

Research Article

The Application Research of Visual Touch Based on Computer Vision in Artistic Visual Image Design

Yao Zhou 

School of Art and Design, Yellow River Conservancy Technical Institute, Kaifeng, 475001 Henan, China

Correspondence should be addressed to Yao Zhou; zhouyao@yrciti.edu.cn

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As a branch of artistic design, artistic visual image design focuses on the visual image, because the scope of artistic visual image design is relatively wide. This research takes ice flower as the research object. After a brief introduction to computer vision and visual touch, it focuses on the current situation of the application of ice flower graphics, the creative graphic design of dew ice flower, the artificial production method of ice flower painting, the method of subject research, the repetition and arrangement of elements, and the type of gradients for ice drawing graphic elements. In addition, the principle of the visual tracking algorithm is introduced through the formula, and the tracking accuracy and success rate of the algorithm in this paper and other algorithms are compared during the experiment, and the experiment shows the formation conditions of the ice flower. Experiments show that tracking results combined with deep features perform the best, with an overall average of 66.95%. The closer the tracking sample is to the real target, the better the tracking performance can be guaranteed. This also proves the effectiveness of using the characteristics of deep features to select candidate samples related to the target and also proves that deep features are more robust in dealing with various challenging factors.

1. Introduction

In recent years, ice window grilles are facing unprecedented challenges, the cycle has become very short, and the thickness of ice window grilles has become thinner and more transparent, which is no longer as colorful as it used to be. Its development can be explained from the natural environment and people's living environment. The most important basic condition for the formation of ice window grilles is the severe cold climate. However, in recent years, environmental damage has occurred frequently, and nature's ability to purify environmental pollution has long been insufficient. With global warming and melting of ice and snow, the risk of future climate disasters will become more serious. It can also profoundly affect the survival and development of the ecosystem and human beings, and the harm caused will not be repeated here. From the analysis of the natural land-

scape of ice flowers alone, the impact of climate change on it in the past forty years can be described as huge.

Elements in nature are the source of inspiration for all artistic contents and forms. In the early stage of human creation, people are constantly extracting the essence from natural objects and learning to create. People are good at discovering beauty in nature, using beauty, and then creating beauty. In addition, the design of natural forms has always been loved by the masses and has been widely used in various product design and architectural design, and pattern design is the most intuitive and basic display method in natural pattern extraction. This expression method is suitable for application in the development of image summaries for ice window grilles. Secondly, the large demand for printed glass products in life also finds a carrier for the promotion of ice flower's graphics. Excellent ice flower graphic design will enhance the charm of glass products. The changeable

and colorful ice flower graphics itself also provides infinite inspiration and ideas for creation and opens up a new direction for people to find beauty in nature. It is worth the time and effort of designers to sum up the beautiful ice flower shape and apply it in life.

The innovations of this study are as follows:

- (1) The visual tracking algorithm based on deep learning is used to realize the capture of the ice formation process, and at the same time, the robustness of the algorithm is well reflected in the tracking effect
- (2) This study introduces the design of artistic visual image with specific examples, which can be used as a basis to provide an effective reference for future research on the design of artistic visual image
- (3) The research content of ice flower's artistic visual image design is relatively new, and there is no similar research result in the existing materials

2. Related Work

Regarding the research on computer vision, visual touch, and artistic visual image design, many scholars at home and abroad have provided a lot of references.

Kim et al. propose a more secure technology that uses tap and gesture methods to protect data and devices. The method was implemented and tested on a smartphone to verify feasibility. Furthermore, Kim et al. extend this method to cloud systems [1].

Yuan-Shyi and Lin proposed a transform filtering-based image model to check for regional defects on the appearance of CTS. Yuan-Shyi and Lin applied Haar wavelet transform and planar region filtering techniques to remove the structural pattern of the background by filtering the approximate subimages of the breakdown wavelet domain image [2].

Merz et al. investigated how motor information in one sensory form affects the perceived final location of motor signals in another form. The results reveal the one-way cross-modal impact of motion information on spatial localization performance [3].

Teraoka and Teramoto address the possibility of a similar association involving touch rather than audition. It has been shown that tactile sequences affect visuomotor perception after prolonged exposure to visual-tactile stimuli [4].

Saktheeswaran et al. conducted a qualitative user study in the context of web visualization tools, comparing a single-modal interface based on voice and touch with a multimodal interface combining the two. Saktheeswaran et al. also describe the interaction patterns that participants use to perform common network visualization operations and highlight topics for consideration in future multimodal network visualization systems [5].

Stramel et al. use a light-touch support paradigm to explore whether a human-following robot can serve as a proprioceptive reference point to stabilize on-ground gait. The results show that light touch support leads to narrower strides in all virtual environment conditions [6].

