

Retraction

Retracted: Application of Photoshop Graphics and Image Processing in the Field of Animation

Journal of Sensors

Received 13 September 2023; Accepted 13 September 2023; Published 14 September 2023

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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) Peer-review manipulation

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] F. Ye, "Application of Photoshop Graphics and Image Processing in the Field of Animation," *Journal of Sensors*, vol. 2021, Article ID 8677479, 18 pages, 2021.

Research Article

Application of Photoshop Graphics and Image Processing in the Field of Animation

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Received 2 August 2021; Revised 23 August 2021; Accepted 3 September 2021; Published 18 October 2021

Academic Editor: Haibin Lv

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With the rapid development of digital art and machine science and technology, the production form of modern animation tends to be diversified, and with the important role of animation color in the animation film foil and rendering, more and more attention was paid by the animation design industry. Computer graphic technology is a new type of artistic creation method, and its birth and development are closely related to computer technology. The purpose of this paper is to make some analysis and induction from the perspective of science and technology and culture and to explore the application of Photoshop graphics and image processing technology in the field of animation. First, the definition of “animation” and the extension of the animation category are introduced. Then, the main functions of Photoshop image processing technology are described in detail. According to the research content, this paper designs a self-made experimental short film “future city.” After the simulation of experimental animation film and the setting and positioning of the experimental scene, Photoshop software was used to show the animation scene. The experimental results show that the color changes in the short film “future city.” After the saturation of sunny scenery is reduced by 3 points and the brightness is reduced by 20 points and the filter, mode change, and color adjustment are carried out, a complete rainy scenery can be obtained. The self-made experimental short film has guiding significance for the creation and practice.

1. Introduction

At present, there are many researches on 3D scene reconstruction technology, and many representative achievements have been achieved. Due to the development of the Internet and the improvement of people’s quality of life, image 3D modeling technology has gradually entered the ordinary lives of the majority of people. How to create and represent a solid 3D model is a vital and critical issue in the realization of virtual reality and 3D animation. However, the 3D scene reconstruction process of a robot depends on the CPU, memory, hard disk, and other hardware configuration of a robot. In the process of 3D scene reconstruction, due to the limited configuration of robots, there may be problems such as long algorithm time and poor reconstruction details. Low configuration robots cannot meet the needs of mass data storage and intensive computing in the process of triple scene reconstruction, while the emergence of cloud robot technology can solve the problem of computing loss of low

configuration robots. Three-dimensional image modeling mainly involves research fields such as computer vision, computer graphics, image processing, and virtual reality. Cloud robots unload the intensive computing and mass storage in the process of 3D scene reconstruction to the cloud, making it possible for low-cost robots to be used for tasks with high configuration requirements. The network configuration of the ROS system is convenient, and the communication between robots is fast and orderly.

Wang et al. summarized the research methods of three-dimensional traffic animation. Firstly, they systematically summarized the research methods of the road network as a vehicle carrier and described the vehicle motion simulation from seven aspects, including one-dimensional following method, continuum method, mesoscopic method, hybrid method, path planning method, rule-based method, and data-driven method. Their principles, advantages, and disadvantages were described in detail. After that, some areas and possible directions for further study are pointed out.

Although their research summarizes the method of motion simulation, the research process is too complicated [1]. In order to make formal specification play a more effective role in software design, Li and Liu proposed a new method to solve this problem. The feature of this method is to integrate the inspection based on standard animation into the construction process of formal design specification. We discussed the basic principle of this method and explained how to use canonical animation as a reading technology to verify the current specification. We describe a prototype software tool of this method [2].

Science and technology are the catalysts for the take-off of films, and every leap in film technology is the result of technological progress. The main work of this paper is to create the animation short of “future city” based on the characteristics of animation color on the basis of digital technology, and on the basis of the specific design and production of this animation, combined with the research of digital color, the color design of classic animation, the rule of color visualization of animation, and the realization of color design of animation, this paper discusses the way and outlet of color design of animation under digital technology. From the technical point of view, the emergence of digital technology makes it possible to shoot, distribute, and show films without film. At the same time, digital technology can not only perform the work of traditional photography better but also create a new way of shooting. At the same time, through the comprehensive analysis of the color realization path and the later production and application of digital animation, this paper discusses the influence of Photoshop software on color in animation production.

2. Proposed Method

2.1. Animation and Animation Digital Software

2.1.1. Definition of “Animation.” Traditionally speaking, animation is a kind of film that uses pictures to show the plot of drama. It is a kind of “moving painting art” that combines painting art and film technology and has film thinking and language. It is a unique form of film and television art. In a broad sense, animation is an active picture. Including “moving” and “painting,” animation is a means as well as a method, in which “moving” is the purpose and “painting” is the means. This kind of “movement” can represent the movement of a virtual character; the change of object shape, structure, and color; and the dynamic change of natural phenomenon [3–5]. Digital film refers to the film and television works that are filmed, produced, and stored by digital technology and equipment and transmitted through physical media such as satellites, optical fibers, disks, and optical discs, to restore digital signals to images and sounds that conform to film technology standards and are projected on the screen. So, we can define animation as an artistic effect that people show the motion process of fictitious characters, animals, or other things in the brain one by one through anthropomorphism, exaggeration, and other methods; the movement process of fictional characters, animals, or other things in the brain is shown one by one in the form of paint-

ing, and then, the method of frame by frame shooting is adopted, and then play at the speed of 24 frames to get an artistic effect [6–9]. Figure 1 shows the framework of the facial animation system.

From the definition of animation, we can see that “animation” has the following characteristics: First, the objects in the animation are virtual, the illusion is created by human beings, and the action of the objects is also the activity image of the given living things; second is the animation thinking; animation is not the continuous presentation of many static pictures but the continuous action or dynamic things with a sense of motion, and the motion is animation. The third is the technicality of animation. Animation production must borrow the technology of frame by frame shooting and forming continuous motion images and animation production technology [10]. The general method of image-based rendering is to first collect a large number of photos of the scene, and these photos are stitched into a spherical or cylindrical panorama, and then, what specific panorama to use is determined according to the viewpoint. Different from painting art, all the images in animation are not directly available for people to enjoy, but through physical and chemical technical means and some technical equipment, it forms a smooth optical TV feel of the image that lets people watch [11–13]. Figure 2 shows the principle of animation production.

2.1.2. The Extension of Animation Category. With the development of science and technology, the means and forms of animation are becoming more and more diversified. In the field of animation, almost all the forms of plane painting and the modeling of three-dimensional idols can be seen, such as simple and clear lines [14], fresh watercolor, gouache, color lead, ink with strong Chinese style, print and decorative painting with simple but warm colors, oil painting, ink-jet painting, computer painting, clay sculpture, puppet, paper-cut, bamboo, and other folk crafts [15]. The digital revolution of animation makes the theme of the story be told more plastic and also makes the animation director expand his knowledge field and quality ability, and the way of telling the story becomes diverse and innovative to cater to the audience’s freshness; in the use of lens, in the three-dimensional world, any way of lens movement becomes possible [16–18].

The popularity of TV has promoted the development of the TV animation industry [19]; the invention of Internet technology has opened up the market of animation, and network animation and mobile animation have emerged [20–22]. The three-dimensional geometric structure of the scene is restored. Image-based modeling and rendering methods were originally mainly used for the research content of computer vision. Now, due to its broad application prospects, scholars and experts in computer graphics and computer vision have turned to this research field. Due to the great freedom and creativity of animation in the form of expression, the concept of animation art now has already surpassed the scope of its film and television animation and is more widely used in various industries and fields in people’s lives, as shown in Table 1.

