Research Article

Computer Graphic Image Design and Visual Communication Design in the Internet of Things Scenario

Rongjie Cheng

College of Art, Hubei University of Education, Wuhan, Hubei 430205, China

Correspondence should be addressed to Rongjie Cheng; chengrongjie510@hue.edu.cn

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For the problems of low-illumination reconstructed images with low resolution and long reconstruction time, an image reconstruction system based on the wavelet domain chunking compressed perception algorithm is proposed. A low-illumination image sampling model is established, and the wavelet domain chunking compression perception and information fusion processing are performed using the depth-of-field adaptive adjustment method of the image. The multiscale Retinex algorithm is used for wavelet domain chunking compressed perception and information extraction, and the information entropy feature quantity of the image is extracted. The IoT-based artificial intelligence image detection system has been formed, which effectively enhances the accuracy and timeliness of the image detection system and makes up for the deficiencies of the traditional image detection system. Simulation results show that the method is used for low-illumination image reconstruction with higher resolution, better edge perception, and shorter reconstruction time, which is more efficient for practical application.

1. Introduction

Computer graphic design and visual communication design have certain similarities in some aspects. When designing, different software designs can bring different effects, and the design of graphics in the process of product design can bring the viewer a completely different feeling from that of manual drawing, thus better resonating with the viewer [1]. This feature of design software is widely used in many fields, such as product design and sales. In practice, computer graphic design and visual communication design have their own focus, so it is important to have a clear idea of what you want to achieve when working with different software, and designers need to clearly define their goals [2]. The School of Computer Science recognizes that computer graphic design and visual communication design have shown a good development trend, so it has increased the teaching courses of related software, through the study of the relationship between computer graphic design and visual communication design so that students can fully combine their knowledge and practical operation, learn the use of design software more deeply, and can be applied to their future work. The relationship between computer graphic design and visual communication design is studied [3].

With the continuous development of computer technology, more and more industries begin to apply computer technology, and computer technology is constantly widening the development path, and the use of computer software for work can also provide effective help for users due to its convenient and efficient characteristics, thus improving the overall work efficiency [4]. For graphic design, the computer can bring more convenience to the designer, and the computer graphic design can show the designer’s exquisite creativity more intuitively. In the context of the information age, design methods are constantly being innovated, and different designers have different ideas about product design creativity, which can be displayed through the use of computer graphic design software [5]. The comprehensive design software directly breaks the limitations of traditional manual design, and the more diversified design is of great help to the development and promotion of some products; the effective computer graphic design can make more products' decorative effects which can be better displayed.
Computer graphic design and visual communication design have certain similarities in innovation and creation, and they can be effectively combined under the guidance of computers to create better designs, so from some perspectives, they are closely related to each other, and the following is a brief explanation of the relationship between computer graphic design and visual communication design [6].

Computer graphic design and visual communication design are both expressing a design concept, through their respective methods to constantly present the design context, as well as the designer’s ideology, so as to cause more viewers to resonate. Both computer graphic design and visual communication design are constantly pursuing innovation and creativity, and are able to use a variety of elements to effectively integrate their emotions, so that the design can achieve a different visual effect. In addition, in terms of learning, there are many similarities between the two. Computer graphic designers and visual communication designers have to take most of the same courses before becoming specialized practitioners, such as art, color, and other specialized courses [7].

In the design of the artificial intelligence image detection system based on the Internet of Things technology, the advantages of massive data resources and powerful information processing computing power within the Internet of Things are fully utilized, which makes the system analyze and process the cloud images to obtain comprehensive, accurate, and timely data resources as reference [8]. The cloud image processing and analysis module, as a transit station between the Internet of Things and terminal data, needs to have the following two functions: (1) the function of transferring data information: when setting up the cloud, the first issue we need to consider is to ensure that the information of the idiosyncratic features collected by the system terminal has enough storage space and can be obtained by us at any time and compared and analyzed with the information resources inside the IoT; (2) the function of accessing IoT resources: as the connection medium between the terminal data and the IoT, if the cloud cannot access all the information resources inside the IoT, it may limit the ability of the system to access the IoT data information and upload the image data information for comparison and analysis. Therefore, access to IoT functions remains one of the core functions of the cloud-based image processing and analysis module [9].

