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Research Article

Application Characteristics and Innovation of Digital Technology in Visual Communication Design

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While China has made major social and economic breakthroughs, it has also raised the level of research, development, and application of science and technology, especially the application of digital technology. Combining digital technology with visual communication design to meet diversified design needs can maximize the level of innovation in visual communication design work. The effective use and continuous innovation of digital technology in visual communication design make visual information more intuitive and image . and constantly bring people a fresh and unique visual experience, and the development of visual communication design has been strongly promoted. This paper analyzes the advantages of the application of digital technology in visual communication design, focusing on the application of digital technology in visual communication design, and from different perspectives such as art space tools, it is extremely critical and important to apply and expand the theory of advanced innovation. From the aspects of artistry, diversification, and science and technology, the application of digital technology in visual communication design is discussed, and the application innovation strategy of digital technology in visual communication design is further discussed. We hope that this research can provide some useful references for the development of modern visual communication design.

1. Introduction

With the continuous progress of my country's electronic information technology and the continuous development of innovation in the design industry, the dynamic visual communication design method will have a huge impact on people for a long time in the future [1]. Visual communication design mainly takes words, graphics, and color as the basic elements of artistic creation, which in the spiritual and cultural field affects people's feelings and concepts with its unique artistic charm and plays a very important role in people's daily life. At the same time, the visual communication design of new digital media technology and art design is widely used in various industries in the context of today's era and continues to progress and develop in the process of practical application [2]. The combined technology can be used in hospital imaging, film and TV series related production, and advertising design. In the process of applying digital technology, relevant design workers apply diversified design thinking in combination with the important needs of visual communication design, which can result in not only more comprehensive design products, but also the combination of comprehensive innovation theories. In the process of optimizing and expanding digital technology, we constantly integrate richer visual resources [3]. Therefore, in the process of discussing this topic, this paper will focus on the important advantages and development process of digital technology and constantly discuss the application direction and application measures of digital technology in visual communication design, so as to more scientifically pass advanced thinking. There are guidelines for improving the level and quality of digital technology applications. [4]. The development of computer digital technology and multimedia technology is constantly changing people's way of thinking, behavior, and even way of life and is also changing our real world. As an important field of art design, visual

communication design is inevitably impacted and influenced by it. The new society of network and digital civilization represented by the Internet urgently needs to innovate design concepts and systems [5]. People look forward to the unprecedented development of visual communication design in the new spirit, new art, new tools, new space, and new media. The main process used in the study is to partition the digital visual image, then extract local features and edge features, and then use the image classification algorithm for image classification and identification, as shown in Figure 1.

With the advent of the digital age, computer digitization technology combines sound, image, numbers, language, text, etc., bringing new forms and characteristics of visual communication. The application of computer digital technology in visual communication design has once again brought revolutionary changes to art design, which is the perfect fusion of technology and art [6]. The practical application of new digital media technology is closely related to the visual communication design method of art design. In the actual application process, the two should depend on each other to achieve better results. Figure 2 shows the digital scale and growth rate of China's industry from 2016 to 2020. Starting from the analysis of the impact of new digital media technology on visual communication design methods, combined with the actual situation in our country, this paper attempts to give the practical application of visual communication design methods in new digital media, considers the future development path of communication design methods [7], establishes communication partition model, extracts the local feature information of computer graphics, and designs the image processing algorithm based on edge features. Combining digital technology with visual communication design to meet the diversified design needs can maximize the innovation level of visual communication design work. Therefore, this paper has important practical significance for the application of digital technology in visual communication design, and the application and expansion of advanced innovation theory from different perspectives such as art space tools [8].

2. State of the Art

2.1. Comparison of Digital Transformation and Upgrading Paths of Manufacturing in Key Provinces. At present, the digital economy is in the ascendant, and a new generation of information technology such as 5G and artificial intelligence accelerates innovation, rapid iteration, and rapid penetration and diffusion to the manufacturing industry, promoting the continuous reform and reshaping of manufacturing production methods, organizational forms, and business models and continuously upgrading in the direction of digitalization. Digital transformation is to redesign a new digital business model based on the development of digital technology and support capabilities. Different regional governments formulate paths and measures to promote digital transformation according to economic and technological development conditions, and promote regional economic growth through enterprise digitalization. [9].

2.1.1. Jiangsu "Intelligent Transformation". Through the development of digital economy, Jiangsu Province releases the value of data resources; focuses on the traditional advantages of the field to improve the level of manufacturing design, manufacturing, management, and service; promotes the transformation of production methods to digitalization, flexibility, and intelligence; promotes the integration of digital technology and industry; cultivates and develops new formats, new models, and new kinetic energy; and finally realizes the digital transformation of manufacturing industry. Through the construction of six major measures and the implementation of ten major projects, the goal of Jiangsu's "intelligent transformation and digital transformation" phase has been achieved (see Figure 3).

2.1.2. Guangdong's Digital Empowerment Industry. At this stage, Guangdong Province will use the industrial Internet as a breakthrough carrier to promote the application of 5G + industrial Internet, and accelerate the digital transformation of the manufacturing industry through the implementation of 5G to empower the high-quality development of strategic industrial clusters; develop the digital economy and advance big data and artificial intelligence. Promote industrial software development and application, intelligent hardware equipment, industrial Internet platform, digital infrastructure, and digital security system; complete the digital transformation of the province. Develop and apply blockchain, Internet of Things, etc.; we will develop the industrial Internet and promote inclusive cloud and platform development. Promote digital transformation of large-scale industrial enterprises [10].

2.1.3. Zhejiang Digital Economy "Project No. 1". In 2021, Zhejiang Province implemented version 2.0 of the "No. 1 Project" of the digital economy, built a high-level innovation platform, created an entrepreneurial innovation ecosystem, and cultivated new types of urban agglomerations, science and technology corridors, new science and technology cities, and characteristic towns. Innovation space gives full play to the advantages of digital transformation and promotes the full integration of digital technology and industry. Through the implementation of the "artificial intelligence + Internet of Things" strategy, the manufacturing industry will continue to transform to intelligence, relying on the integration development trend of digital technology and manufacturing, to accelerate the formation of a new digital industry ecosystem characterized by digitization, intelligence, and networking, and create hundreds of billions of dollars [11]. In the field of digital manufacturing, through the implementation of the "New Manufacturing Plan," the penetration of digital technology in the entire process of the advantageous manufacturing industry will be accelerated, and the global intelligent manufacturing industry will usher in the industry peak.