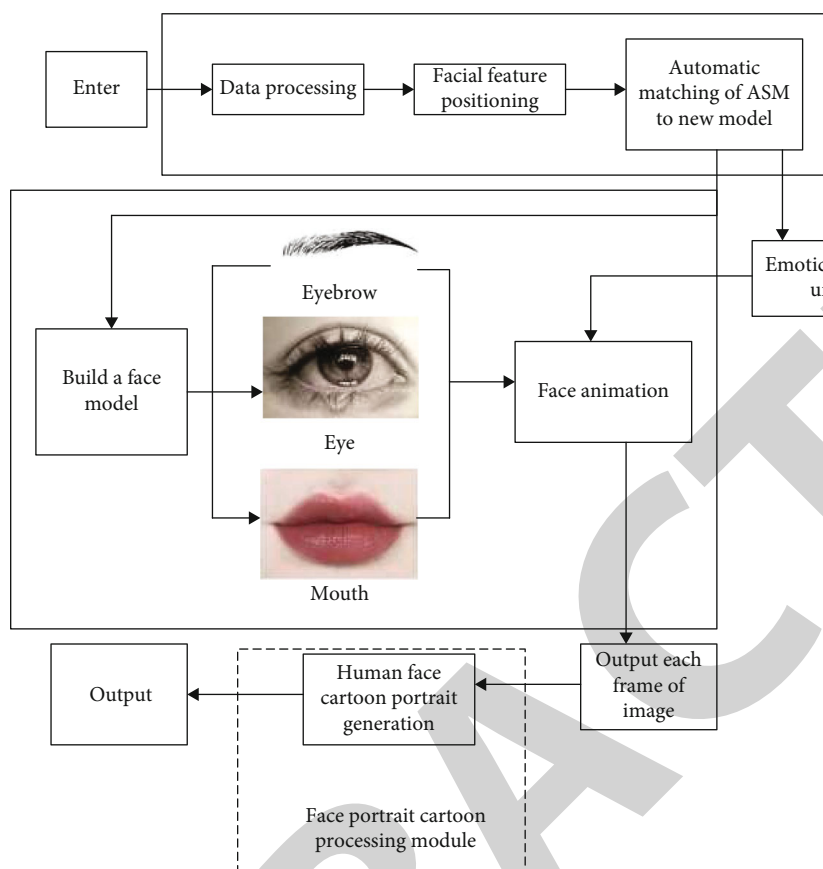


FIGURE 1: Principle structure diagram of face animation system.

The expansion of animation also enriches and expands the application market of animation. Animation can be seen in film and television, TV advertisements, TV columns, medicine, industry, science and education, games, webpage production, virtual reality, and other fields [23–25]. For example, in TV news or science and education films, we will often see the simulation animation produced by digital technology to deduce the occurrence of an event or show the occurrence process of natural phenomena [26], so that we can understand in more detail the unforeseen things around us; the virtual display animation used in the field of the construction industry can help real estate developers and potential customers to see the scale and completion effect of the building more intuitively [27, 28].

2.1.3. Animation Digital Software. The progress of science and technology has always injected new vitality into animation production, especially the invention and development of computer graphic technology and Internet technology, which provides new animation technology and digital software for animation production. Animation digital software is a program written by software developers for animation production with the help of computer equipment, computer graphic technology, and graphic processing technology. It is an indispensable tool for animation production in the digital era compared with paper, pen, camera, and other tools in traditional animation production. On the one hand, the animation digital soft-

ware provides an efficient and convenient way to make animation and shortens the production cycle, thus reducing the production cost to a certain extent; on the other hand, the animation production software also expands the expression form and application field of animation, and at the same time, the animation artists can more freely express their imagination with the help of the software, providing animation artists with a broader creative space. Typical image-based 3D reconstruction methods generally include image acquisition, camera calibration, image matching, 3D reconstruction, and other steps. Figure 3 shows the processing system in the animation digital software.

The traditional hand-painted animation production uses the method of manual drawing to depict a series of continuously changing pictures on the film or celluloid film and adopts the method of taking pictures one by one and then continuously playing at a certain speed to obtain the activity effect of the created image. According to this production method, not only every step of the action should be painted on paper or film but also the background of the character should be painted over and over again, which is a huge workload; moreover, the creator is required to have profound painting skills and animation production experience; if there is a slight deviation in the drawing, it will cause a large amount of waste of resources.

2.1.4. Advantages of Animation Digital Software. The essence of computer animation production is to replace the

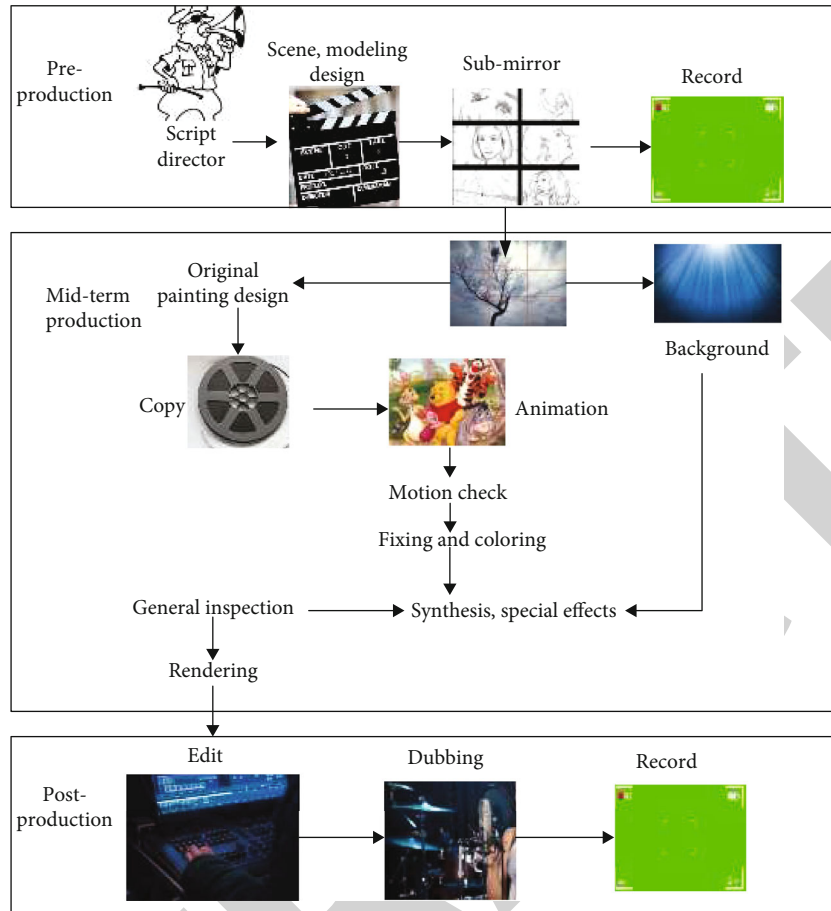


FIGURE 2: Principles of animation (pictures from Baidu Picture).

TABLE 1: The field of "animation."

Category	Animation field			
(1) Cartoons	TV animation	Cinema animation	Art animation short film	Network series short film
(2) CG animation	Advertisement	Film and TV special effects	Package of TV program	Game
(3) Application of animation form	Virtual reality	Cultural education	Preview of design effect	Event simulation

traditional paper and pen with digital equipment and software technology, which makes the animation gradually get rid of the heavy manual animation production and causes another revolution in the field of animation with its simple, efficient, and multistyle characteristics.

(1) *Improvement of Animation Production Efficiency and Reduction of Production Cost.* From the perspective of the animation production process, the technological display of animation art is mainly manifested in two aspects with the help of computer: one is to scan the pencil sketch of animation, which is then reflected by the processing of lines and coloring of drawings by software; the other is to directly use computer technology to draw characters and color in the software. The computer-generated two-dimensional animation greatly improves the smoothness and clarity of lines. The thickness and depth of lines will be automatically uni-

fied into lines of the same specification, and the input black lines can be changed into lines of different colors as required. The coloring process also becomes simple. In the closed range of the line, just a little mouse can fill the color you want, ensuring the color uniformity during the coloring, and the color will not crack, there is no cross color, and there is no need to wait for drying or change color for a long time. The computer has thousands of colors for the makers to choose, while the general manual coloring pigments are often only hundreds of kinds; in special cases, there are also different colors to mix. A skilled coloring staff, if working 8 hours a day, can complete about 20 pieces at most, and the use of computer coloring can reach 200 or more.