Krylova and Vodyakha focus on the analysis of early and preschool children's perception of virtual objects (objects of a virtual environment displayed on the screen of a touchscreen device) acting with these objects. Krylova and Vodyakha analyzed the perceptual experiences acquired by early and preschool children when using touchscreen devices [7].

The data of these studies are not comprehensive, and the results of the studies are still open to question, so they cannot be recognized by the public and thus cannot be popularized and applied.

3. Computer Vision and Visual Touch and Artistic Visual Image Design

3.1. Computer Vision. Computer vision belongs to a processing technology. The main processing objects are images or videos. After computer vision processing, digital signals are output, so that other operations and analysis can be performed on these processing objects. The application areas of computer vision are shown in Figure 1 [8, 9].

Computer vision occupies a certain proportion of weight in today's research fields. In addition, computer vision also belongs to a discipline, which is inextricably linked with many disciplines. The relationship between computer vision and related disciplines is shown in Figure 2 [10].

The outstanding feature of the field of computer vision is its diversity and imperfection. Computer vision includes image processing and pattern recognition. In addition, it also includes spatial shape description, geometric modeling, and cognitive processes. Achieving image understanding is the ultimate goal of computer vision.

3.2. Visual Touch. Visual touch is a combination of two senses—vision and touch [11, 12]. Visual touch, to define its concept, we must first start with "touch." Touch is one of major senses. There are many tactile sensations. These tactile sensations spread all over the body surface of the body. We receive touch pressure through the nerve endings on the body surface and experience external information. Touch, like sight, is the primary means of perception for people to contact external things. People's reliance on touch can be said to be a reflection of instinct, just like we are in various public places. For example, museums and exhibition halls will see signs similar to "do not touch," which means that the public is not satisfied with pure visual perception, and personal experience is the most real feeling [13]. Tactility is not uncommon in design, and its existence brings special meaning to design. Whether it is a sense of freshness, a sense of design, and a sense of caring, it is a progress of the times, and it also makes the benefit of design more obvious to human beings.

Visual communication is one of the main ways we communicate with the outside world. Everything in the world is displayed in its own unique form, which we call visual symbols. The brain rearranges these symbols and transmits them to all parts of the body in various forms of information, resulting in various psychological and physiological changes, and various expressions and feelings appear [14, 15]. Visual touch is a kind of visual communication, which adds tactile

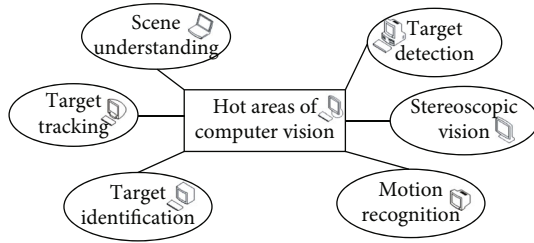


FIGURE 1: Areas of application of computers.

elements on the basis of vision. Since vision precedes other senses, vision has an absolute advantage in sense organs. Designers apply texture elements to design works to achieve a sense of stimulation through human vision. The more senses involved, the richer the stimulation. The public will reextract the previous tactile experience in the brain, mix with later emotions, and form a series of new sensory symbols in the brain. The visual object tracking framework is shown in Figure 3 [16].

The concept of visual touch is a brand-new theoretical application of touch theory in artistic creation. It triggers people's tactile experience memory through visual perception, thereby producing tactile perception [17, 18]. Touch is divided into skin touch and psychological touch. As one of the tactile sensations, the psychological tactile sensation is the tactile perception produced by human tactile experience without physical contact, that is to say, an imaginary tactile sensation. From an artistic point of view, "imaginary sensation" includes the imaginary sensation of motion, the imaginary sensation of energy, the imaginary sensation of space, and the imaginary sensation of touch. The most important of which is the imaginary sensation of touch. The imaginary feeling of touch is the most important manifestation of what we call psychological touch [19].

As the main sensory organ of touch, the hand has frequent contact with the external world. More than 90% of human activities are realized through the hand [20, 21]. However, it is impossible for us to touch and experience everything in life, so we need to mobilize the accumulated experience in life practice to perceive more objects that we cannot touch [22].

Since psychological touch is derived from tactile imagination and tactile imagination is related to the actual experience of life, the accumulation of mental touch must also be related to the experience and cognition of life. The visual signal processing process is shown in Figure 4 [23, 24].

3.3. Visual Image Design of Ice Flower

3.3.1. Status of Application of Ice Window Grille Graphics. From the way people live with glass as windows, water mist quietly enters every household through a complex transformation mechanism, which is the product of the collision between nature and civilization. The historical process is rapid, and the changes of ice flowers are both rapid and rich with the development of environment and social science and technology. Compared with the ever-changing ice flower, people's research level on ice flower is very low, and the

application of ice flower pattern is even less. In view of the current creation situation, we have sorted out the application of derivatives inspired by ice window flowers and the creation and design of materials to understand the application status of ice flower graphics.