2.1.4. Shanghai Promotes Urban Digitalization. In 2021, Shanghai released the "14th Five-Year Plan" to

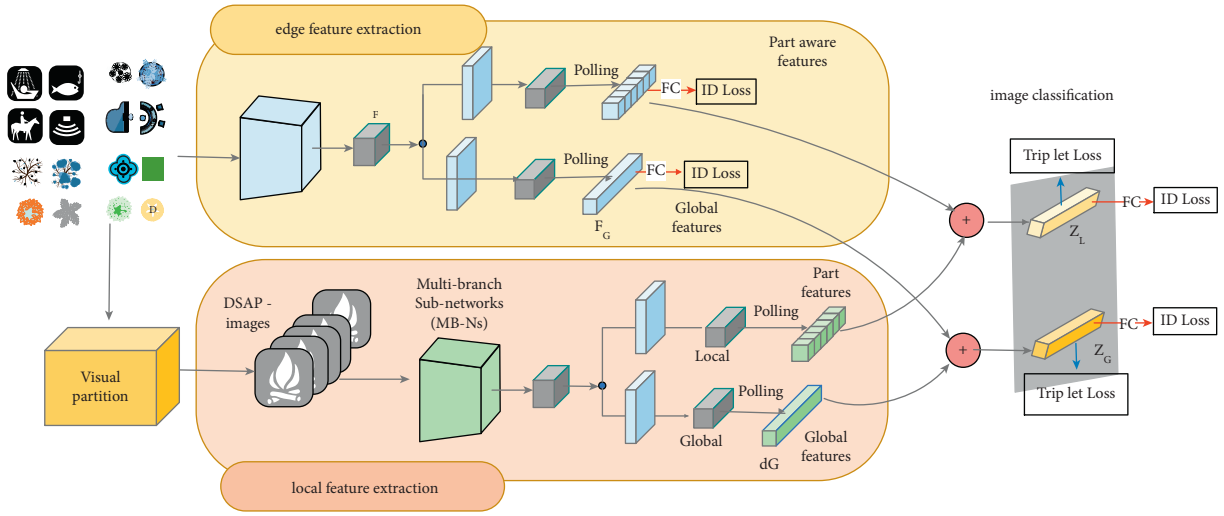

Figure 1: The application framework of digital technology in visual media.

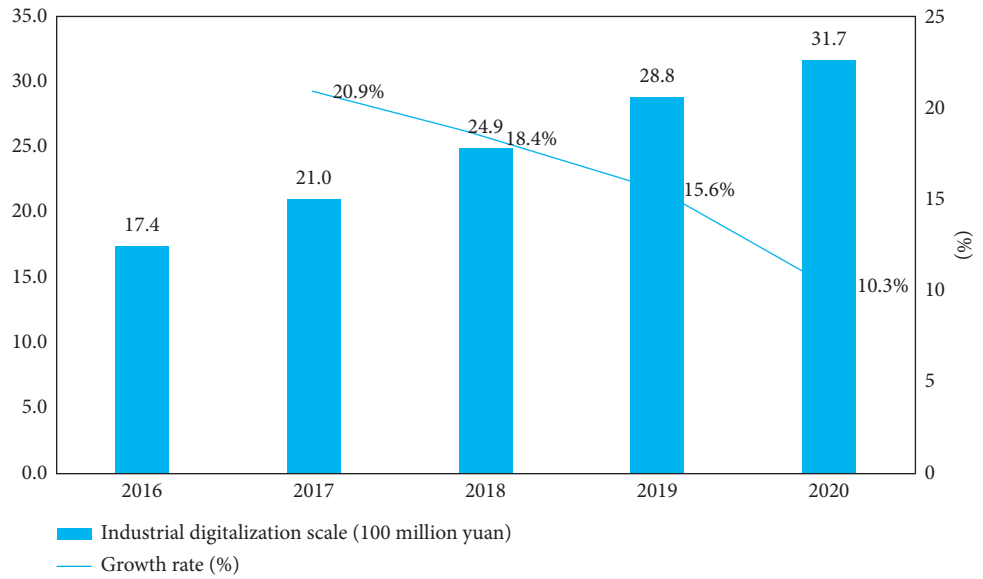

Figure 2: Scale and growth rate of industrial digitalization from 2016 to 2020 (unit: trillion yuan, %).

comprehensively promote the digital transformation of the city. By strengthening the "four functions" and deepening the construction of "five centers," the city's energy level and core competitiveness will be closely linked with the city's soft power. The basic foundation of "digital intelligence empowerment," the leap of digital economy based on "cross-border integration," the "people-oriented" digital life experience, and the "efficient and coordinated" digital governance reform build an international digital capital with world influence, promote the integrated development of the digital economy and the real economy, promote digital technology to carry out all-round and full-chain transformation of traditional industries, and promote the co-construction and sharing of digital education resources and key application scenarios (see Figure 4).