(2) *The Enhancement of the Expressive Power of Animation and the Expansion of the Scope of Creation.* Today's two-dimensional software has some special effect plug-ins, and the

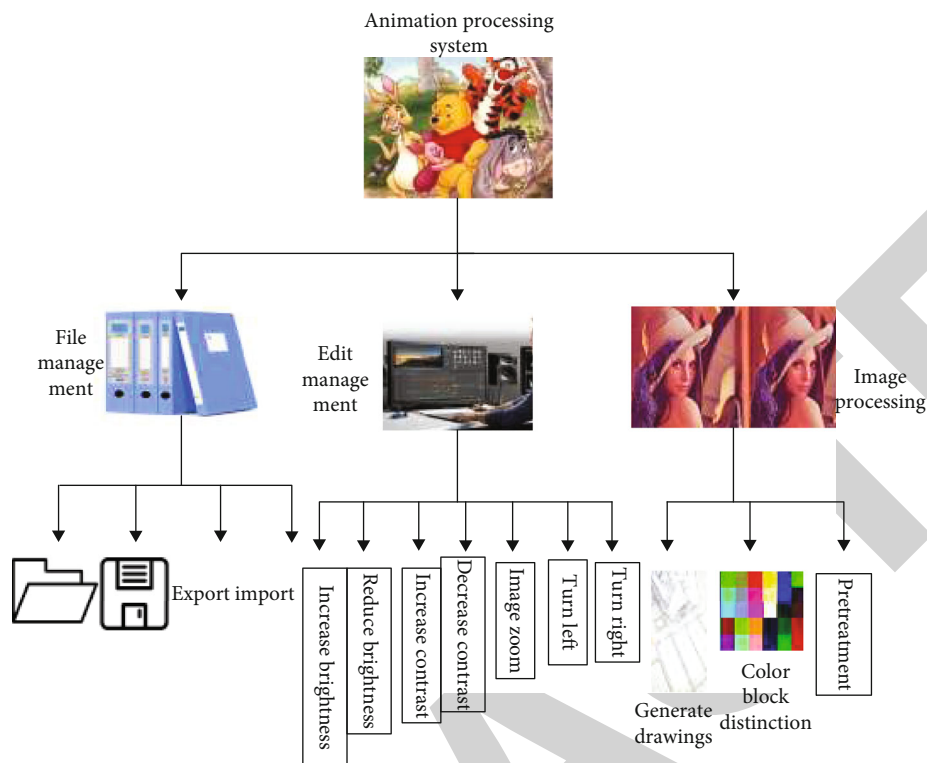


FIGURE 3: Animation processing system (pictures from Baidu Picture).

producers can increase the performance of the screen through the use of these functions. The development of three-dimensional technology lies in the purpose of realism. Animation creators value that three-dimensional technology can simulate real things more realistically, and the audience also likes to see the sense of presence when a thing appears. The effect of three-dimensional animation breaks through the restriction that traditional hand-painted animation can only be a single line and flat painted. Through the design of materials, three-dimensional software can produce far more fine character modeling than hand-painted, so that the character modeling not only has its own three-dimensional sense but also through the simulation of three-dimensional space, the character in the three-dimensional environment can carry out endless movement changes, resulting in strong visual impact. Finally, through the combination of high-quality rendering tools and various special effects, realistic animation can be created to meet the aesthetic and spiritual needs of more age groups.

(3) *Parallel Development of Animation Digital Software and Traditional Production Technology.* The widespread use of digital software in animation does not mean the replacement of traditional production technology, just as the coexistence of painting art and photography, the common development of film and television. Traditional animation, through the representation of painting itself, gives new meaning to the image content.

2.2. *Photoshop.* Table 2 shows the development history of Photoshop. The characteristics of the image are widely used

in the field of image registration as one of the representations of the image. It is formed by the physical and geometric characteristics of the shooting scene that make the gray level of the local area of the image change significantly. Photoshop is Adobe's most famous and commonly used graphic design software. It involves a wide range of fields, including advertising design, web page production, photo restoration, image creativity, and art and text. Designers can use all kinds of drawing tools, image adjustment, filter processing, etc., in Photoshop to create imaginative works in blank pictures and also can decorate a ready-made picture to achieve the desired effect. Table 3 shows the introduction of some concepts in Photoshop.

2.2.1. *Pen Tool.* Pen tools are mainly used for matting in the process of drawing repair. Only by mastering the application skills of pen tools can designers draw the desired curve and quickly separate the main body and background. The pen tool is located in the toolbox of Photoshop. Right-click the pen tool button to display the five options included in the pen tool: pen tool, free pen tool, add anchor tool, delete anchor tool, and conversion point tool as shown in Figure 4.

These five buttons can complete the path drawing. The lines drawn by the pen tool are all Bessel curves; that is to say, their curves are composed of line segments and nodes, and each node has two control points, as shown in Figure 5. We just adjust these control points to draw the line we want.

After selecting the pen tool, you can see the options bar of the pen tool below the menu bar. The pen tool has two creation modes: create a new shape layer and work path.

TABLE 2: The development of Photoshop through the ages.

Adobe Photoshop 1.0	Only for Macintosh computers
Adobe Photoshop 2.0	Brings a host of new features, including a colorful boot screen, paths for building edges of objects, and more
Adobe Photoshop 3.0	Developed for Windows and Mac and introduced the most basic feature—layers—into the program
Adobe Photoshop 4.0	Adjustment layer functionality and macros were introduced. The addition of action features raises the possibility of automation in image processing and improves the efficiency of Photoshop
Adobe Photoshop 5.0	Important features such as magnetic lasso tools, editable types, and history panels have been introduced
Adobe Photoshop 6.0	Major improvements and additions in version 6.0 include improved user interface, liquefaction filters, support for vector graphics, and an improved layer style interface
Adobe Photoshop 7.0	Enhanced the ability to process the ever-increasing number of camera images used in Photoshop
Adobe Photoshop CS	This version adds the ability to customize keyboard shortcuts and to add text directly to the design path. Other features include added support for large files, a new color matching tool and a new layer management tool, layer groups, added shadows and highlights, lens blur filters, and more

TABLE 3: Introduction to the basic concepts in Photoshop.

Bitmap	Typically used for photoquality image processing, the image is made up of many “pixels” like small squares. Represented by its position and color value, it can show the change of color shadow
Vectorgraph	The image physical properties of the resulting photos are usually not available. They are commonly used for engineering drawings
Resolution	Pixels per unit length
Channel	Refers to the range of colors, in general, a basic color for a channel
The layer	In general, multiple layers are used to make each layer as if it were a piece of transparent paper, stacked together to create a complete image

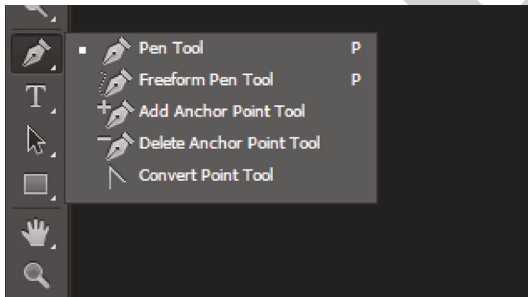


FIGURE 4: Pen.

Next on the right are two options: pen tool and free pen tool. In the process of matting, we usually choose “working path” and “pen tool” as shown in Figure 6.

After selection, we can start to draw the outline with a pen. In the pen tool state, click the left mouse button on the screen to start a new anchor point. During the drawing process, hold down the CTRL key and click the left mouse button to move the anchor or adjustment point. Click the left mouse button on the anchor to delete it. After mastering this method, you can start to draw the desired curve freely.

2.2.2. Stamp Copying Tools. The copy stamp tool is an important repair tool. It can copy a part of an image from one location to another within the same layer, and this kind

of copying can also be done between different layers. Stamp copying tools are often used to remove defects in images or to repair imperfections. It is inevitable that there will be some stains in the photos that affect the overall effect. At this time, you can use the copying stamp tool to remove them. The copy stamp tool is located in the toolbar on the left side of the view, select the tool, and then place the mouse.

In the image window to be copied, hold down the ALT key and click the left mouse button to select the copied content, so the copied image is saved to the clipboard. Move the mouse to the position of the image to be pasted, and then press and hold the left mouse button to drag to display the image to be copied.

2.2.3. Color Adjustment Tool. In color adjustment, the most important tool is the curve adjustment tool. The curve tool can be used to quickly increase the brightness and contrast of pictures. In the Photoshop menu, click “image” → “adjust” → “curve” (the shortcut key is Ctrl+m), and the curve adjustment control panel will appear in the view, as shown in Figure 7.