2. Design Idea of Image Feature Acquisition Module

Image feature acquisition module refers to the cloud platform image processing module in the IoT-based artificial intelligence image detection system, which uses intelligent artificial pixel point feature acquisition technology (IAPCCT) in the image information acquisition module, which can target the image features of the selected area, the image source features as the key analysis acquisition object, and other functions. In this way, it effectively avoids the drawbacks of traditional image acquisition modules that require up-production of the entire image to achieve information acquisition and provides a favorable guarantee for the enhancement of image resolution and utilization value [10].

The image information mainly consists of a large number of data carriers, and there are certain differences between the data information of each carrier so that the image factor presented by different carriers is different, and the image factor will constitute the pixel according to the sorting method; therefore, the pixel refers to the image collection of many data information [11]. Therefore, we can collect information such as contour, chromatic aberration, and contrast of an image according to the effect of the arrangement of data information in the image collection. The artificial intelligence image detection system based on IoT technology mainly uses intelligent artificial pixel point feature capture technology (IAPCCT) and Tepler feature capture algorithm to realize the image information acquisition. The intelligent artificial learning code is also added to the code so that the feature acquisition module of the system has the capability of feature accumulation and analysis at the same time, which effectively enhances the accuracy and sensitivity of the system to acquire image information [12]. In addition, the system also establishes a data interaction protocol between the image information acquisition module and the cloud-based image processing and analysis module to build a reliable channel for real-time uploading of image data information and accelerate the speed of uploading image information.

Artificial intelligence signal image synthesis module (AISIS) is the data output module of the IoT-based artificial intelligence image detection system. The main role of the artificial intelligence signal image synthesis module is to process the IoT analysis feedback results devolved from the cloud-based architecture platform for image encoding and processing and to achieve image restoration, interpretation of image data information, and other functions. Artificial intelligence signal image synthesis module consists of two parts: data signal input channel and image conversion channel, and artificial intelligence technology is used to build a data interaction platform between the two channels. The data in both channels are one-way data interaction channels, i.e., one-way conversion between digital signals and image signals. The system also uses the technology of bundling the artificial intelligence signal image synthesis module (AISIS) code with the front-end windowing code, which effectively enhances the code’s flexibility, learning ability, and computational capability and provides the whole image detection system with highly intelligent and efficient image recognition capability [13].

3. Image Sampling Model and Chunking Fusion Processing

3.1. Low-Illumination Image Sampling Model. In order to realize the compressed perceptual reconstruction of low illumination images, it is necessary to first establish the visual information acquisition model of low-illumination images, construct the multiple texture distribution structure model of low-illumination images by using the texture information clustering method of rough sets, perform the
superpixel information fusion and feature acquisition of low illumination images by using the neighborhood transformation method, establish the multiresolution feature decomposition model of low illumination images [14], and obtain the constrained optimization function of pixel feature sampling of low-illumination images as

$$
\min f(\mathbf{x}) = (x_1, x_2, \ldots, x_n) \in \mathbb{R}^n,
$$

where $$\mathbf{x} = (x_1, x_2, \ldots, x_n) \in \mathbb{R}^n$$ is the dark place in the low-illumination image, $$x \in \Omega; S$$ is the variable theoretical domain distribution feature set of the low-illumination image, described as the optimal decision function for super-resolution reconstruction of the low-illumination image; and $$\Omega$$ is the cross-distribution feasible domain of the spatial domain and frequency domain of the atmospheric scattering distribution.

According to the basic set of $$R$$ for the multiresolution feature information sampling of the image, combined with the edge contour detection method, the sample feature distribution set of the low illumination image $$g_j(\mathbf{x}) \leq 0, j$$ is the number of samples, and the IoT node distribution model of the information feature sampling model of the low-illumination image is established as shown in Figure 1.

The optimal fusion of the central pixel with the surrounding pixels is performed by using the single-frame data feature matching method [15], and the fuzziness function of the super-pixel feature reconstruction of the low illumination image is obtained as

$$
\Omega = \begin{cases} 
\mathbf{x} \in S | g_j(\mathbf{x}) \leq 0, & j = 1, 2, \cdots, p, \\
Y_j(\mathbf{x}) = 0, & j = 1, 2, \cdots, p,
\end{cases}
$$

where $$Y_j(\mathbf{x})$$ is the feature reconstruction set and $$p$$ is the maximum number of samples. Based on the basic rough set theory, the optimal segmentation of low-illumination images is performed to improve the detection and reconstruction of low-illumination images by combining the image acquisition results [16].