2.1.5. Beijing Continues to Promote the "Five New Policies". As China's economic and cultural center city, Beijing is in a leading position in terms of data indicators and industrial transition. In recent years, Beijing has put forward the "Five New Policies" for the development of the digital economy, which has continuously spawned new industries, new formats, and new models [12]. The specific contents are shown in Table 1. The focus will be on five aspects: new digital infrastructure, new digital scenarios, new digital consumption, new digital opening, and new digital services, focusing on promoting enterprise digital transformation; cultivating new advantages, new formats, and new models of digital resources; promoting industrial clusters such as blockchain and artificial intelligence; we will guide and support the compliance transformation and development of

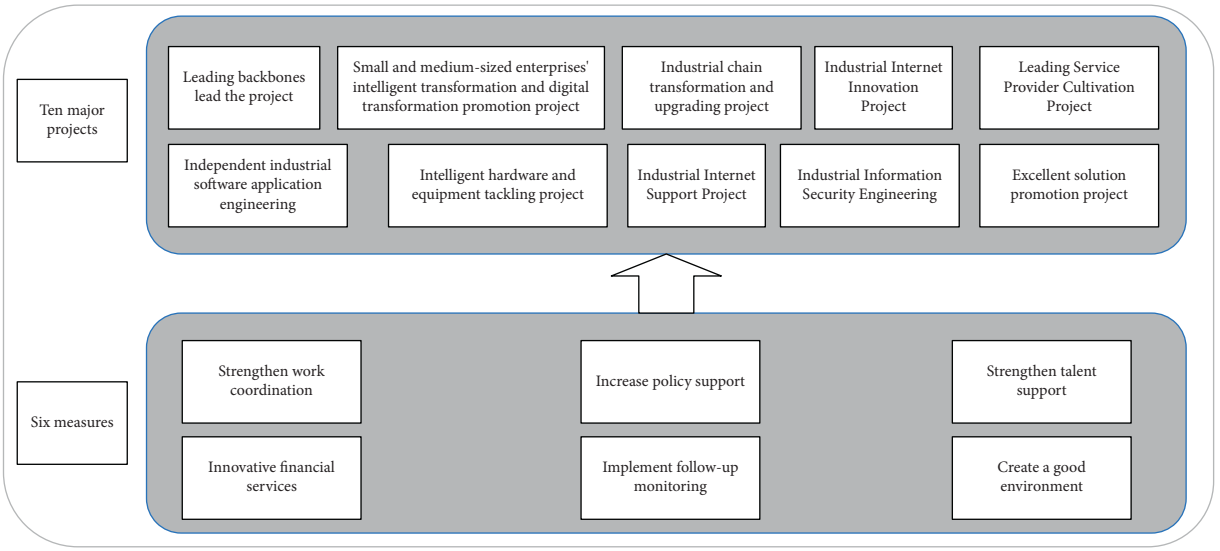

Figure 3: Jiangsu "intelligent change digital transformation" path.

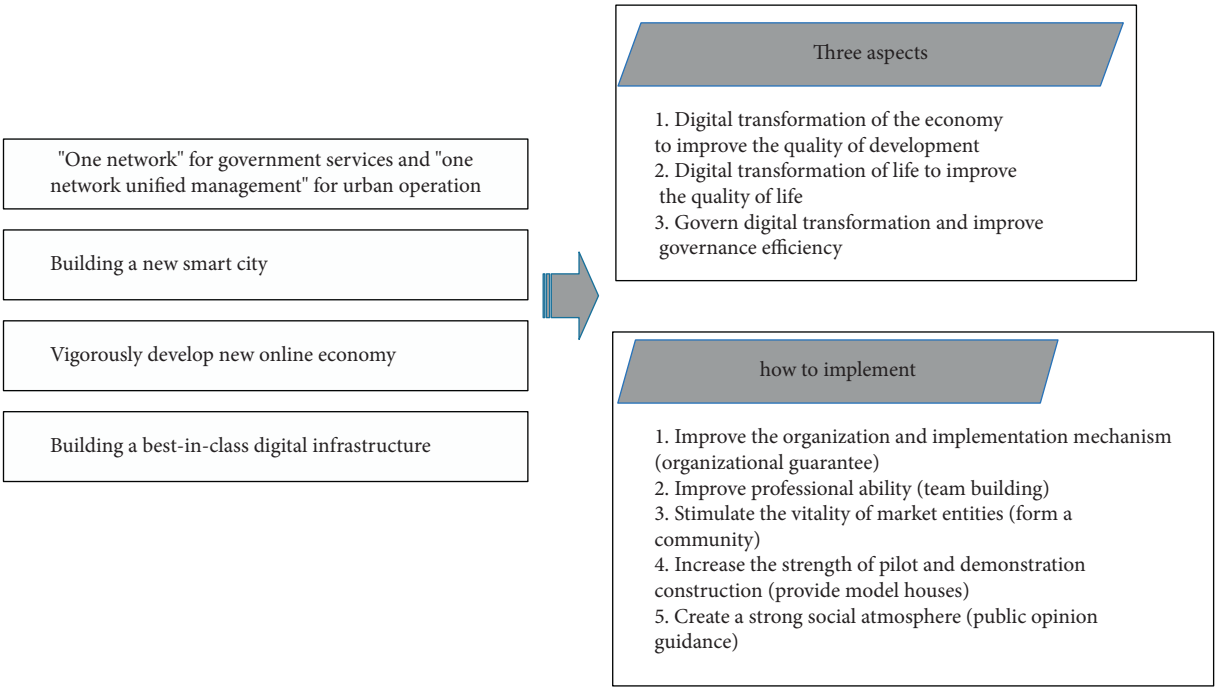

Figure 4: The path of Shanghai's promotion of urban digitalization.

platform enterprises and cultivate leading enterprises with international competitiveness.

2.2. The Basic Connotation of Visual Communication Design. Visual communication is a discipline name derived from Western culture and communication, which means using visual directional expressions to convey meaning [13]. Visual communication design became popular in the mid-20th century. When discussing visual design, it is argued that as the influence of the media continues to expand, vision and imagery can become a more complete medium capable of fully expressing a certain meaning [14]. It can also have the same effect as the verbal communication method, being more intuitive and specific. Visual communication design has evolved from a pure artistic design concept to the meaning of multimedia communication [15]. In a word, visual communication design has become an important means for people to achieve the purpose of information transmission, persuasion, and influence, forming a series of design activities from planning and conception to problem solving. Expressing visuals through effective design graphics

Table 1: Beijing's "Five New Policies."