Pull the diagonal position to increase or decrease the contrast of the picture. Click the left mouse button to add control points on the curve to enrich the light and shade effect of the picture by pulling the curve. The default channel of the system is RGB; that is to say, when pulling the curve, it changes the brightness and contrast of all colors in the picture. Of course, you can also select a color in red, green, and blue in the channel, so as to adjust the picture more precisely.

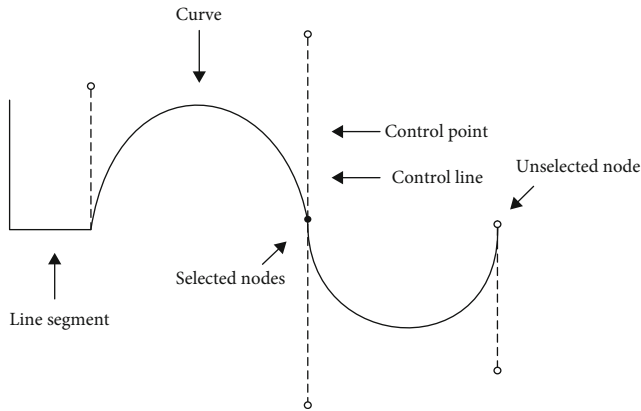


FIGURE 5: Bezier curve.

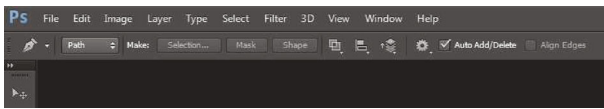


FIGURE 6: Toolbar.

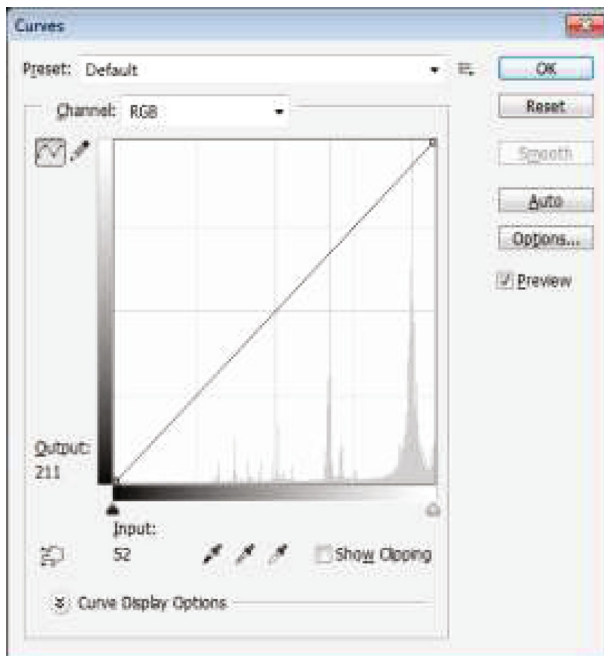


FIGURE 7: Curve tool.

The color balance tool can be used to adjust the overall tone of the photo, remove the too yellow or blue color in the photo, and make the photo look clearer. In the Photoshop menu, click "image" → "adjust" → "color balance" (the shortcut key is Ctrl+B), and the color balance control panel will appear in the view. In the hue balance option, the image is generally divided into three hues: dark tone, middle tone, and highlight. Each hue can be adjusted independently. In the process of dragging the balance slider,

the color of the picture changes accordingly. Here, we need to mention the reverse color in the color principle, also known as complementary color. Cyan and red are complementary colors, magenta and green are complementary colors, and yellow and blue are complementary colors. That is to say, two colors belonging to complementary colors cannot be increased or decreased at the same time. If a certain tone is too heavy, it is necessary to increase its complementary color accordingly, so as to achieve the balance of screen color.

The color options are also available in Photoshop under image → adjust menu bar. The function of optional color options is similar to that of color balance, both of which are used to adjust the tone of the picture. The difference is that the optional color options are more targeted and accurate. The optional color options can be used to remove the too heavy tone and return to the true beauty. The color of the picture is a mixture of red (R), green (G), and blue (B). Each color we see can be expressed by the RGB value. The optional color options can select nine colors in the image: red, green, blue, cyan, magenta, yellow, black, white, and neutral. Under each color, you can change the color by adjusting cyan, magenta, yellow, and black. For example, in the process of taking a picture, the color of a part of the picture is too blue because of the light. We can adjust the value in the optional color options to remove the excessive blue hue and return to the original color.

2.2.4. GIF Image File Format. GIF is an image file storage format in Photoshop. The GIF image file uses the LZW compression algorithm, which has high storage efficiency, has a diversified structure, and supports multiple image sequencing or overlay. GIF is mainly a transmission format designed for data flow, with a sequential organization form. GIF has five main parts appearing in a fixed order, and all parts are composed of one or more blocks. The first byte of each block is used to store the feature code identification. The order of these parts is file mark block, logical screen description block, optional "global" color table block (palette), each image data block (or dedicated block), and tail block (end code). The GIF image file format is shown in Table 4.

2.2.5. Plug-In Type. The plug-in file types in Photoshop and the file extensions of each type are shown in Table 5.

2.2.6. Filter. Table 6 shows the filters commonly used in Photoshop. By using filters, you can change the light and shadow changes of the image and the effect as well as the overall feeling.

2.3. Image Processing Technology. In the actual image collection process, the image collected by the system is not perfect, and there are many factors that can affect the image effect, such as the image collected by CCD in the A/D conversion process, line transmission process, light uniformity and concentration, and the factors and the characteristics of the detected object itself. Therefore, image preprocessing must improve the quality of collected images. The characteristics of the digital technology itself

TABLE 4: GIF image file format.

File flag block	Identification identifier "GIF" and version number	
Logical screen description block	Defines the size, vertical and horizontal dimensions, and color depth of an image plane surrounding all subsequent images and whether there is a global color table	
Global color table	The size of the color table is determined by the number of colors used in the image	
Image data block	Image description block	
	Local color table	
	Table-based compressed image data	Can repeat n
	Image control extension block	
	Comment extension block	
Tail block	Application extension block	
	If the value is 0, it means that the data stream has ended	

TABLE 5: Plug-in file type and extension.

Plug-in type	Windows file extension
General	8BP
Automation	8LI
Color picker	8BC
Import	8BA
Export	8BE
Extension	8BX
Filter	8BF
Format	8BI
Parser	8BY
Selection	8BS

determine the high fidelity in the production and transmission process, reducing the quality loss, and thus maximizing the restoration of the original style of the film. The intervention of digital technology gives the film a completely different way from the previous production and thus an experience beyond imagination.

2.3.1. Image Denoise. Image denoising is the basic step of image processing, and the degree of denoising effect directly affects the effect of subsequent image processing (edge extraction, image segmentation, etc.). Common noises are as follows:

- (1) Gaussian noise, also called normal noise, originates from electronic circuit noise and sensor noise caused by low illumination or high temperature. It is the most common noise. Its probability density function is expressed as

$$T(d) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(d-v)^2/2\sigma^2}. \quad (1)$$

Among them, d represents the gray value and v is the expected value of the noise.

- (2) Salt and pepper noise is also called bipolar impulse noise. The noise characteristic is similar to sprinkling pepper and salt on the image. Its probability density function is

$$T(d) = \begin{cases} T_i & d = i, \\ T_j, & d = j, \\ 0, & \text{other.} \end{cases} \quad (2)$$

Among them, salt and pepper noise is the noise that appears in the image and only has two gray values of a and b .

- (3) In evenly distributed noise, noise is uniformly distributed, and its probability density function is

$$T(d) = \begin{cases} 1, & i \leq d \leq j, \\ j - i, & \\ 0, & \text{other.} \end{cases} \quad (3)$$

There are a variety of image denoising methods based on the above noises, such as mean filtering, median filtering, maximum filtering, Gaussian filtering, adaptive filtering, and wavelet denoising.

- (1) Mean filtering is a common filtering algorithm in image processing, and it is mainly used to smooth noise. Its principle is to use the average value of the surrounding pixels of a certain pixel to achieve the effect of smoothing noise. The gray value of the processed pixel is

TABLE 6: Photoshop filters.