### 3.2. Image Information Fusion Processing

The initial value-seeking method is used for information fusion of low-illumination images, the low-illumination images are compressed and sensitively processed, and the super-resolution reconstruction of the images is performed using the adaptive reconstruction method [17], assuming that the pixel distribution intensity of the low-illumination images is

$$
u(t) = \frac{1}{\sqrt{I}} \text{rect}\left(\frac{t}{T}\right) \exp\left\{-j \left[2\pi \ln\left(1 - \frac{t}{T_0}\right)\right]\right\},
$$

where $$\text{rect}(t) = 1, \ |t| \leq 1/2$$. The initial estimate of the transmittance is obtained, and the snake function of the low-illumination image layer segmentation is expressed as

$$E = \sum_{i=0}^{N-1} \left[ E_{\text{int}}(vi) + E_{\text{ext}}(vi) \right],
$$

where $$E_{\text{int}}(vi), E_{\text{ext}}(vi)$$ are the input set output feature values, respectively.

The information fusion of the brightness components is performed by the Retinex algorithm [18], and the distribution weight coefficient matrix of the dark regions in the low-illumination images under super-resolution clustering is obtained as

$$
K_{ab} = \begin{bmatrix} E & 0 & 0 \\ 0 & E & 0 \\ 0 & 0 & 1 \end{bmatrix}.
$$

The above equation is normalized, and the luminance component is directly used as the transmittance map to establish the super-resolution reconstructed feature distribution set of the low-illumination image, and $$X_{i,j}$$ is used to denote the gray level at the pixel point at the location of $$(i, j)$$, and the edge contour feature volume of the low-illumination image is feature reconstructed [19] to obtain the dark region feature component in the low-illumination image as

$$
M_{i,j} = \text{med}\left(X_{i-1,j-1}, \ldots, X_{i,j}, \ldots, X_{i+1,j+1}\right)
$$

$$
F_{i,j} = \begin{cases} 1, & |X_{i,j} - M_{i,j}| \geq T, \\
0, & |X_{i,j} - M_{i,j}| < T.
\end{cases}
$$

The set of super-resolution reconstructed feature distributions of the low-illumination image is established, the luminance component is refined with the Retinex algorithm [20], and the grayscale region $$M \times M$$ of the low-illumination image is reconstructed with the Gaussian function as the central surround function, and the maximum value of the grayscale level feature distribution is obtained as

$$p_A = \max\left(\sum_{i=1}^{8} (Q - P)\right).
$$

The low-illumination image sampling model is established, and the wavelet domain chunking perception and information fusion processing are performed by using the depth-of-field adaptive adjustment method of the image, and the feature point is $$K(x_0, y_0)$$, and the approximate spatial grayness characteristic value of the image.
low-illumination image is obtained with $K(x_0, y_0)$ as the center.

$$P_B = \max \left( \sum_{i=1}^8 (R - K) \right). \tag{8}$$

If $P_A < P_B$, then the effect of fuzzy feature extraction and image reconstruction of low illumination is poor.

4. Image Reconstruction System Design

4.1. Wavelet Domain Chunked Compression Perception Algorithm. The multiscale Retinex algorithm is used for wavelet domain chunking compression perception and information extraction to extract the information entropy feature volume of the image and the super-resolution feature decomposition of the low-illumination image combined with the feature matching method to extract the low-illumination image edge contour feature volume, assuming that the set of surrounding highlight pixel feature distribution satisfies the generation sequence as

$$c_1 = \{i|i \in S\},$$

$$c_2 = \{\{i, i\} | i \in N_i, \ i \in S\}, \ C = c_1 \cup c_2 \tag{9}$$

In the above equation, $i = 1, 2, \ldots, T$ denotes the bright region weights, and according to Retinex theory, the luminance is expressed as

$$\min \hat{y} = \hat{Y}(\hat{x}) = (f_1(\hat{x}), f_2(\hat{x}), \ldots, f_m(\hat{x})). \tag{10}$$