The most common application of ice flowers is the extraction of ice flower patterns and the use of ice elements. The common pattern extraction is very simple, very similar to the painting method of plants and flowers, and does not follow the growth characteristics and characteristics of ice flowers to create strict and distinctive creations. Most of them are used for element development of traditional patterns, or auxiliary applications for video production. Some of the works are beautiful but have not had time to form a series.

Among them, the ice and snow element applications in Disney animations are well produced, in which the ice and snow patterns used in animation and videos can reflect the effective development and utilization of the characteristics of ice patterns. Beautification without lacking its authenticity and unique style, it is a pleasing and excellent work.

3.3.2. The Method of Subject Research. In the visual image design research of dew ice flower, the focus is on graphic analysis and creative painting, as well as verifying the correlation between water icing patterns and music, and preparations are made for these three research purposes. In the writing of the thesis, the field investigation method, observation method, and experimental method are used.

- (1) Fieldwork method: collect a large number of ice window flower patterns, including existing network materials and literature materials, as well as photographic journals. Focus on taking real-life photos of the ice window flower pattern, and obtain the first-hand real and effective ice window flower graphic data, which will be fully prepared for the later stage of the ice window flower pattern arrangement, the characteristic graphic induction and design of the ice flower, and the creation of the ice flower painting. An interview survey was conducted to investigate the shape and formation of ice window grilles. The focus of the interviews was the elderly, followed by young people and teenagers, to sort out the changes of the ice window flowers over the years.
- (2) Observation method: clarify the different types of ice window grilles, summarize the graphic characteristics of ice window grilles, inspire design thinking, carry out creative drawing, discover new perspectives, and expand people's understanding of ice window grille patterns.
- (3) Experimental method: first, summarize the various natural conditions required for the formation of ice window grilles, conduct experimental analysis, find the reasons for the graphic characteristics of ice window grilles, and provide a basis for the summary and innovation of ice flower graphics. Secondly, the key direction of the experiment is to find more

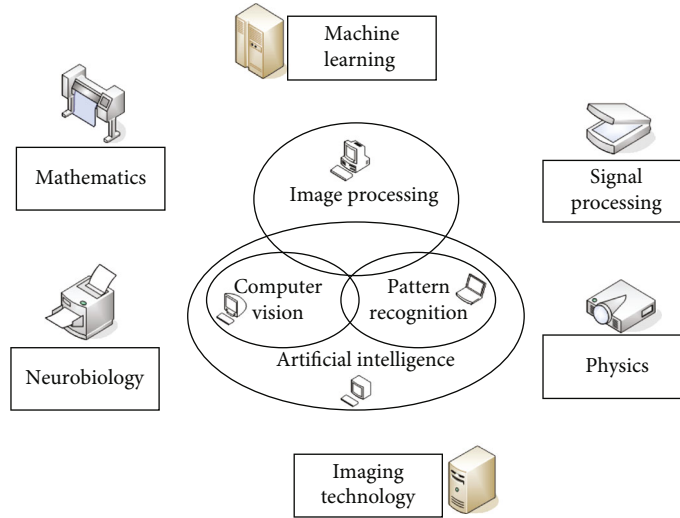


FIGURE 2: Relationship between computer vision and related disciplines.

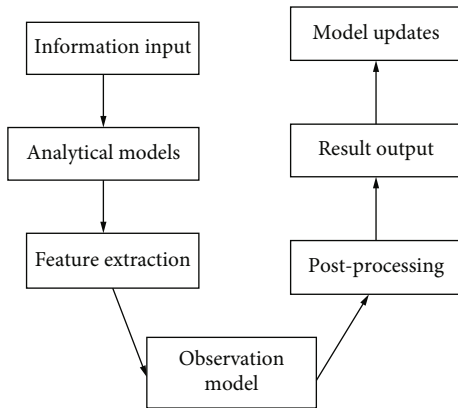


FIGURE 3: Visual target tracking framework.

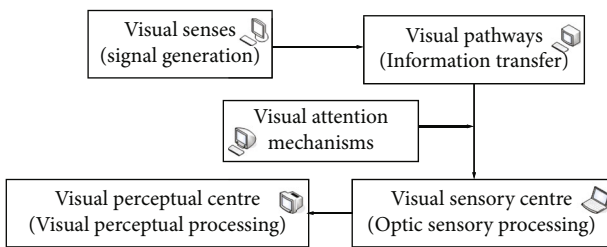


FIGURE 4: Signal processing for vision.

possibilities for the formation of ice flowers. In addition to the natural environment factors, the experiment focuses on the possibility of sound affecting the shape of ice patterns.