Bulge	Objects in three-dimensional space can be made with the filter, or the image can be transformed into three-dimensional objects.
Spread	The filter spreads out the image to produce the effect of looking through frosted glass.
Collage	The filter splits the image into many tiles, as if they were a collage of tiles.
Overexposure	The filter mixes the positive and negative parts of an image, creating an overexposure effect that increases light intensity in photography.
Find the edge	The filter passes through the region of change in the main color, protruding the edge, and producing the effect as if you were using a pen to scratch the outline.
Embossed effect	The filter produces varying degrees of bump and dent effects by outlining the image or selected area and reducing the perimeter color value.
Illuminate the edges	The filter searches the edges of the image and enhances its transition pixels to produce a luminous effect.

$$g(m, n) = \frac{1}{xy} \sum_{(a,b) \in A_{mn}} f(a, b) \quad (4)$$

- (2) Median filtering is a nonlinear smoothing denoising method. The basic principle is that the gray value of each pixel in the image is set to the median of the gray values of all pixels within a certain neighborhood window of that point. It can make the pixel value of the surrounding image closer to the actual pixel value, can effectively remove isolated points, and can solve the problem of unclear image details. The formula is as follows:

$$g(m, n) = \text{med}\{f(m-p, n-q), (p, q \in O)\}. \quad (5)$$

Among them, $f(m, n)$ is the original image, $g(m, n)$ is the filtered image in the table, and O is the window template.

- (3) Adaptive filtering can use the previously obtained data in the filtering process to automatically change the current filter parameters. It can be applied to the statistical characteristics of unknown or time-varying signal and noise, so as to achieve optimal filtering:

$$H = \text{wiener2}(K, [s, t], \text{noise}). \quad (6)$$

Among them, $[s, t]$ represents the size of the specified filter window.

2.3.2. Image Enhancement. Image enhancement is to improve the intelligibility of the image, improve the visual effect of the image, attenuate unnecessary features, highlight the features of interest in the image, and make the image more conducive to subsequent analysis and processing.

(1) *Histogram Enhancement.* Histogram enhancement refers to the method of realizing contrast adjustment after

image grayscale transformation. Its main technology is to stretch the narrower image grayscale range according to a certain law and finally obtain an image with distribution in the entire grayscale range. Its definition formula is as follows:

$$T(v_w) = \frac{b_w}{B} \quad (w = 0, 1, 2, \dots, K-1). \quad (7)$$

Among them, K represents the number of gray levels and B represents the total pixel value of the input image.

The core of the histogram enhancement is to calculate the grayscale transformation function through the grayscale probability density function. The relationship between the transformation function $Y(v)$ and the probability density function $T_v(v)$ of the input image is

$$t = Y(v) = \int_0^v T_v(v) f_v(0 \leq v \leq 1). \quad (8)$$

The above formula is the relation of continuous random variables, and the relation applied to the discrete form of the digital image is

$$t_w = Y(v_w) = \sum_{m=0}^w \frac{i_m}{I} = \sum_{m=0}^w T_v(v_n). \quad (9)$$

2.3.3. Image Edge Detection. The most commonly used edge detection methods are LOG operator, Roberts operator, and Canny operator.

- (1) The LOG operator is a kind of second-order differential operator, which is tested according to the property of the second-order derivative through the origin. The operator is not a vector but a scalar, does not depend on the edge direction, and has the characteristics of rotation invariance. It is very sensitive to the noise of the input image. Its expression is

TABLE 7: Overall planning of high rise.

Functional area	Regional location	The measure of area
Central island industrial zone	Central island industrial zone is located in the core area of the park	60000 square meters
High-rise industrial building area	High-rise industrial building area is located in the southeast of the park	90000 square meters
Single industrial building area	Single family customized industrial building area is located in the northeast of the park	100000 square meters
Commercial supporting services	Supporting business service area is located on the west side of the park	50000 square meters

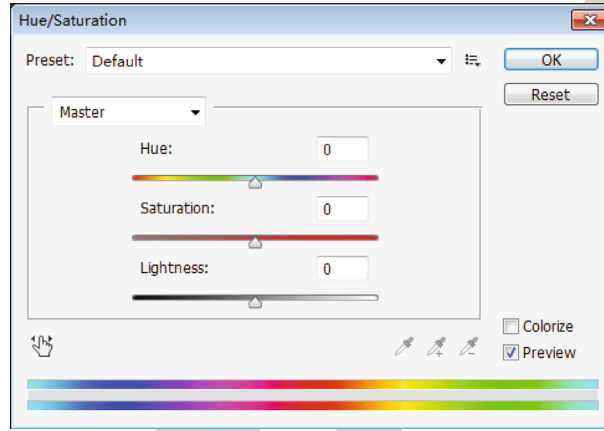


FIGURE 8: PS hue and saturation tool.

$$\ell^2 g = \frac{\partial^2 g}{\partial m^2} + \frac{\partial^2 g}{\partial n^2} \quad (10)$$

(2) Roberts operator uses the gray difference of diagonally adjacent pixels instead of gradient, and the operator calculates pixels as follows:

$$\ell g = (g(m, n) - g(m-1, n), g(m, n) - g(m, n-1)). \quad (11)$$

The calculation formula of the Roberts operator is

$$S(x, y) = \sqrt{[g(x, y) - g(x+1, y+1)]^2 + [g(x, y+1) - g(x+1, y)]^2}. \quad (12)$$

2.3.4. Binarization. Image binarization is a kind of image segmentation technology. The image binarization can convert the image into grayscale black and white. The commonly used methods of binarization are maximum between-class error method (Otus), iterative method, and maximum entropy (minimum mean square error) method.

(1) The main content of the maximum difference between classes is to select the image threshold.

Assuming that the image has K -level grayscale, any threshold r can divide the pixels into two categories: useful information and background:

$$\begin{aligned} M_0 &= \{0, 1, \dots, r\}, \\ M_1 &= \{r+1, r+2, \dots, K-1\}. \end{aligned} \quad (13)$$

The probabilities of M_0 and M_1 class pixels appearing in the entire image are

$$\begin{aligned} p_0 &= \sum_{w=0}^r t_w = p(r), \\ p_1 &= \sum_{w=r+1}^{K-1} t_w = 1 - p(r). \end{aligned} \quad (14)$$

M_0 and M_1 class mean of the class:

$$\begin{aligned} v_0 &= \frac{\sum_{w=0}^r w \cdot t_w}{p_0} = p(r), \\ v_1 &= \frac{\sum_{w=r+1}^{K-1} w \cdot t_w}{p_1} = \frac{[v_R - v(r)]}{p_1}. \end{aligned} \quad (15)$$

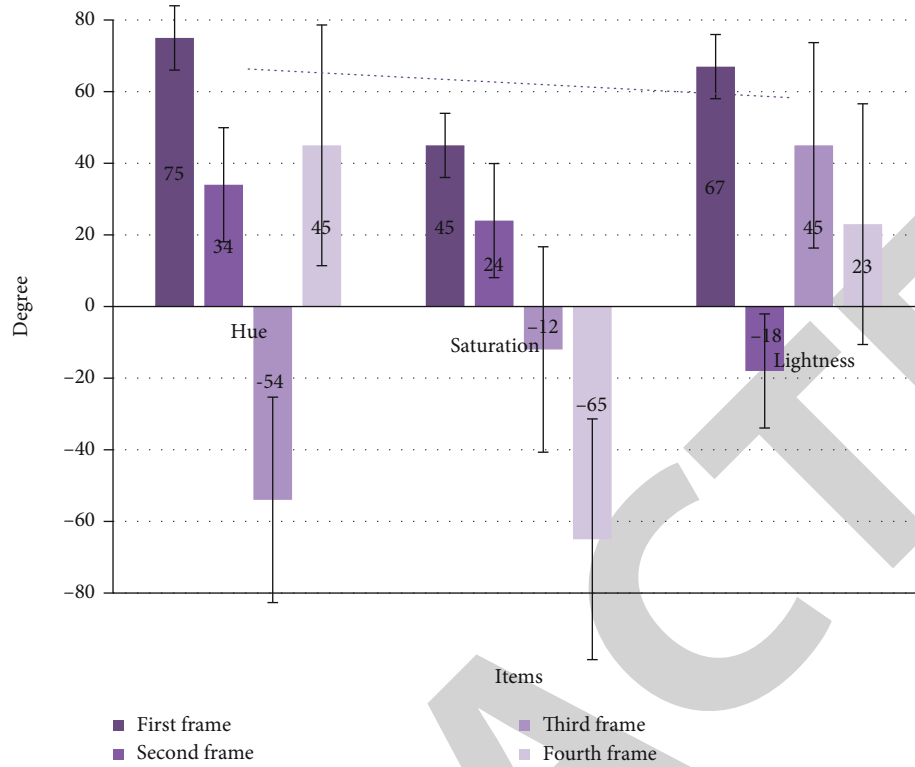


FIGURE 9: Hue and saturation of different frames of animation.