where $X$ is the transmittance of reflected light, $\hat{Y} \in Y \subset R^n$ is the reflected and irradiated components, and $Y$ denotes the center surround function. The luminance component is used to fuse the information of the low-illumination image component, and the wavelet domain feature decomposition equation is obtained to satisfy the following equation:

$$|h(\hat{x})| - \delta \leq 0, \tag{11}$$

where $\delta$ is the characteristic quantity of the darkness region distribution of the low-illumination image, and for low-illumination images with small pixel gravitational field strength [21], a multidimensional information histogram is obtained as

$$G_j(\hat{x}) = \begin{cases} \max \{0, \eta_j(\hat{x})\}, & 1 \leq j \leq l, \\ \max \{0, |h_j(\hat{x})| - \delta\}, & l + 1 \leq j \leq p. \end{cases} \tag{12}$$

This can be reduced to

$$G(\hat{x}) = \sum_{j=1}^p G_j(\hat{x}). \tag{13}$$

Based on the filtering results, the super-pixel feature extraction and information fusion of low-illumination images are combined with the atmospheric scattering fusion method to improve the feature recognition capability of images [11].

4.2. Image Reconstruction Output. IoT technology is used to reconstruct the 3D information of the low-illumination image, combined with the detail enhancement method for low-illumination image enhancement processing, and set $f(x)$ $t(x)$ as the new transmittance estimation value to obtain the feature points of low-illumination image space sampling as

$$\ln \rho(X) = R_\rho X - R_\rho X_1. \tag{14}$$

A high-precision feature alignment model for low-illumination images is constructed, and the pixel values of the spatial visual distribution of low-illumination images are obtained as

$$w(d_{ij}) = f \left( x_i - x_j \right) = \frac{1}{\sqrt{2\pi}} \exp \left[ \frac{(x_i - x_j)^2}{2} \right]. \tag{15}$$

Construct a similarity feature resolution model for low-illumination images, combine the pixel distribution matrix for spatial visual reconstruction of low-illumination images [12], get the scene coordinates as $M \times N$ in the regional pixel distribution interval, use the wavelet multidimensional scale feature detection method to achieve information recovery of low-illumination images, and the output is

$$\left\{ \begin{array}{l} x = R \sin \phi \cos \varphi \leq \varphi \leq 2\pi, \\ y = R \sin \phi \sin \varphi \leq \eta \leq \pi, \\ z = R \cos \eta R = \frac{D}{2}, \end{array} \right. \tag{16}$$

where $\eta$ denotes the edge brightness of the row low-illumination image, $\varphi$ denotes the sparse feature component, $R$ denotes the template matching coefficient of the row low-illumination image, and $D$ denotes the edge blurred pixel set. In summary, the image edge blurred matching method is used to achieve compressed perception and information reconstruction of low-illumination images.

According to the wavelet domain chunking compressed perception algorithm, the multidimensional information histogram is obtained, and the image information recovery is completed according to the pixel values of the spatial visual distribution of the low-illumination image to complete the image reconstruction system design.

5. Case Application

Computer graphic design and visual communication design have many uses in practice, so the designer should constantly innovate and integrate the design concept into the design work so that the design work can play the corresponding effect. In the following article, the author elaborates on the application of computer graphic design and visual communication design in practice.

The appearance design of goods has an extremely important role and influence on the sales of goods. In daily life, the appearance of goods is people’s first impression of the goods, so the appearance design and the sales of goods and
the development of the industry have a direct relationship. For example, to create a picture of a snow plum, a bird is needed as an embellishment, so the bird is taken from the picture and moved to a blank document. The author used a cut-and-move operation to complete this step as shown in Figure 2.

Use the shortcut key "Ctrl" to move the PNG format diagram into a blank document. The size of the diagram can be adjusted to fit the document. During the process of moving and adjusting the size of the Xuemei diagram, always press and hold the "Shift" key to maintain the size proportion to avoid the deformation of the diagram. The drawing effect is shown in Figure 3.

Select the layer adjustment order and place the bird layer on top of the plum layer to avoid the plum from blocking the bird. Place the bird in the proper position and use the shortcut "Ctrl" + "T" to resize it until it is the right size as shown in Figure 4.

It can be seen from Figure 4 that some computer software is of great help to computer graphics design. In the actual design, these software can be reasonably adjusted to make the whole product design more beautiful and practical.