3.3.3. Dew Ice Flower Creative Graphic Design. The painter can summarize the emotions he wants to express in a simple picture, so that he can fully express the emotions. Compared with the human eye, photos can more accurately record the process and results of the formation of ice flowers. It can record the truth, but often in the truth it reminds us of

something inherent in mindset, which has a lot to do with the standard of authenticity and the aesthetics of optical illusion. In front of a naturally formed ice flower, the purpose of the machine’s recording is not to see what we can see, but to display the nonvisual form in a visual form. In layman’s terms, it is an imitation of nature, and the visual function such as “optical illusion” is fully used in the imitation.

The brand creation of “dew ice flower” is based on the graphic style and characteristics of the ice window grilles. It is based on the spiritual core of ice flower’s natural ice bones, unpretentiousness, and natural free and easy, the pattern characteristics of jade clean and clear, and the combination of hardness and softness. Creating the “dew ice flower” brand, effectively use the pattern characteristics of the ice window flowers, develop and produce graphics, show its beauty, and let more people know about it and love it. It inspires people with its purity, makes people free from depression, calms from irritability, and rises from silence.

For the pattern imitation and creation of ice window flowers, there are two directions. The first one is to summarize the patterns and methods of pattern growth and use different techniques to create regular copies of them. There is another kind of content that this chapter wants to introduce. The creative works show things that can only be seen in a specific time and place. Perfect imitation and interesting creation form an important innovation point for the creative promotion of dew ice flower graphics to create a wonderful ice painting by depicting the magic of nature.

If eyeballs roll around the peephole with one eye, it will notice that the image loses certainty, becomes blurred, or even disappears. In addition to using human optical illusions, creative ice flowers also require creators to have sufficient graphic reserves and imagination to create stories and “realistic” creations. Vision, lighting, and the nature of the ice flower itself—the contrast between the pattern, thickness, and background environment—these and other factors have a profound impact on the creation of ice painting stories. As shown in Figure 5, the color adjustment of the same ice pattern will give people a completely different feeling. We



FIGURE 5: Pure white ice window flower.

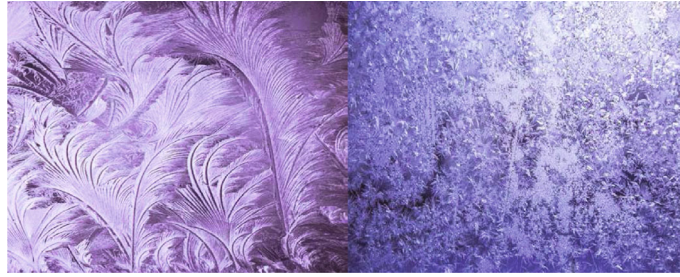


FIGURE 6: Color-treated ice window flower.

TABLE 1: Result 1.

	KCF	Struck	CNSGM	Ours
Basketball	82.28	10.48	89.46	77.70
Biker	34.57	81.45	35.79	78.49
Bird1	7.98	17.49	21.43	48.59

TABLE 2: Result 2.

	KCF	Struck	CNSGM	Ours
CarDark	74.19	94.58	84.16	79.59
CarScale	70.56	43.20	76.90	34.40
Couple	15.71	45.84	46.79	82.91

