. Its application structure is shown in Fig. 1.



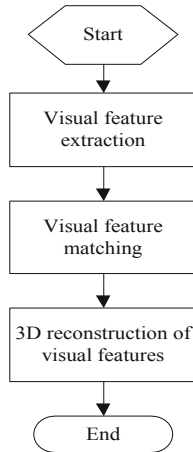
**Fig. 1.** CGI program running flow

The browser sends the interactive animation interface-related data to the Web server, the Web server sends the data to the CGI program using STDIN, after executing the CGI program, you may access some documents that store the data, and finally use STDOUT to output the visual refactoring result file. Web server sent back to the browser to display to the user.

CGI programs can be written in any programming language, such as shell scripting language, Perl, Fortran, Pascal, C language, etc. But UC Linux does not support the language of Perl, Fortran, and so on, and the C language is not well-related to the platform, so we choose to use the C language to write CGI programs. In addition, the web does not support the database, so the data that needs to be saved can only be saved to the file, and the CGI query data is also a query of the files, rather than accessing the database.

## 2.2 Implementation of visual reconstruction of interactive animation interface

In that follow, the visual reconstruction flow of the interactive animation interface is realized by the above-mentioned Web technology, as shown in Fig. 2 below.



**Fig. 2.** Process of visual reconstruction of interactive animation interface

All the above visual reconstruction steps are completed under the guidance of the program written by Web technology.

### (1) Visual feature extraction

The scene of interactive animation includes logical scene and visual scene. The logical scene reflects the content information of animation from the logical feature, and the visual scene reflects the content information of animation from the visual feature. Therefore, visual feature extraction is the basis of visual reconstruction. At present, there are two main methods to extract feature points.

Methods based on contour lines: this method first extracts the edge of the image from the interactive animation interface, then searches for the maximum curvature point on the chain composed of edges, or approximates the edge with polygons, and then calculates the vertices of polygons as feature points [6]. Asada and Brady extract the feature points from the edge profile curve and, in order to get robust results, they also introduce a multi-scale framework. This approach is very similar to the method proposed by Mok 'harian and Machworth using the deformation point on the curve. Mediumi and Yasumot. The B-spline function is used to approximate the contour curve, and the characteristic points are the places where the curvature changes most on the B-spline number function. Horaud first extracts the part of the line from the contour line, and these lines are grouped according to certain rules. The intersection point of the line in each group is the characteristic value.

Method based on gray value. This kind of method firstly defines an operator and extracts the feature points by searching the extreme value of the operator on the grayscale changing image. In 1978, Beaudé proposed a method of detection based on the rotation invariant. Dreschler and Nagel used the Gaussian curvature principle in the detection process. Kitchen and Rosenfeld proposed a method of finding a feature point along the gradient change direction of the edge of the interactive animation interface. Noek attempts to give a theoretical formula for corner detection with differential geometry, and he plans the principle of detection under the Plessey's algorithm [7]. In 1988, Harris and Stephen proposed the Harris operator.

Here we collect the Harris operator to complete the point detection in the feature. First, the average gradient square matrix of each pixel in the image is calculated.

$$S(x, y) = \begin{bmatrix} \frac{I(x,y)^2}{x} & \frac{I(x,y)}{x} \frac{I(x,y)}{y} \\ \frac{I(x,y)}{x} \frac{I(x,y)}{y} & \frac{I(x,y)^2}{y} \end{bmatrix} \tag{1}$$

Of which,  $I(x, y)$  is coordinate  $(x, y)$  in the ima The grayscale of the point;

In order to quickly find the gray pixels of the image, this paper defines an index  $GI$  to judge the pixel gray value in the logarithmic range, and the expression is:

$$GI(p) = \sqrt{\frac{1}{3} \sum_{c \in \{r,g,b\}} \frac{(\Theta I_{\log}^c(p) - \Theta \bar{I}_{\log}(p))^2}{S(x, y)}} \tag{2}$$

In the formula:  $\Theta I_{\log}^c(p)$  represents the local area operator for identifying gray pixels in the logarithmic range, namely:

$$\Theta I_{\log}^c(p) = \left( \sqrt{\sum_{q \in \omega(p)} I_{\log}^c(q) - I_{\log}^c(p)} \right) \tag{3}$$

Among them,  $\omega p$  represents the local neighborhood with  $p$  as the center and size  $3 \times 3$ ,  $I_{\log}^c(q)$  represents the result of taking the logarithm of the  $c(c \in \{r, g, b\})$  component  $I^c(p)$  of  $p$ ,  $I_{\log}^c(q)$  is the partial mean of  $I_{\log}^c(p)$  in neighborhood  $\omega(p)$ . Assuming  $\Theta I_{\log}^c(p) = \Theta I_{\log}^g(p) = \Theta I_{\log}^b(p)$  and  $GI(p) = 0$ ,  $p$  is a standard gray pixel.