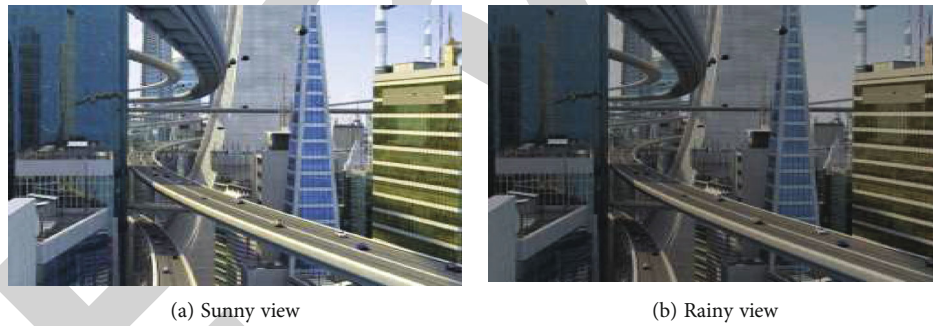


FIGURE 10: Effect of saturation brightness and filter adjustment.

Among them, V_R represents the average value of the entire image; for any r value in $[0, K - 1]$, there is

$$v_0 = p_0 v_0 + p_1 v_1. \tag{16}$$

The variances of M_0 and M_1 classes are

$$g_0^2 = \frac{\sum_{w=0}^r (w - v_0)^2 \cdot t_w}{p_0}, \tag{17}$$

$$g_1^2 = \frac{\sum_{w=r+1}^{K-1} (w - v_1)^2 \cdot t_w}{p_1}.$$

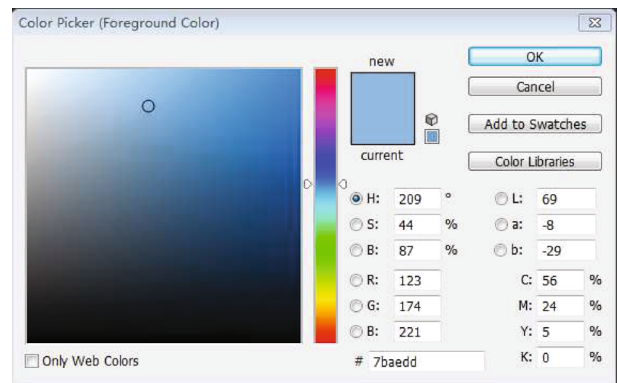


FIGURE 11: Pipette tool color picker page.

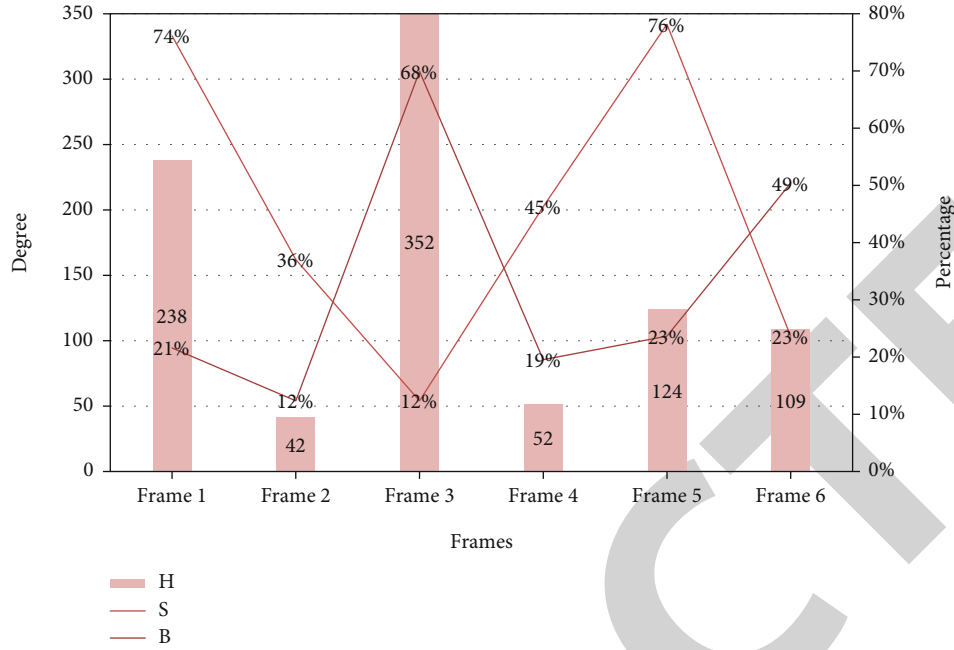


FIGURE 12: Color picker data of different frame pictures.

The intraclass variance of the M_0 and M_1 classes, the overall variance of the interclass variance, and the relationship between the three are

$$\vartheta_p^2 = p_0 \vartheta_0^2 + p_1 \vartheta_1^2, \quad (18)$$

$$\vartheta_H^2 = p_0 (v_0 - v_R)^2 + p_1 (v_1 - v_R)^2, \quad (19)$$

$$\vartheta_p^2 + \vartheta_H^2 = \vartheta_R^2. \quad (20)$$

Among them, ϑ_p and ϑ_H is the number of the threshold r

- (2) Entropy is first defined in the maximum entropy method. Entropy is a concept of physics. It was first introduced in information theory for the purpose of statistical model information. The definition formula is as follows:

$$Q = - \sum_{m=0}^K t(i_x) \log h(i_x). \quad (21)$$

The definition of entropy in the grayscale image is

$$Q = - \sum_{x=0}^{x<255} t(x) \log h_x. \quad (22)$$

If the segmentation threshold is L , then the background entropy value is

$$Q_h = - \sum_{x=0}^{x<L} h_x \log h_x. \quad (23)$$

Then the foreground entropy is

$$Q_0 = - \sum_{x=L}^{x<255} h_x \log h_x. \quad (24)$$

The formula L_{\max} for the maximum threshold of the sum of background and foreground entropy is

$$L_{\max} = \max_{0 < L < 255} \left\{ - \left(\sum_{x=L}^{x<255} h_x \log h_x + \sum_{x=0}^{x<L} h_x \log h_x \right) \right\}. \quad (25)$$

3. Experiments

3.1. Experimental Animation Film Simulation. "Future city" is a design effect preview animation film based on architectural performance. It describes the beautiful blueprint of future development planning with high-rise buildings as the project basis and multiple lens languages. The animated film "future city" is a short film with more scenes. When watching the animation, more than 90% of the areas they see in each scene are the background environment. The main character of "future city" is the building, and all other animated characters are for matching. For the overall planning of "future city," the park planning strives to achieve reasonable distribution of

functional divisions and form an organic whole. The park is divided into four functional areas: central island industrial area, high-rise industrial building area, single building customized industrial building area, and supporting business service area. Table 7 shows the overall planning of high rise.

3.2. Setting and Positioning of Experimental Scene. Three-dimensional animation technology is developing rapidly. It brings convenience and laughter to our daily lives and provides a lot of technical support in architecture, games, advertising, film and television, exhibition, medicine, and many other aspects. The work focuses on emotional expression; starts with fishing movement; paves with rhythm, heart, and shadow movement; and ends with moon movement. It shows the theme of Multimedia Center: prosperous city, busy life, neon with luxury stimulating nerves, and savoring success in the gap between steel and cement. So, the setting of scene and color is located in the location of the project: temperate zone. The seasonal characteristics of temperate zone are obvious changes in the four seasons, with significant differences in spring, summer, autumn, and winter; the sprouting of grass and blue sky and clear clouds give people a sense of vitality and the recovery of all things: in the picture of summer, flowers, plants, and trees grow luxuriantly, and all kinds of wild flowers are blooming and bustling; in the depression of autumn, wind blows and rain blows; in the solemn winter, snow fog and ice frost, a white frost world, enriching the characters. The living environment can accurately convey the positioning of this design.