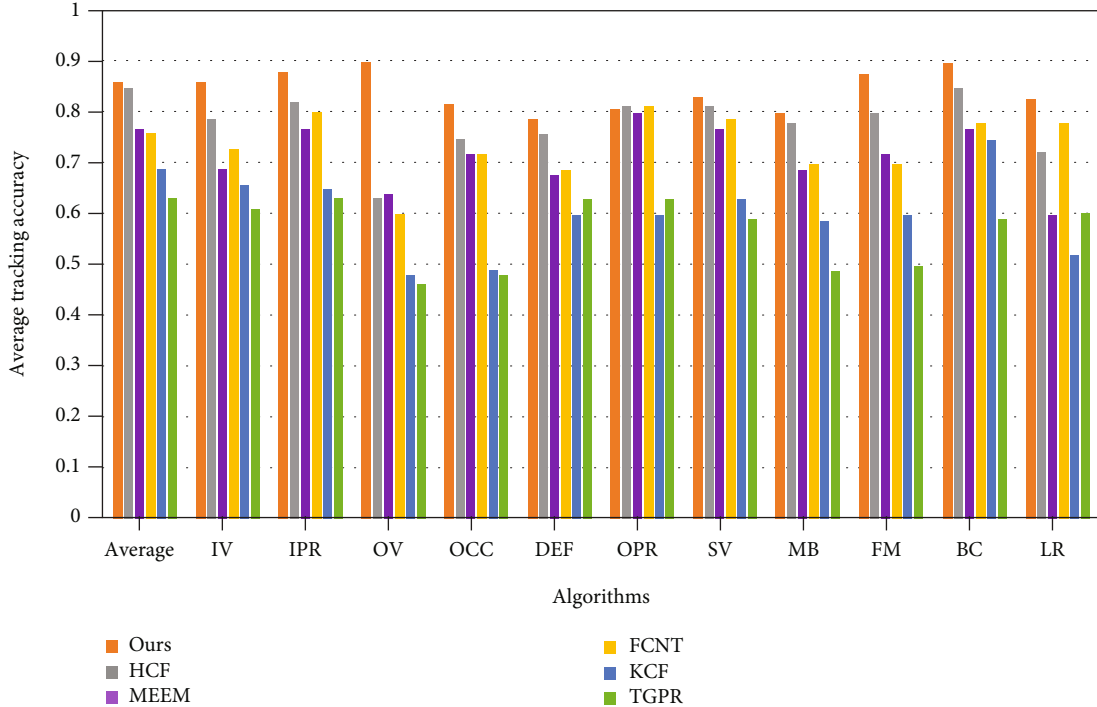
cannot claim that the two pictures in Figure 6 are not as real as the first, this kind of artistic treatment is common, and the treated picture may be real in another sense; it evokes something. This kind of thing is not a criterion of authenticity but an interesting experience and subjective feeling that ice flower gives us.

Due to the complicated reasons for the formation of ice flowers, the ice flowers on the glass are influenced by different factors, and there are often many different areas on a piece of glass, and each area can be painted independently. Some parts are like landscapes, some places are like people, and there are various types of flowers, trees, and rare animals, which are lively and in different shapes. Therefore, when shooting the composition of the ice flower painting, we should pay attention to finding a good area. When composing a picture, choose the shooting level accurately, choose the correct subject, and the picture should be rigorous and coordinated. After mastering the composition ratio, the pic-

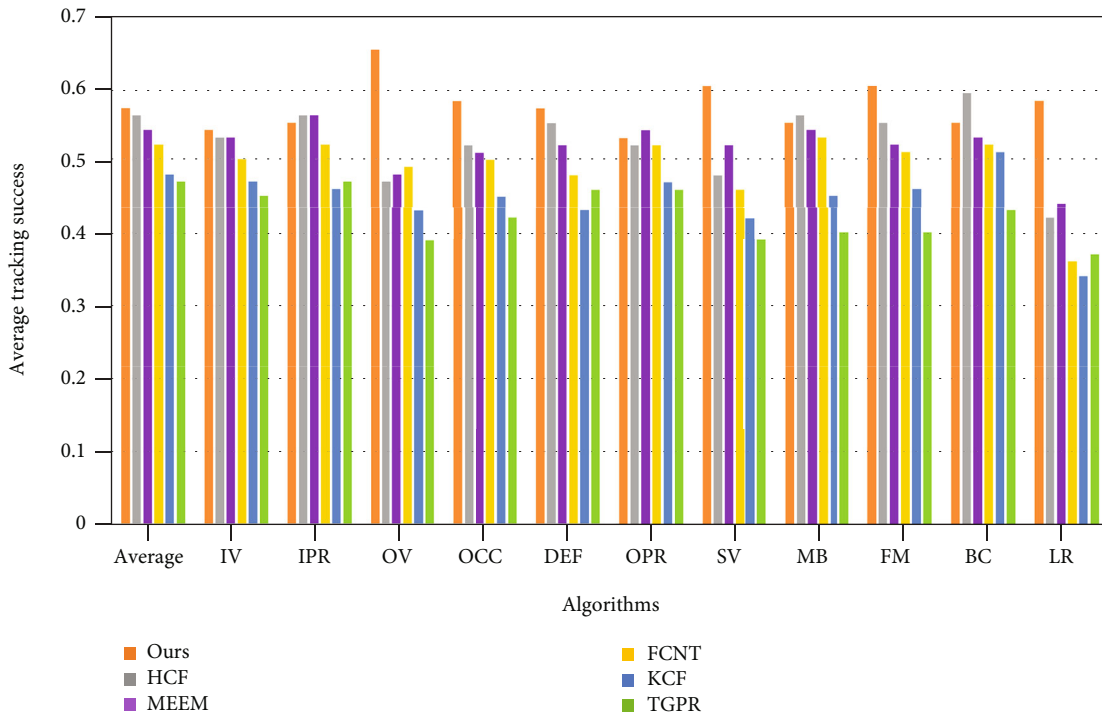
ture should be vivid, the impression should be accurate, and the fantasy should be wonderful.