Policy	Content
New digital infrastructure; new digital scene; new digital consumption; new digital opening; new digital services	Promoting digital transformation and industrial chain; cultivating new advantages, new formats, and new models of digital resources; promoting the formation of industrial clusters such as blockchain, artificial intelligence, extended reality, and ultrahigh-definition display; guiding and supporting platform enterprises to transform in compliance; developing and cultivating leading enterprises with world-class competitiveness

can evoke inner feelings and generate positive associations [16]. This is an important connotation of contemporary visual communication design. Today, due to the diversity of media, visual communication design has become a collection of art and science. From the perspective of practical application, the essence of visual communication design is to use image design to convey information [17]. Its development is inseparable from the prosperity of modern commerce. It is an interdisciplinary subject on the edge of art. Its theory has shadows of many disciplines such as market, media, society, physiology, and aesthetics. The category of design can no longer be summarized by ordinary art or language categories [18]. It covers a wider range of levels. From the current situation, it includes information digital media such as advertisements, books, packaging, signs, images, and multimedia networks [19]. With the continuous development of digital technology, especially in the field of visual communication design, the visual communication design under digital technology presents the remarkable characteristics of rich and diverse means and styles, shows a very strong visual impact in the transmission of visual information, and also makes the application and development potential of digital technology in visual communication design greatly displayed. It can be said that with the help of digital technology, visual communication design is becoming an important discipline affecting mass media and a design discipline with broad prospects [20].

2.3. The Development Process of Digital Technology and Visual Communication Design. Before analyzing the application content of digital technology in visual communication design, it is necessary to fully understand the specific development process of digital technology and visual communication design, which can help us combine theoretical knowledge and understand specific development needs and design connotations. Specifically, this development process is mainly manifested in the following aspects.

2.3.1. The Development Process of Digital Technology. Digital technology is developed on the basis of computer network technology. In the 1990s, combined with the needs of different industries, computer digital technology was derived, which can be supported by the Internet system to expand channels for more information dissemination. At this time, people's access to information resources has become more abundant, and it also provides an important technical carrier for visual communication design, which not only expands people's visual space, but also further integrates diversified resources through the optimization of communication channels. Since the 1990s, the information superhighway represented by multimedia technology and the Internet has become the trend of the development of computer digital technology, which has brought unlimited information resources to human beings. As a result, visual communication design not only is an image expression in the traditional sense, but also can have the form of multimedia, communicate through networked communication channels, broaden people's visual space, and achieve a more efficient and artistic visual communication effect. Computer digital technology is an epoch-making achievement, which is of revolutionary significance to the development and progress of human society, and is the catalyst for the revolution of visual communication design. We have every reason to believe that the visual image, which is the common language of mankind, will serve as the main medium of communication and dissemination in the digital age.

On the whole, the use of digital technology can better improve the design level of visual communication, and the advent of computer digital technology has made it possible to rely on Internet systems to expand the way for more information to be disseminated. In particular, through the optimization of communication channels, diversified resources have been further integrated, a very important technical carrier has been provided for visual communication design, people's information resources have been greatly enriched, and the visual space has also been enriched. The effect of information communication is also better, and the artistic value is higher. Therefore, based on the analysis of the above content, the development of digital technology has gone through a long process, which not only highlights the characteristics of the times in each period, but also combines different cultural moods to display artistic characteristics. All factors are closely related. It is necessary to correctly understand the development process of digital technology and show the specific advantages, so as to promote the progress and development of the visual communication design work in a scientific direction.

2.3.2. The Development Process of Visual Communication Design. Visual communication design arose from the expansion and extension of European and American print art design in the mid-19th century. The "composition" course, which is set based on the purpose of teaching, reflects the

new concept of modern design with its scientific creative thinking and abstract artistic expression, opens up the designer's imagination and creativity, and broadens the vast world of visual art. At the World Design Conference held in Tokyo, Japan, in 1960, the participants generally recognized that vision and images had existed as independent means of communication. Visual communication design endows people with some complex emotional factors in visual language and reflects them in artistic creation. With the rapid development of modern communication technology and communication technology, the development of visual communication design has experienced several stages of evolution, such as commercial art, arts and crafts, printing art design, decoration design, and graphic design. Visual symbols express and convey information in design. With the deepening of the information age, technology has become a catalyst for the continuous development of the field of art design, constantly affecting the development of visual communication design and prompting profound changes in this field. For example, the visual communication design has gradually changed from the flat and static forms in the past to the three-dimensional and dynamic direction; the visual communication media has gradually developed from a single medium to the field of multimedia combination; and the communication method has developed from one-way information communication to interactive information communication.

In the middle of the 19th century, visual communication design has been widely expanded around the world and has been fully displayed and applied in European and American art design. In order to display the content of visual communication design more scientifically, countries are also actively innovating the talent training mechanism. In the process of setting various courses, the artistry and scientific nature of visual communication design are more highlighted, which greatly improves the development level of visual art and also promotes the derivative quality of modern ideas. Entering the 21st century, China has also attached great importance to the development of visual communication design, combining visual language with artistic creation, which has greatly promoted the development of modern communication technology. In this process, the application of digital technology to visual communication design can also better meet the relevant design needs of commercial art crafts and art decoration design. Using all kinds of visual symbols to integrate all kinds of information content can also better achieve the transition goal from plane to stereo.

2.4. Application of Digital Technology in Visual Communication Design

2.4.1. Application of Dynamic Visual Communication Design in Education. Dynamic communication design can create dynamic media presentation effects through the use of text, graphics, colors, and shapes. Therefore, in order to make the classroom more interesting, dynamic visual communication technology is widely used in the field of education. For example, the "flipped classroom" education, which is popular all over the world, allows students to watch the multimedia teaching videos made by teachers after class, complete the learning of new knowledge points, and complete the review and questioning of knowledge points in the classroom. With this teaching method, students' learning efficiency and learning enthusiasm have been significantly improved.

2.4.2. Application of Dynamic Visual Communication Design in the Game Field. The game field is the fastest growing and most popular entertainment field in the Internet field, and the industry competition is also very fierce. Therefore, in order to make the game have a stronger texture and appeal, many game developers also apply dynamic visual communication design technology to their work. For example, Tencent's racing game "QQ Speed" makes full use of dynamic visual communication technology to make its pictures very realistic, simulating the real racing situation to the greatest extent, which greatly enriches the user experience and helps this game become more and more popular.