In order to remove the pixels with extremely low light, modify  $GI$  to obtain the following formula:

$$GI^*(p) = \frac{GI(p)}{E(p) + \varepsilon} \tag{4}$$

In the formula,  $E(p) = (I^r(p) + I^g(p) + I^b(p))/3$  represents the brightness value of pixel  $p$ , and  $\varepsilon$  represents a small positive number, which can avoid the situation where the denominator is zero. Therefore, it can be concluded that the pixel  $E(p)$  in the

area with extremely low light is also low, and the  $GI^*$  value will rise, and it will not be considered as a gray pixel.

If the two eigenvalues of the mean gradient square matrix corresponding to a point are larger, then a small movement near the point will result in a larger gray level change, which means that the point is a corner point. Corner response functions are:

$$R = \det S(x, y)GI^*(p) - k[\text{trace}[S(x, y)]]^2 \quad (5)$$

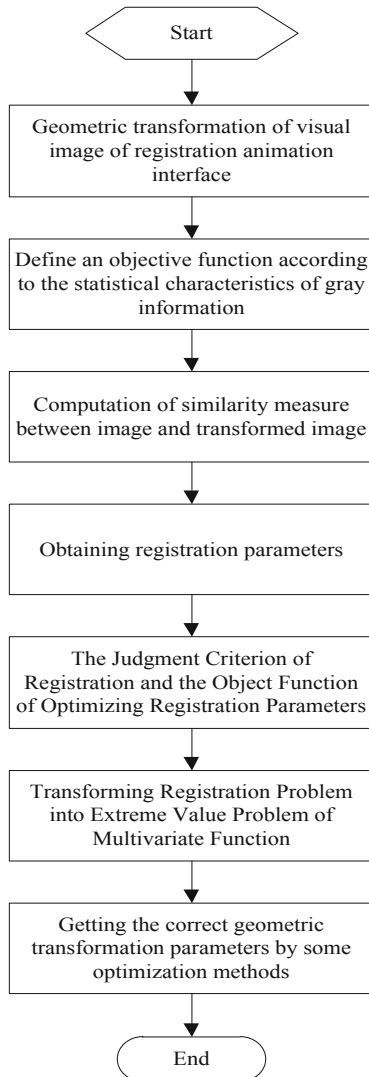
Where,  $k$  Set to 0.04 (recommended by Harris).

Any pixel satisfying  $R$  greater than a certain closed value  $T$  is considered to be a feature point when the feature points are extracted by the formula above. The closed-value  $T$  depends on the attributes of the actual image, such as size, texture, etc., but because  $T$  has no intuitive physical meaning, its specific value is difficult to determine. Therefore, the method of indirectly determining  $T$  is adopted in the experiment: we only need to give the maximum number of possible feature points to be extracted in the image, that is,  $S_{\max}$ , matching program to sort the possible feature points according to  $R$  value. Then some pixels with maximum  $R$  value are selected as feature points according to  $S_{\max}$ . When you actually match, you should constantly adjust the  $S_{\max}$  according to the matching result [8].

## (2) Visual Feature Matching

The goal of the initial match is to determine a set of candidate matching pairs. Candidate matching pairs can contain a large number of mismatches, all of which will be eliminated in subsequent robust matching processes as well as in the reconstruction process. Binocular stereo matching is based on a point matching criterion, according to some characteristics of the visual image. At present, visual feature matching mainly includes gray-scale correlation-based matching, feature-based matching and model-based matching. Among them, gray-scale correlation-based matching is a classical method of image matching. Based on the gray-scale information, the visual interface image is statistically analyzed, and gray-scale correlation and similarity are used as correlation matching decision. Search and match according to one or more similarity measures. In this chapter, the feature point matching method based on gray-scale correlation is adopted [9].

The basic idea of matching based on gray scale correlation is as follows: firstly, geometric transformation is done to the visual image of the registration animation interface, and then an objective function is defined according to the statistical characteristics of the gray level information, which is used as a similarity measure between the reference image and the transformed image. So that the registration parameters are obtained at the extreme value of the objective function, which is used as the criterion of registration and the objective function of the optimization of registration parameters, so that the registration problem can be transformed into the extreme value problem of multivariate functions. Finally, the correct geometric transformation parameters are obtained by a certain optimization method, as shown in Fig. 3 below.