Dew flower's creative paintings are mainly characterized by graphic associations, which are a flexible and vivid form of composition and element composition. If there is no interesting part of the ice flower graphics itself, it must rely on the creator's flexible thinking for redesign. The layout is full of interest, which enhances the publicity effect of ice painting and plays a magical role in the finishing touch, thereby attracting more people who like ice painting and impressing most people who lack knowledge of ice flowers. To enhance the visibility of ice window paintings, various production methods such as implication, association, and exaggeration can be used. Distinctive personality is the creative soul of ice painting typesetting design. If only personal experience and imagination were used to create pictures and design layouts, we can imagine that it will take a lot of skill and require long-term accumulation of materials and skills. If we have a weaker foundation, the graphics drawn will appear simplistic and conceptual and appear similar. It is conceivable that through the simple creation and drawing of memory, it is impossible to achieve a surprising and unique creative effect. Therefore, it is necessary to collect a lot of materials, have eyes for discovering taste, dare to think, and dare to create, and the most important thing is to have a kind of love born in the creation of ice flower painting. In the layout design, we should look for individual creation methods, enhance the uniqueness of creation, reject mediocrity, and finally obtain unexpected pictures, which are far beyond their own design and painting abilities and win the love of most people.

In the creative promotion of dew ice flower graphics, the original form of the ice flower is used as the basis for creation, and the story and interest of the picture are



(a)



(b)

FIGURE 7: Test plot of tracking properties of the tracking algorithm on the OTB100 using the OPE evaluation method.

emphasized. In particular, exaggeration and deformation are used to produce story paintings with a strong sense of expression, which can express unrealistic natural landscapes, fairy tales, and abstract feelings. Making the nonrealistic creation pictures moving and interesting can even arouse the viewers' love for the ice window grilles and their recognition

of the ice paintings and arouse the viewers' enthusiasm for appreciation.

3.3.4. *Artificial Production Method of Ice Flower Painting.* The pattern of the ice window flowers can be controlled manually, and the formation of ice flowers can be affected

TABLE 3: Result 1.

	KCF	Struck	CNSGM	Ours
Basketball	78.26	8.91	82.47	76.15
Biker	14.67	11.14	33.67	44.81
Bird1	5.49	15.68	14.57	29.46

TABLE 4: Result 2.

	KCF	Struck	CNSGM	Ours
CarDark	62.23	90	100	7.18
CarScale	34.41	31.38	89.61	10.48
Couple	14.29	44.30	42.19	72.18

TABLE 5: Result 3.

	KCF	Struck	CNSGM	Ours
DragonBaby	20.48	8.49	38.18	69.79
FaceOcc1	100	88.36	90	88.43
Football1	86.49	71.69	80.40	46.79

by controlling the humidity and wind direction. The quickest results are prefabricated patterns on unfrozen glass. Use a rag to wipe out different wet and dry marks on the glass or control its cleanliness to different ranges. Efficiently use various materials to make ice window paintings come into being as desired, try painting on glass with things such as wine, vinegar, and dust, and then let them form naturally. After the pattern is generated, it can also be modified with a utility knife to enhance the effect. It can also use the hot compress method and use a hot rag and finger heat to melt and modify the unsatisfactory part of the ice flower painting. The final effect of the painting can also effectively use color, such as the angle of the blue sky, the background patterns of different colors, and the colored artificial light to match the patterns to form the most beautiful ice window painting.

During the data collection and research stage, we conducted interesting experiments to verify the possibility of artificially making ice flowers. The experiment is very simple. The main materials used are as follows: a pot of hot water with a higher temperature, a piece of glass about 20 cm, and a refrigerator. The specific process is as follows: the first step is to place the glass over the hot water, let the water vapor cover the glass, fully contact each inch of glass for 5-10 minutes, and then proceed to the second step: immediately put the glass in the freezer of the refrigerator to freeze. The third step is to remove the glass from the refrigerator after 10 minutes. As a result, it will be found that there is a layer of ice on the glass, which has a pattern similar to ice flowers, but the effect is far from the ice window flowers naturally formed on the glass window.

Many artificial methods rely on the same principle as the naturally formed ice window grilles, all because water vapor condenses into frost. The glass windows isolate the hot and humid indoor air from the cold and dry outdoor air, so that