2.4.3. Application of Digital Technology to Make Vision More Realistic. With the help of digitization, the design results of visual communication are no longer delivered in a single flat form, but expanded into two- and three-dimensional spaces. The so-called digital technology is to use the computer to make the artistic creation come to life, make it have unique aesthetic value, and form a visual impact. Human vision can obtain extremely rich information within a certain period of time; that is, through vision, people can perceive the changes of time and space, so as to obtain the shock of the soul. This experience has gone beyond the appreciation of purely visual communication design works, bringing a new visual impact. For example, commercial short films in the past were often shot based on real scenes, but the appeal of digital technology has changed that. The creation and introduction of virtual scenes has changed the situation of limited scenes in the past. While expanding the field of visual communication design, digital animation technology also has a huge impact on the audience, thus expanding a wider world for visual communication design.

2.4.4. Application of Multimedia Technology in Visual Communication Design. Through the application of digital technology, text, image, language, and sound are integrated, thus further enriching its expressiveness and effect in the process of work design. Compared with traditional media, its three-dimensional effect is more obvious, and it has a stronger visual impact on people. In addition, the application of digital technology in the design field can also be an important means of product promotion and corporate marketing to further expand product sales. For example, multimedia technology can be applied to visual communication design, which can make the work achieve a more realistic effect. The amount of information contained in it is very rich, can be spread infinitely, has strong influence, and

has strong interaction, so that the visual communication design can achieve a more ideal effect.

2.4.5. Application of Digital Technology Communication Design in Animation Field. Nowadays, watching cartoons is not only a hobby for children, many adults also enjoy it, and some people relieve their pressure by watching cartoons. For this more traditional way of visual communication, there is now a perfect production and processing method. Therefore, if you want to use digital technology to innovate, there are still some difficulties in the process. For example, the cartoon "Nezha" broadcasted a few years ago is very interesting in plot, but the playback technology can no longer satisfy the current audience. The film company used digital technology to communicate and a series of special effects to produce "Nezha's Devil Child Reincarnation" which was very popular with audiences. Digital technology communication is a product of technological development, its use in many industries will have unexpected effects, and the same is true for animation.

2.4.6. Improving the Information Transmission Effect of Visual Communication Design. In the traditional visual communication design process, designers usually use words, graphics, colors, and symbols according to the requirements of visual communication design, combined with the characteristics of visual communication design service objects. After the target group receives the information, they need to understand the design intent through certain thinking and master the real information to be conveyed by the visual communication design. In this process, the visual communication design is easily affected by the cultural level and thinking mode of the information receivers, which reduces the quality and efficiency of information transmission. The application of multimedia technology can express the design content in a more intuitive, vivid, and specific way; reduce the influence of the misunderstanding of the information receiver on the information transmission effect; and improve the quality and efficiency of information transmission. The application of digital technology in visual communication design is shown in Table 2.

2.5. Innovation of Digital Technology in Visual Communication Design

2.5.1. Innovation in Visual Art Forms. Visual communication methods are constantly enriched, relevant technical personnel are constantly innovating the types of visual communication, and many excellent technologies are constantly being tried. Among them, digital technology is a relatively advanced innovation in recent years and even the next few years. Under the influence of digital technology, visual communication design has changed in both form and content. The main reason is that digital technology has brought new creative approaches and designs to visual communication design. Therefore, the center of gravity of the design has shifted from the excessive dependence on the material to the dependence on the spiritual connotation, making the whole design more static and single, and the material creation will also be dynamic and complex. The essence of art design is to give full play to people's subjective initiative and talents to further optimize the design. Designers can incorporate their own creativity into design, and the shift from material design to nonmaterial design has greatly facilitated the development of modern technology.

2.5.2. Multidimensional Innovation of Visual Arts. The visual arts recorded earlier in our country include opera and shadow play. Although there was no blessing of science and technology at that time, its significance lies in the dissemination of information and entertainment, which is almost the same as that of today's visual art. In recent years, the development of science and technology has also gradually been successfully integrated into the visual arts. The biggest change is the enrichment of dimensions. In the past, people could only be heard and watched, and now it can be felt and even touched. The fundamental reason is that the presentation of visual arts has changed. From shadow puppetry to 3D movie playback, in addition to the changes in presentation content with the society and the times, digital technology has enriched the presentation form and communication channels, allowing more people to appreciate viewing visual arts.

2.5.3. Application of Visual Communication Design. In the era of new media, digital communication technology has been greatly developed, and virtualization technology has emerged as the times require. Virtualization can visually change parts that are not visible. Therefore, visual communication designers can adopt virtual methods to virtualize the transmitted information, convert physical objects into virtual digital codes, and realize virtual digital reality through different composition, color, graphic techniques, and line outlines. New media has brought huge technological breakthroughs to visual communication design, which can achieve realistic effects that are unattainable and unimaginable in photography. virtual and reality,The sense of existence, strangeness, and reality brought by new media surpasses the traditional visual communication design.

3. Methodology

In order to combine digital technology and visual communication design, this paper establishes a visual communication partition model, extracts the local feature information of computer graphics, and designs an image processing algorithm based on edge features, and the specific experimental methods are shown below.

3.1. Establishing a Visual Communication Partition Model. Under normal circumstances, the image in the human eye is stored as a continuous image, and a vector representation of a two-dimensional image can be established at this time; namely,

Table 2: Application of digital technology in visual communication design.