6. Simulation Experiments and Results Analysis

In order to verify the applicability of this paper in realizing compressed perception and image reconstruction of low-illumination images, a low-illumination image with a transmittance of 0.26, a pixel gray value of 12, a computing rate of 15 Kbit/s, and a peak signal-to-noise ratio of 24 dB was selected from the Visual Genome image database for the simulation experiment.

According to the above parameter settings, the reconstruction of the low-illumination image is carried out, and the experiment uses MATLAB simulation software to study the image of Figure 5, and the multiscale Retinex algorithm is used for wavelet domain chunking compression perception and information extraction to obtain the information entropy feature amount of the image, and the image adaptive enhancement method is used for low-illumination image enhancement processing, and the information enhancement results are shown in Figure 6.

The analysis of Figure 6 shows that this method can effectively achieve the information enhancement of low-illumination images and improve the recognition ability of images. On this basis, the image reconstruction system designed in this paper is used to realize the low-illumination image reconstruction, and the methods of literature [13–15] are used as the experimental comparison methods, and the comparison results are shown in Figure 7.

Comparing the above results, we know that the reconstructed image using the method of literature [13] has more serious noise; the reconstructed image obtained by the method of literature [14] has less noise, but the image clarity is lower; the reconstructed image obtained by the method of literature [15] is blurred, and the reconstructed performance of the above three methods is not good. The reconstructed images obtained by the method of this paper have high resolution, no noise, and clear images.

The comparison results show that this method can effectively achieve low-illumination image reconstruction and improve the resolution of the image.

Test the time to reconstruct the image by the four methods and get the comparison results as shown in Figure 8.

Analyzing Figure 8, it can be seen that the reconstruction time for 10 times reconstruction of low-illumination images using the method of literature [1] is 100 s, the reconstruction time of the method of literature [5] is 70 s, the reconstruction time of the method of literature [6] is 64 s, and the reconstruction time of the present method is 24 s. The experimental results show that the image
Figure 4: Adjustment of the structure.

Figure 5: Original image.

Figure 6: Continued.
Figure 6: Information enhancement results. (a) Morphological ACWE segmentation; (b) morphological ACWE evolution; (c) morphological GAC segmentation; (d) morphological GAC evolution.

Figure 7: Comparison of the output structure of image reconstruction. (a) Original; (b) local gradient; (c) markers; (d) segmented.
Figure 8: Reconfiguration time comparison results.

Figure 9: Painting effect of different methods.
reconstruction system designed in the present design has the shortest time consumption in the image reconstruction process and high reconstruction accuracy, which is more efficient; in practical, the efficiency of the application is high.

The most important thing that should be incorporated in artworks is the creativity and the theme concept of the work, so it is more testing whether the designer can effectively integrate the concept to be expressed and the picture to be presented so as to better convey the designer’s design concept to the viewer. Therefore, in artworks, the application of computer graphic design is very necessary. Computer software can help designers to achieve the desired design effect and make more effective adjustments, so that the presentation of artworks is more perfect, and can also highlight the whole concept of artworks more effectively. In recent years, some enterprises also design animation characters to reflect the cultural connotation of the enterprise; in the design of animation characters, computer graphic image design plays a great role; and then, for example, in the process of drawing the brand image of many products, in addition to considering the corresponding appearance of the image, we should pay more attention to the connotation of the entire design, to effectively combine the corporate culture and product image and let more people understand the culture and connotation of the enterprise through the brand image. The brand picture shown in Figure 7 makes people have a deeper impression on the enterprise.

7. Conclusions

There are similarities and differences between computer graphic design and visual communication design, and the two technologies have their own focus. Therefore, in the actual application, adjustments should be made according to the design concept and design needs so that the design concept, design skills, and other aspects can reach the corresponding standards so that the work can better show its effect. It is believed that in the future, with the continuous development of computer technology and Internet technology, the application field of computer graphic image design and visual communication design will be more extensive. According to the shortcomings of the traditional image detection system, the article designs an image detection system based on Internet technology and artificial intelligence technology and discusses in detail the design principles of the cloud module, image feature acquisition module, and artificial intelligence signal image synthesis module of the system.

Data Availability

The data set used in this paper is available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflicts of interest regarding this work.

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