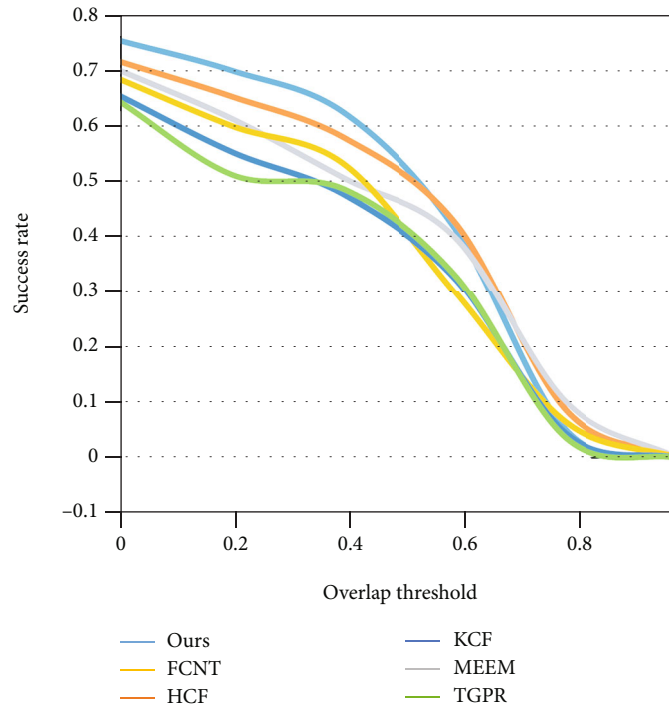
the two sides of the same glass are exposed to different temperatures and humidity. When the temperature around the glass becomes cooler due to the influence of the cold air outside, it will naturally frost the glass on one side of the house and form patterns in combination with factors such as airflow.

For the completed ice flower painting, the shooting time is very important, and the time between the completion of the production and the shooting should not be too long. After a long time, in some places where the outdoor temperature is too low or there is no light for a long time, the ice flower will be full of thick frost, affecting its crystal and beautiful physical state, be good at using light when shooting, including colored light sources. The flexible use of lighting will increase the three-dimensional sense of the ice flower painting and reflect its depth in the plane, making the picture more expansive. In flexible light control, know how to change the background color, and use a variety of color backgrounds to form a variety of changing effects on ice flowers.

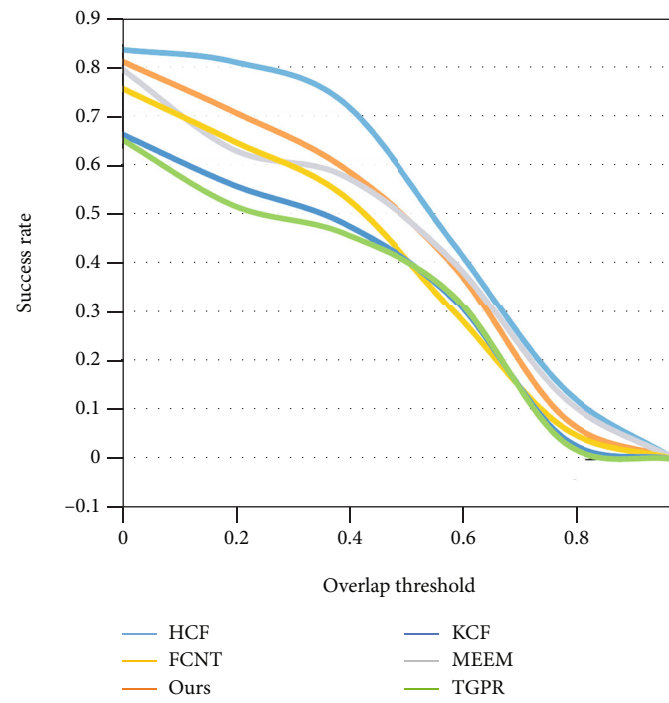
3.3.5. Repetition and Arrangement of Elements. In a visual communication design, we have always attached importance to the novelty and originality of elements. We are accustomed to extracting elements from nature, and most of them have certain rules and principles to avoid simple collage and stacking of elements. The creative graphic design of dew ice flower strives to integrate more emotional enthusiasm of the designer and summarizes the unique elements of nature, which can not only fit the characteristics of the ice flower but also reflect the new creativity of artistic conception aesthetics.

(1) *The Law of Repetition of Ice Elements.* Repetition refers to the repeated arrangement of the extracted elements. This form is very common in the graphic growth of ice window flowers. Usually, the pattern elements in an area are the same; only the size and arrangement are different. We abstract and refine the pattern elements and then repeat them in batches to form the creative graphics of dew ice flower. The abstraction is applied to the visual image design of dew ice flower, the original graphic image of the ice window is refined through generalization and simplification, its essential characteristics are grasped, and it is exaggerated to reshape the expression.