Field of application	Significance
Education	Making classrooms more interesting by using text, graphics, colors, and shapes to create dynamic media presentations; significantly improving students' learning efficiency and learning positive performance
Games	Making games have a stronger texture and appeal, which greatly enriches the user experience and helps games become more and more popular with the public
Visuals	Expanding design results to two-dimensional and three-dimensional spaces, rather than delivering them in a single plane—making them unique aesthetic values, forming visual impact, and expanding the limitations of visual communication
Multimedia	Integrating text, images, language, and sound, thus further enriching its expressiveness and effect in the process of designing works, with more obvious three-dimensional effects and stronger visual impact on people
Animation	Complementing the production and processing of more traditional forms of visual communication
Information transmission	Making the design content expressed in a more intuitive, vivid, and specific way; reducing the influence of the misunderstanding of the information receivers on the information transmission effect; and improving the quality and efficiency of information transmission

$$g(x_i, y_i) = \{g_r(x_i, y_i), g_g(x_i, y_i), g_b(x_i, y_i)\}. \quad (1)$$

In the formula, $g_r(x_i,y_i)$, $g_g(x_i,y_i)$, and $g_b(x_i,y_i)$ represent the vector functions of the three primary colors of red, green, and blue in the image signal, respectively, and $g(x_i,y_i)$ represents the original image signal expression form, where x_i and y_i, respectively, represent the function of light intensity and spatial coordinates in the image. Each of the different primary colors can be represented as a color channel. When the color saturation in the image is 0, it is proved that $g_r(x_i,y_i) = g_g(x_i,y_i) = g_b(x_i,y_i)$, and the image at this time is a grayscale image, that is, a black and white image. When the vector functions of the three primary colors are not equal, the image is a color image. Through such color expression, a partition model of the image itself can be established. When extracting feature descriptions, the descriptors can be recorded as follows:

$$G_K = [g_1, g_2, \ldots, g_n]. \quad (2)$$

This set needs to guarantee $GK \in Hb \times P$, where b represents the dimension of image features and P represents the number of image features. In the process of extracting these descriptors, it is necessary to select a large amount of feature data in the training set according to the characteristics of the convolutional neural network, divide the clustering types through the feature space, and obtain a visual partition criterion based on this. In the process of clustering visual communication partitions, the set of visual communication partitions can be expressed as follows:

$$F_K = [f_1, f_2, \ldots, f_n]. \quad (3)$$

Through this collection of visually conveyed partitions, each element can be stored as a feature inside the cluster center. According to the trained visual data, the distance between the visual communication partition and the cluster center of each image is calculated, and the statistical results are presented in the form of a histogram and saved in the classifier. All clusters are coded separately, and each continuous feature space is summarized as a set, so quantization error can be reduced. The calculation formula of error clustering is as follows:

$$D_{S-U} = \frac{e^{\left(-\|d_X - d_C\|^2/\delta_k\right)}}{\sum e^{-\|d_X - d_C\|^2/\delta_k}}. \quad (4)$$

In the formula, $D_{s\text{-}u}$ represents the distance from any feature space s to the cluster center u; d_x and d_c represent any two features with similar distances, respectively; and δ_k represents the clustering weight parameter. When the distance is close, the description ability of all feature codes will be strengthened accordingly. This coding method will lead to the transformation of the original discretization method into the form of weighted processing, so as to reserve a part of the ability to distinguish discrete information during encoding, thereby improving the recognition performance.

3.2. Extracting Local Feature Information of Computer Graphics. Based on the visual communication partition model, the internal classification of images can be done in the form of coefficient expressions. Build the encoded coefficient features:

$$\arg\min\left\|P_X - H^T\right\|^2 + k_p \sum_{i=1}^{n} |h(i)| \text{ s.t.} \sum_{i=1}^{n} h(j) = 1. \quad (5)$$

In the formula, $p_x - H^{T2}$ represents the constraint error in the process of reconstructing the local features of the image; on the premise of ensuring that its value is as small as possible, it is necessary to make $\sum_{i=1}^{n} h(j) = 1$; k_p represents the weight parameter that balances constraint coding and dictionary coefficients. Within the reconstruction constraints of the feature encoding, the non-convex features of the problem can be solved for building a set of locally constrained linear encoding methods. In the aggregation matching strategy of its local features, each region can be evenly divided according to different scales and encoded independently. Build a two-layer pyramid structure, organize all independently existing feature histograms on the first layer, and divide the second layer into a 3×3 grid, including a vector that can be used as the final representation of the image. At this time, the efficiency of the cost function needs to be reduced by the support vector machine. Delineate a hyperplane on the feature plane:

$$f(a):\ a_k = H^T k + k_0 = 0. \tag{6}$$

In the formula, $f(a)$ represents the data discriminant model of the hyperplane, a_k represents the parameter feature of the hyperplane, H^T represents the class label of the distance matrix, and k_0 represents the degree of separation of the samples. When $f(a) > 0$, it can be determined that the data type is on the hyperplane; when $f(a) \le 0$, the data is not on the hyperplane. When the data is completely separable, a hyperplane that satisfies all data points can be found. At this time, a visual communication feature function is established by using high-level information, its probability distribution is calculated, and then the local feature information of the graphics can be extracted by computer algorithms. The weight calculation formula of Gaussian coding is as follows:

$$w_{ij}(f) = \left(\frac{\sqrt{M_n}}{\sum_{i=1}^{n} N_i}\right)^{a-1}. \tag{7}$$

In the formula, $w_{ij}(f)$ represents the encoding format of Gaussian distribution under the condition of constrained weight, M_n represents the encoding vector of the cluster center, and N_i represents the zero-order information smoothing coefficient. The local feature information of computer graphics is extracted by this formula, so as to obtain the core parameters of visual communication.

3.3. Designing Image Processing Algorithms Based on Edge Features. The digital image in the computer is divided into several grids by sampling and quantization, and the brightness value of the analog image in each grid is calculated. Quantize the black and white tones in a grayscale image and segment them into different levels. Among them, 0 degrees is the darkest image, and the color of the image is completely black at this time; 255 degrees is the brightest color, and the image is completely white at this time. By definition, the frequency of a grayscale pixel in an image can be obtained:

$$D(t_k) = \frac{N_i}{K_n}. \tag{8}$$

In the formula, $D(t_k)$ represents the frequency of a certain gray level pixel in the image, t_k represents the gray level quantization value, N_i represents the total number of pixels with the i brightness value, and K_n represents the total number of pixels in the image. In the grayscale histogram, an image with more concentrated grayscale levels can be obtained by describing the distribution characteristics of the grayscale of the image. By adjusting the gray level in the image, an image with a more prominent contrast effect can be obtained, and the visual communication effect of such an image will be better. In addition, it is also necessary to obtain the transformation relationship in the image by means of grayscale transformation; namely,

$$f_i = G(t)D(t_k). \tag{9}$$

In the formula, f_i represents the grayscale transformation function in the image and $G(t)$ represents the normalization index of the image transformation in the region. Using this transformation function, the number of grayscale values with a grayscale distribution in the image ranging from 50 to 100 can be concentrated in an interval. Compared with other pixels, the pixel of gray value is the least obvious in terms of visual expression effect, so it can be converted into a pixel with better gray effect through grayscale conversion. Through the above methods, a visual communication design with better recognition effect can be obtained.