4. Discussion

4.1. Photoshop Color Rendering

4.1.1. Color Mode. Photoshop is the assistant of animation color design, the most common one is color rendering, and the very important factor in color rendering is to choose a handy color adjustment tool. In Photoshop's color mode, we often use the smudge tool, lightening tool, stamp tool, deformation tool, definition pattern tool, hue/saturation tool, optional color tool, color balance tool, curve line tool, color scale tool, and so on. The operation of each tool is relatively simple. First, use the hue/saturation tool as shown in Figures 8 and 9 which shows the hue and saturation of the first five frames of the animation designed in this article.

4.1.2. Filter Adjustment Effect. Through the three sliders in the tool to adjust the color saturation and hue of the picture, as long as you move the sliders, you can see the effect of the adjustment, and the effect is highly controllable; you do not need to have a deep understanding of color knowledge, but it also can be used normally, so it is mainly used for the simple and rapid adjustment of the color saturation of the picture and the overall adjustment. For the color change in the short film "future city," after reducing the saturation of the sunny scenery by 3 and the brightness by 20 and then adjusting the filter, mode change, and color, you can get a complete rainy scenery as shown in Figure 10.



FIGURE 13: Stills of the lion king.



FIGURE 14: Color application of future city.

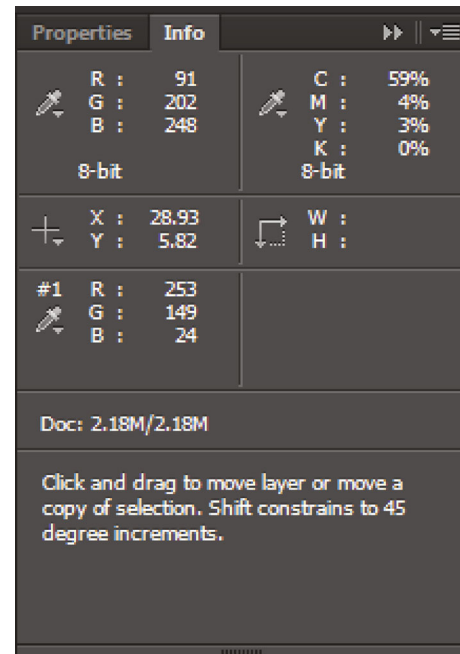


FIGURE 15: Sampling information.

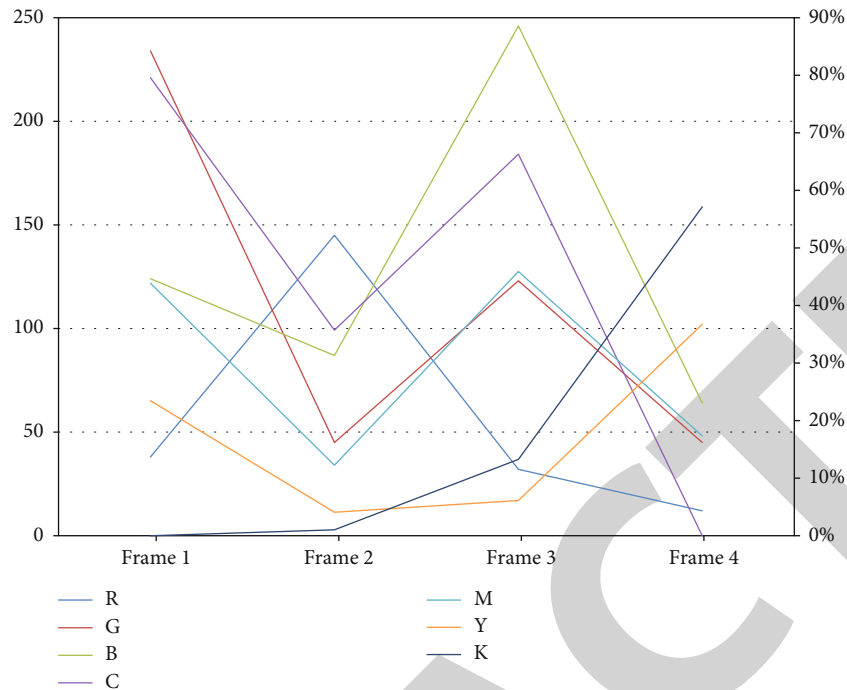


FIGURE 16: Color system and printing color system.

4.1.3. *Color Absorption Analysis.* The straw tool can absorb the color of any document in Photoshop as shown in Figure 11.

In addition to this purpose, another important role is to absorb colors from different locations, and Figure 12 is the data value of the color picker for different frames of pictures and then view the color values in the “information” panel and compare them. This function can meet the reference of excellent color design in animation color design. Use Photoshop to design scenes, grab some good animation design pages first, and take some colors with beautiful colors from them, then the straw tool will play its function. This design grabs a part of the picture in the classic cartoon lion king (you can use the print screen key on the keyboard or the special grabbing software to grab it), as shown in Figure 13.

The effect of color absorption after use is shown in Figure 14.

The general procedure is to select “pipette tool” from the toolbox of Photoshop, and then press and hold Shift+Alt to draw the color. At this time, you can see the sampling point in the document window, which is marked with an “I” in the lower right corner. At the same time, the “information” palette will pop up automatically, and the blue area is the color value of sampling point 1, as shown in Figure 15.

In this way, a sampling point can be completed. If you need to take several more color samples, you can hold down the Shift+Alt key and click the second position to sample. With the same method, you can mark up to four sampling points on the image. After the color sampling is completed, the color can be applied directly to the design. If it is applied in Photoshop, you can directly take the foreground color and fill it. Or you can use a drawing tool (such as a brush tool and pencil



FIGURE 17: Nemo.

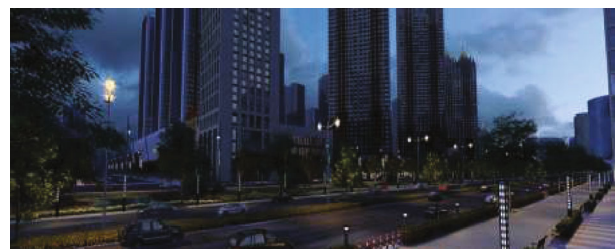


FIGURE 18: Night view of the future city.

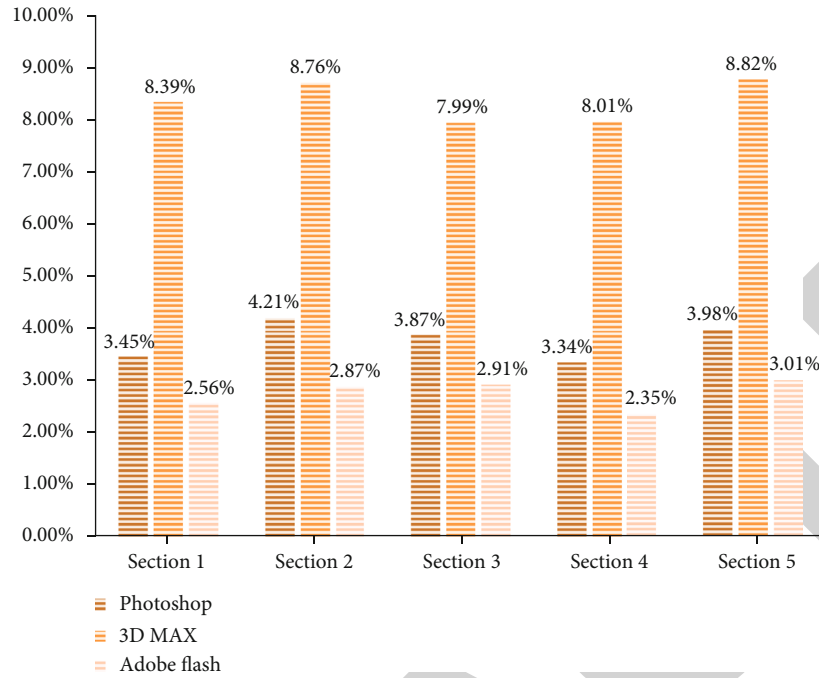


FIGURE 19: Loss degree of different animation production platforms.