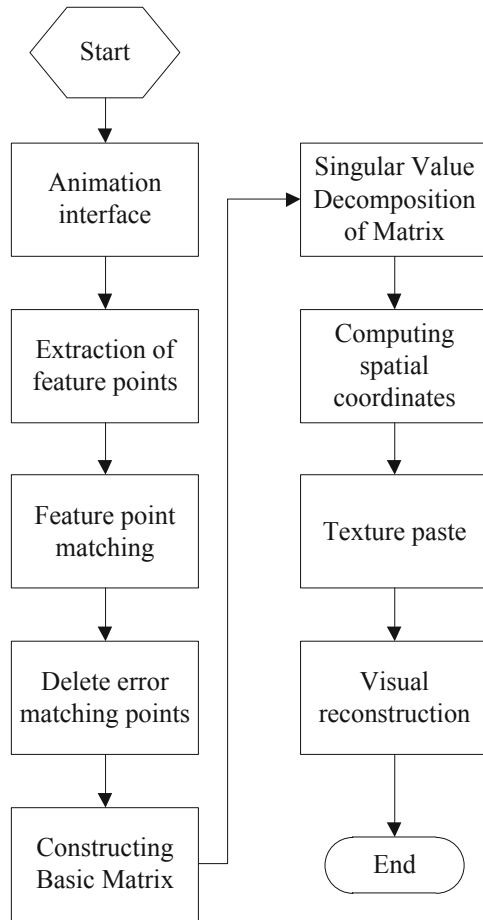


**Fig. 3.** Visual feature matching based on Gray-scale correlation

The performance of this kind of algorithm mainly depends on the similarity measure and the choice of search strategy. The selection of matching window size is also a problem that must be considered by this kind of method. Large windows may be mismatched, and small windows can not cover enough intensity changes. Therefore, the size of the matching region can be adjusted adaptively to achieve better matching results [10].

### (3) Visual Feature 3D Reconstruction

Visual reconstruction is the ultimate goal of this study [11]. Feature extraction and stereo matching in the above two chapters are the basis and precondition of visual reconstruction. In this paper, binocular stereo vision technology is used to reconstruct interactive animation interface. Its principle is as follows: firstly, two images of interactive animation interface are obtained by binocular camera, based on parallax principle [12]. The trigonometric principle is used to recover the 3D geometric information of the scene [13, 14], and then the 3D shape of the interface is reconstructed, as shown in Fig. 4 below.



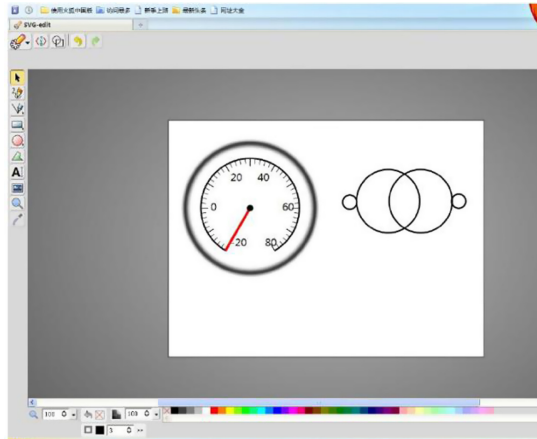
**Fig. 4.** Process of 3D reconstruction of visual features



### 3 Experimental Results and Analysis

The purpose of this study is to improve the visual quality of the interactive animation interface, which is more humanized and better reflected in the interactive performance. So in this simulation experiment, the visual effect of the interface before and after visual reconstruction is taken as the object, and the visual effect of the interface before and after visual reconstruction is taken as the object. Carry out experimental analysis.

Fig.5 below shows the interactive animation interface for visual reconstruction.



**Fig. 5.** The interactive animation interface to be visually reconstructed

Now, using the method mentioned in the above-mentioned article to perform the visual reconstruction, the visual effect evaluation is carried out on the two interfaces before and after the visual reconstruction by the expert evaluation method, and the result of the evaluation is shown in Table 1 below.

**Table 1.** Expert Assessment score (score).

Expert	Before Visual Reconstruction	After Visual Reconstruction
1	92	98
2	89	97
3	88	97
4	90	96
5	88	98
6	88	97
7	90	98
8	91	96
9	92	97
10	89	97

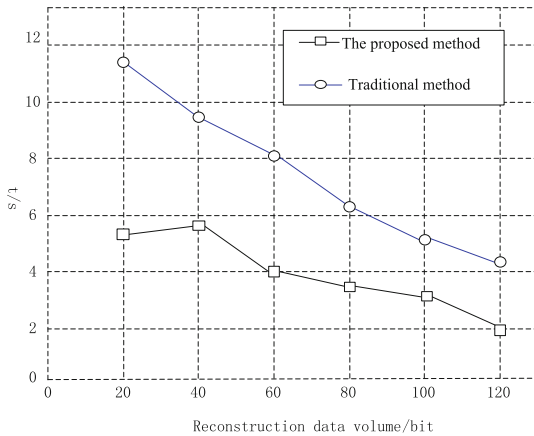
In order to reduce the subjectivity of the expert screen evaluation, the weight conversion calculation is carried out, and the results are shown in Table 2 below.