4. Result Analysis and Discussion

4.1. Establishing the Dataset and Setting the Experimental Parameters. In order to test the effectiveness of the graphics image processing method in this paper, the performance of the method is tested by means of comparative experiments. First, it is necessary to establish a dataset of graphic images and set the parameters on the experimental dataset. Four types of images were selected, and 36 images of similar categories were selected, which were set as Type A, Type B, Type C, and D Type D images. Among them, Type A images are mainly a collection of images of interior architectural decorations of families, Type B images are mainly a collection of images of pets, Type C images are mainly a collection of images of household daily necessities, and Type D images are mainly a collection of images of natural scenery. Put these 4 types of images (40 in total) into 9960 random images, and get a total of 10000 image samples as a dataset. 2000 images are randomly selected from the dataset as training samples, and the remaining 8000 images are used as test samples. Descriptors can be used to extract image scales when describing the original features of an image. Divide these scales into image patches of radius 2t2R, where R usually takes a value of 16; set the number of pixels per feature interval to 2; and the area of the image scale is $2t2R \times 2t2R$. Assuming that the feature distribution can satisfy the Gaussian distribution of the diagonal sum of covariances, use a fixed scale as the spatial pyramid strategy in the dataset, and use the mashup-type number of neighbors as the intersection A procedural tool for cross-validation, which is configured on a PC for training on training samples.

4.2. Parameter Evaluation. When evaluating the parameter attributes, it is necessary to test the influence of the key parameters of the method in the paper on the performance of computer graphics and image processing, such as the distribution law of the feature space and the capacity of the dictionary space. At this time, the influence of parameter changes on other indicators as shown in Figure 5 can be obtained.

According to Figure 5, when the dictionary space capacity gradually increases, the accuracy rate (mAP) of the algorithm is also increasing, until the dictionary space capacity is 1024 MB; then, the growth rate slows down. When the number of feature space distributions increases, the mAP also increases in a "Z" shape, until the number of

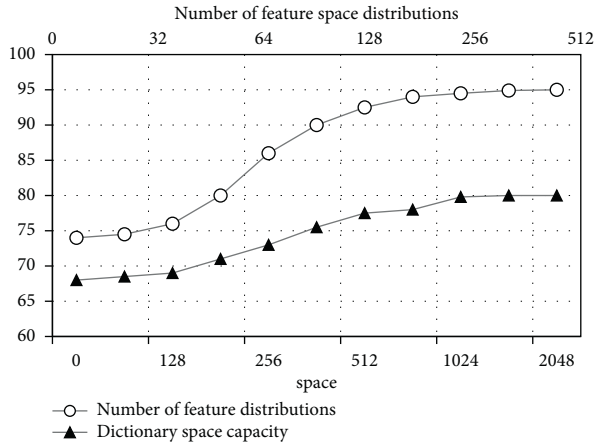

Figure 5: The impact of parameter changes on other indicators.

distributions reaches 256, and the accuracy peaks. With the change of the dictionary space capacity and the number of feature space distributions, the recognition accuracy changes synchronously. When the parameter is 0, the recognition accuracy is the lowest, 67%, and 73. In order to ensure that the feature space can maintain the best performance in the process of local aggregation, it is necessary to retain as much information as possible to increase the saturation of the feature space. At this time, the dictionary space capacity should be 1024 MB, and the number of feature space distributions should be 256. When the recognition accuracy reaches the maximum, in order to take into account the balance between the recognition accuracy and the recognition efficiency, it is necessary to simultaneously determine the optimal value of the weight parameter. Figure 6 can be obtained by spatial clustering.

According to the influence of the weight parameter change on the recognition accuracy in Figure 6, when the dictionary space capacity is 1024 MB and the number of feature space distributions is 256, with the increase of the weight parameter, the MAP changes in a "ji" shape. When the weight parameter is 0.34, the recognition accuracy reaches the maximum value of 89.5%.

4.3. Image Recognition Effect Comparison. The graphic image processing technology designed in this paper is compared with the traditional PCANet, linear discriminant method, and computer vision method, and the versatility and effectiveness of the three image recognition methods are tested. Embed the algorithm of Gaussian distribution in linear space, and get a cut-in method that directly guarantees the vectorization of Gaussian distribution:

$$p_i = \frac{[h_1, h_2, \ldots, h_i, \ldots, h_n]}{N_i}. \quad (10)$$

In the formula, p_i represents the characteristic index of the covariance diagonal in the Gaussian distribution vectorized image parameter extraction method, N_i represents the total number of images to be recognized, $[h_1, h_2, (43)\ h_i, (43), h_n]$T represents Transpose matrix for image encoding.

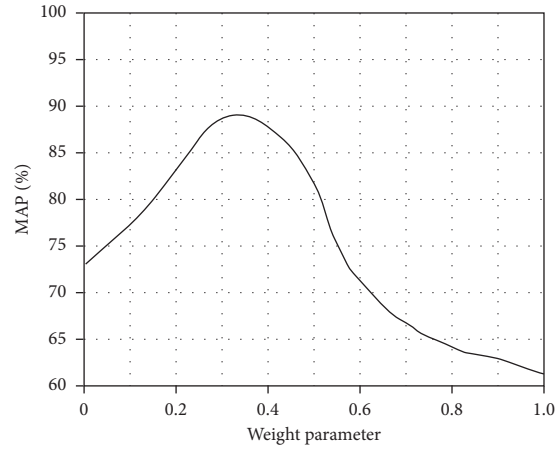

Figure 6: Weight parameter selection.

The four types of images in the test set were selected as the landmark samples for image recognition, the four types of image samples were detected and recognized in the 800 test set images, and the recognition accuracy of the three methods in different image categories was obtained, as shown in Table 3.