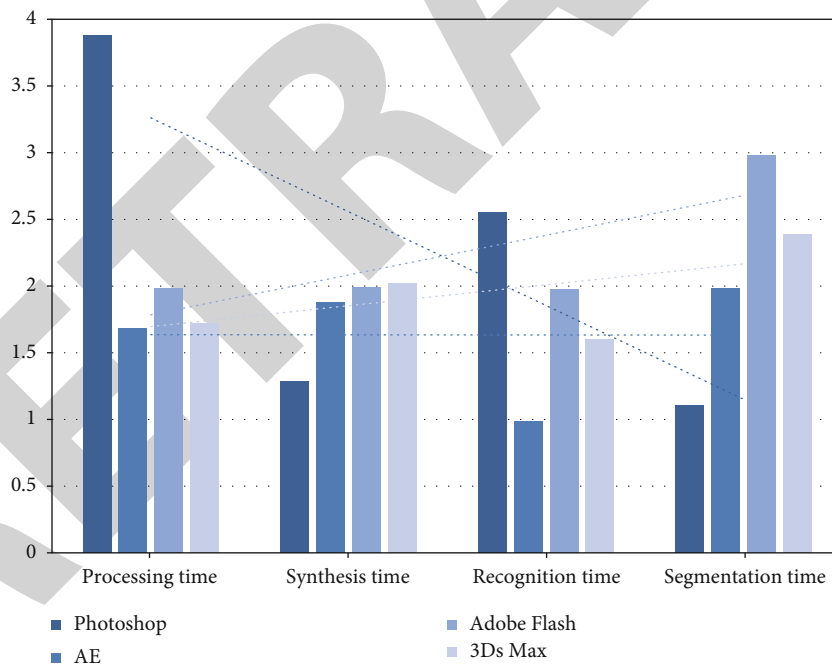


FIGURE 20: The running time of the four animation production platforms.

tool) to draw a picture, or you can use the stamp tool to sample. In the production process, for the reference of overall color, you can use the straw tool, click “color range” and “select similar” in the menu to select similar color, estimate the area proportion, and then apply it to a specific picture of the animation created by yourself. Figure 16 shows the color system and printing color values in the first four frames.

4.1.4. *Night View Effect of Future City.* If you need a more accurate color reference, you can use the mosaic method; that is, you can import the reference picture into Photoshop, and use the pixel mosaic tool in the filter menu; that is, you can divide the color concretely, so that you can extract the specific color tone, summarize the color proportion according to the proportion of mosaic lattice, and get the relatively accurate

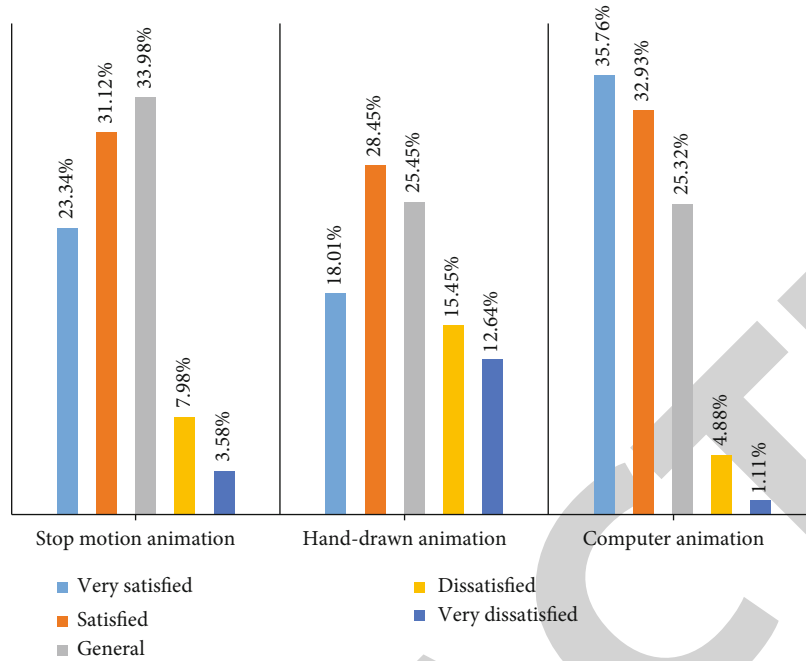


FIGURE 21: The public's satisfaction with different animations.

color matching, and directly use the matching proportion with the animation. In the scene design of the film, the color calculated from the mosaic in "general mobilization of the sea bottom" is applied to the night scene of "future city." Because the big background of the night scene is night, the color of the work and the original picture are transposed in black and white as shown in Figures 17 and 18.

The straw tool has a very important role for the reference of color and hue of excellent animation, especially for beginners; the straw tool can help them to quickly cut into the state of art design, such as many characters, scene design, and two-dimensional animation color design, and can use the straw tool to complete harmonious and unified color works. At the same time, the use of straw tools is also very important for later color matching and color correction. Photoshop also has a very special contribution to the design and production of special maps in 3D MAX. The production and color adjustment of maps can meet the needs of plot and 3D MAX production. While mastering the subjective color feeling, Photoshop can flexibly use the color mode and mode adjustment, the subtle setting of color value, and timely carry out color conversion according to the needs. After conversion and painting in the process, the loss is the smallest and the effect is the best.

4.1.5. Comparison of Different Animation Software. Different image software has obvious differences in the parameters of animation production. Figure 19 shows the degree of image loss. Obviously, Adobe's AE software is more professional for animation production, and the loss of images is the least among the three software. But for Photoshop as an image processing software, the loss of animation production is only a little bit more than that of professional animation production software, and the loss of professional software is very low com-

TABLE 8: The effect of watermark on size.

Test program	Original size	Size after embedding watermark	Growth rate
Photoshop	1203	1322	9.89%
AE	1987	2108	6.14%
3D MAX	2138	2457	14.83%

TABLE 9: The impact of watermarking on runtime.

Test program	Original execution time	Execution time after embedding watermark	Growth rate
Photoshop	123	133	8.13%
AE	147	158	7.48%
3D MAX	279	302	8.24%

pared to 3D MAX. Compared with two-dimensional animation, three-dimensional animation has more impact and fullness in visual effects, and it can also well inherit the advantages of traditional two-dimensional exaggeration and deformation, which makes it dominate the big screen of movies, the current trend. It is to concentrate three-dimensional animation into the special effects of the film.

In addition, shown in Figure 20 is a comparison of the running time of the four animation production software. It can be seen that Photoshop is excellent in image synthesis and segmentation, which reflects the advantages of image processing.

4.1.6. Public Satisfaction. With regard to computer animation, hand-drawn animation, and stop motion animation, the public has different attitudes towards these three kinds of animation. Figure 21 shows that the public's acceptance

of computer animation is still very high, which reflects the importance of animation processing software.

4.1.7. The Impact of Watermarks. Tables 8 and 9 show the degree of change in processing time and image size for different animation production software after adding watermarks. It can be seen that Photoshop is still relatively good in these two aspects.

5. Conclusions

Today's cartoon design has a strong backing of machine technology, artistry is of course important, but the support of machine technology can make the artistic performance even more powerful. The complementary of machine technology and art makes the cartoon more visible and artistic. At the same time, the development of machine technology makes the audience pay more and more attention to the visual effect. In this paper, the design and production of digital animation color are promoted to a more important position, which increases the depth and breadth of the research and application of digital animation color.

This paper is aimed at the practice of color design and production in animation short films, explores the combination and expression of digital animation color systems, excavates the color patterns and color schemes that can be used for reference in comprehensive art, and discusses the flexible application of these patterns and schemes in animation creation, so as to put forward a series of constructive suggestions for animation color design. At the same time, through the comprehensive analysis of the color realization path and the later production and application of digital animation, this paper discusses the influence of Photoshop software on color in animation production.

In this paper, based on the current situation of Photoshop software production technology in China, through a self-made experimental short film "future city," the animation color design skills based on digital technology are displayed in the work, to improve the overall visual quality of the animation, and summed up the digital color application scheme suitable for the research topic, from theory implementation to practice, and in practice, the technology is constantly improved. The technique is applied to the production process of cartoons. The country is now vigorously developing the animation industry, and related technologies will gradually be combined with animation, making animation a comprehensive discipline that spans various fields.

Data Availability

This article does not cover data research. No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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