**Table 2.** Evaluation results weights

Expert	Before Visual Reconstruction	After Visual Reconstruction
1	0.8798	0.9547
2	0.8567	0.9514
3	0.8642	0.9514
4	0.8754	0.9474
5	0.8642	0.9547
6	0.8642	0.9514
7	0.8754	0.9547
8	0.8788	0.9474
9	0.8798	0.9514
10	0.8567	0.9514
Average value	0.8695	0.9516

As can be seen from Table 2, the average weight of interface visual effect after visual reconstruction is 0.9516, while the average weight of interface visual effect before visual reconstruction is 0.8695. The comparison between the two shows that the performance of the visual reconstruction method is better.

On this basis, the time of interface reconstruction is recorded and counted, and the statistical results are shown in Fig. 6.



**Fig. 6.** Comparison of Interface Reconstruction

As shown in Fig. 6, the proposed method has short time, obvious advantages and high practical application.

## 4 Conclusion

To sum up, visual reconstruction has always been one of the focal points and hot spots in interactive animation interface research. In order to generate a synthetic environment for known objects and virtual objects, the research on reconstruction methods is of great academic significance and application value both in computer vision and in engineering applications. In order to solve the problem of poor visual effect of interactive animation interface, a visual reconstruction method of interactive animation interface based on Web technology is proposed in this paper. Finally, after the visual reconstruction of interactive animation interface with web technology, the visual effect is better, which achieves the purpose of this study.

## References

1. Anyifei. Application of Dual-mode Interface Based on Three Library in Interactive Web3D. *Electr. Technol. Softw. Eng.* **132**(10), 62–65 (2018)
2. Rui, W., Liang, H., Peng, B., et al.: Research on interactive 3D geographic scene construction method based on WebGL. *Map. Spatial Geogr. Inf.* **226**(2), 62–64 (2018)
3. Mengye, L., Shuai, L.: Nucleosome positioning based on generalized relative entropy. *Soft. Comput.* **23**, 9175–9188 (2019)
4. Li S., Nan, Y.D., et al.: Research on web dynamic page hierarchical reconstruction in complex context. *Comput. Digital Eng.* **45**(11), 2218–2222 (2017)
5. Liu, S., Liu, D., Srivastava, G., et al.: Overview and methods of correlation filter algorithms in object tracking. *Complex Intell. Syst.* (2020). <https://doi.org/10.1007/s40747-020-00161-4>
6. Jinglei, H., Yongqiang, Z., Haimeng, Z., et al.: Three-dimensional reconstruction of highly reflective and textureless targets in polarized multispectral machine vision. *J. Surv. Map.* **47**(6), 130–138 (2018)
7. Pingxi, L.Y., Xinming, D., et al.: Three-dimensional reconstruction of textureless high reflective targets based on polarized binocular vision. *J. Infrared Millimeter Wave* **36**(4), 432–438 (2017)
8. Marlowe, Y.B., Ting, D.: Research on three-dimensional reconstruction simulation of human identity authentication visual image. *Comput. Simul.* **34**(9), 288–291 (2017)
9. Baiyue, W.M., Hao, Z., et al.: Cotton three-dimensional reconstruction technology based on binocular vision. *Mech. Design Manuf. Eng.* **46**(11), 150–154 (2017)
10. Wenwen, L., Shanxi, D.: Optimizing the foreground vision of 3-D free-form stereo display based on double-view reconstruction. *Chinese J. Image Graph.* **12**(6), 1119–1123 (2018)
11. Zheng, P., Shuai, L., Arun, S., Khan, M.: Visual attention feature (VAF): a novel strategy for visual tracking based on cloud platform in intelligent surveillance systems. *J. Parallel Distrib. Comput.* **120**, 182–194 (2018)
12. Di, W., Hua, L., Xiang, C.: A miniature binocular endoscope with local feature matching and stereo matching for 3D measurement and 3D reconstruction. *Sensors* **18**(7), 2243 (2018)

13. Li, C., Lu, B., Zhang, Y., et al.: 3D Reconstruction of indoor scenes via image registration. *Neural Process. Lett.* **48**(3), 1281–1304 (2018)
14. Fu, W., Liu, S., Srivastava, G.: Optimization of big data scheduling in social networks. *Entropy* **21**(9), 902 (2019)