According to Table 3, in the same method, the recognition accuracy of Type C images reaches 87.12%, which is generally higher than that of A, B, and D. Moreover, when using the research methods of this paper, the PCANet and linear discriminant methods, and the computer vision methods for identification, we find that the methods in this paper achieve the highest recognition accuracy for the four types of images. It can be seen that simple images are easier to identify when designing visual communication cases using computer graphics and image processing techniques.

5. Conclusion

The application of digital technology in visual communication design can not only effectively enhance the sense of visual impact and bring people a different visual feeling and

Table 3: Identification results.

Method of use	Type A image recognition accuracy (%)	Type B image recognition accuracy (%)	Type C image recognition accuracy (%)	Type D image recognition accuracy (%)
This paper method	82.35	85.36	87.12	85.74
PCANet and linear discriminant methods	75.36	76.63	81.17	74.52
Computer vision methods	73.74	72.85	79.28	73.73

experience, but also significantly enhance the designer's ability to innovate, so as to create a different work of art for people. The application of digital technology in visual communication design, while expanding the design space, conforms to the trend of the development of the new era and is more conducive to the innovation of design content to make the richer design concept be realized, so it has a very positive impact on the integration of interactive information content and the exertion of advanced technology advantages. In this paper, by establishing a visual communication partition model, the local feature information of computer graphics is extracted, and an image processing algorithm based on edge features is designed. it can be seen through comparison that when using computer graphics and image processing technology to design visual communication cases, simple images are easier to identify.

Data Availability

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

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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References

[1] X. Liu, "Application of cloud-based visual communication design in Internet of Things image," *Soft Computing*, vol. 24, no. 4, pp. 9–17, 2020.

[2] M. Fan and Y. Li, "The application of computer graphics processing in visual communication design," *Journal of Intelligent and Fuzzy Systems*, vol. 39, no. 8, pp. 1–9, 2020.

[3] X. Zhang, "The application of ethnic cultural symbols in modern visual communication design," *Scientific and Social Research*, vol. 12, no. 10, pp. 34–41, 2021.

[4] B. Yan, "Exploration on the application of 3D printing and dyeing patterns in modern clothing visual communication design," *Journal of Physics: Conference Series*, vol. 1486, no. 17, pp. 158-159, 2021.

[5] W. Liu, "Research on the application of multimedia elements in visual communication art under the Internet background," *Mobile Information Systems*, vol. 2021, no. 7, Article ID 5525648, 10 pages, 2021.

[6] L. Zamzami, A. Sugiyatno, and H. Harwanto, "Innovation characteristics and adoption opportunity of bujangseta technology for tangerine farming," *Caraka Tani: Journal of Sustainable Agriculture*, vol. 36, no. 1, p. 144, 2021.

[7] X. Hu, W. Zhang, J. Shu, F. Wang, Q. Nie, and Y. Mei, "Research on the application of experience-based materials in product innovation design," *E3S Web of Conferences*, vol. 179, no. 12, Article ID 02054, 2020.

[8] P. Song, Q. Wen, and X. Zhang, "Application of digital technology innovation in campus cultural and creative design——take Jiangxi University of Finance and Economics as an example," *E3S Web of Conferences*, vol. 236, no. 54, Article ID 05041, 2021.

[9] Q. Yang, "Research on design innovation for reshaping local cultural characteristics of the tourist souvenirs," *E3S Web of Conferences*, vol. 179, no. 21, Article ID 02087, 2020.

[10] N. Ming, "Characteristics and trends of English testing research in China: visual analysis based on CiteSpace," *Region - Educational Research and Reviews*, vol. 3, no. 3, pp. 1–6, 2021.

[11] O. Kaleena, H. Sarah, and B. J. Blaskewicz, "Investigation of communication type and individual characteristics: a longitudinal hrs analysis," *Innovation in Aging*, no. 1, pp. 21–40, 2021.

[12] V. Agrawal, Y. H. Lin, and J. Cheng, "Understanding the characteristics of visual contents in open source issue discussions: a case study of jupyter notebook," *arXiv e-prints*, vol. 12, no. 3, pp. 14–20, 2022.

[13] G. Zhang and X. Kou, "Research and implementation of digital 3D panoramic visual communication technology based on virtual reality," *International Journal of Communication Systems*, vol. 14, no. 2, pp. 31–45, 2021.

[14] H. Tang and X. U. J. Long, "Research on the strategy of applying BIM technology in housing construction engineering——taking hong-yu-lang-Yue-fu phase II project as an example[J]," *Sci-tech Innovation and Productivity*, vol. 13, no. 9, pp. 15–25, 2020.

[15] E. Wei, "Intonation characteristics of singing based on artificial intelligence technology and its application in song-on-

demand scoring system," vol. 2, no. 2, Article ID 5510401, 38 pages, 2021.

[16] H. Yan, N. Zhao, W. Geng, Z. Hou, Y. Gao, and B. Lu, "Pericoronary fat attenuation index and coronary plaque quantified from coronary computed tomography angiography identify ischemia-causing lesions," *International Journal of Cardiology*, vol. 357, no. 2, pp. 8–13, 2022.

[17] W. Liu, R. H. Liu, H. Chen, and J. Mboga, "Perspectives on disruptive technology and innovation: exploring conflicts, characteristics in emerging economies," *International Journal of Conflict Management*, vol. 28, no. 5, pp. 42–44, 2020.

[18] J. Irwin, M. Roughley, and K. Smith, "To donate or not to donate? that is the question!': an organ and body donation comic," *Journal of Visual Communication in Medicine*, vol. 43, no. 3, pp. 103–118, 2020.

[19] Y. Zhou, X. Hu, and M. Shabaz, "Application and innovation of digital media technology in visual design," *International Journal of System Assurance Engineering and Management*, vol. 13, no. 1, pp. 470–480, 2021.

[20] Z. Ma, "Application of graphic language automatic," *Arrangement Algorithm in the Design of Visual Communication*, vol. 48, no. 1, pp. 113-114, 2022.