(2) *Arrangement of Ice Elements.* An important point in the graphic features of dew ice flower mentioned above, the balance style, including symmetry, translation, and rotation, refers to the basic graphic style of the ice flower element under balanced conditions. Then, under the repeated elements in batches, how is the layout of ice flowers distributed, and what kind of arrangement and combination are adopted. Through the analysis of featured pictures, it can be roughly summarized as the following. The first type is the way of division and arrangement. There are no obvious rules, and the composition of elements without regularity is relatively free, with great randomness and freedom. The second type is the regular repeated arrangement and



(a)

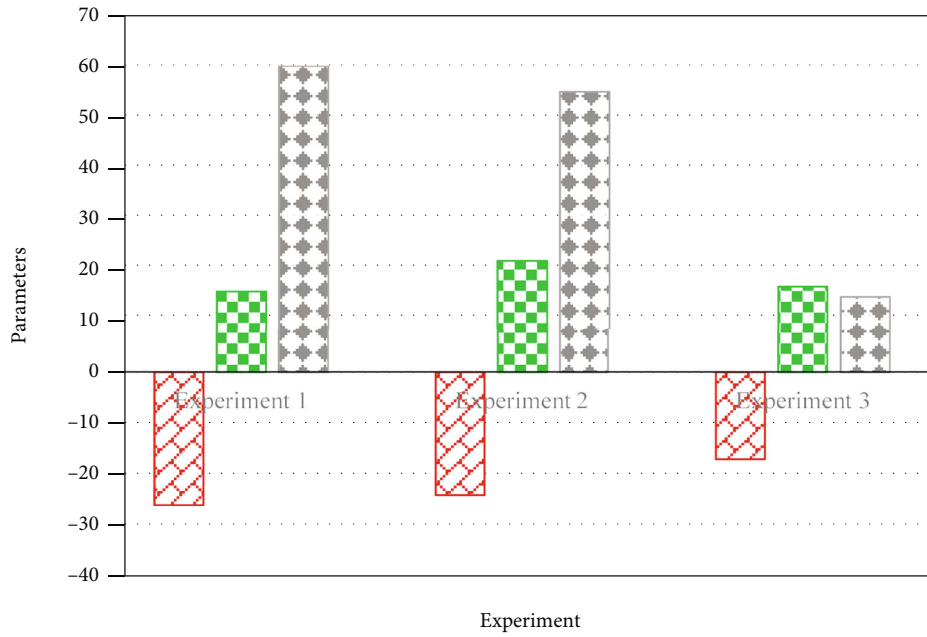


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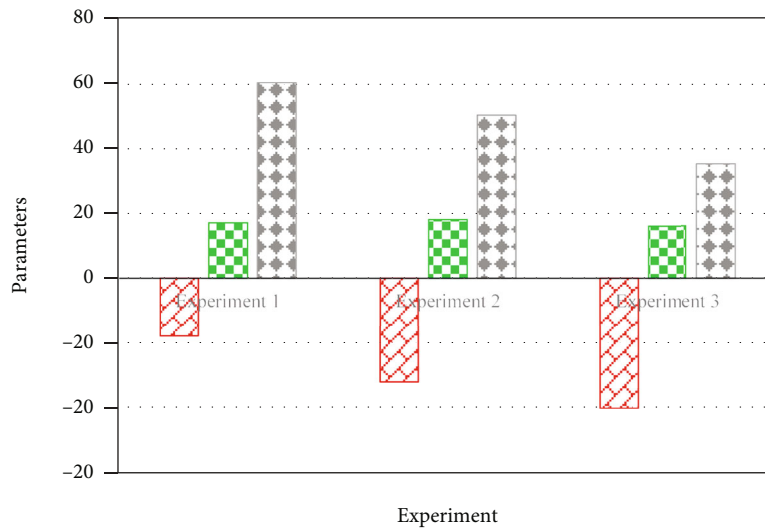
FIGURE 8: Comparison results for SRE and TRE.

combination, and the regular arrangement of elements is formed in a rigorous mathematical way. The more regular the ice window pattern, the more rhythmic beauty. Looking for the repeating rules of elements in the graphics of the ice window flowers, summarize the rules and apply them, so that the pattern design of the dew ice flowers can follow the natural beauty of the ice flowers.

3.3.6. *Gradient Types of Ice Drawing Graphic Elements.* Gradient graphics means that in graphics, one image evolves into another image through a certain time and process, and the two images are naturally fused together through this process. Gradient is a natural form that we can often observe in ice flower graphics. The defects and integrity of the ice flower pattern, the distribution of ice flowers on the whole



(a)



(b)

FIGURE 9: Experimental parameters for the formation conditions of ice window flowers.

glass, and the growth process of ice flowers are all changed step by step, so we feel soft and familiar with the form of the gradient. In the observation of graphics, we can often see the gradual change of the ice pattern from small to large or from whole to broken. In general, the gradient shape in graphic design requires designers to use their imagination to complete this unreal process, but in the design of dew ice flower, we can naturally follow the realistic gradient of the ice flower shape to complete the copy creation.

There are two kinds of gradation phenomena of ice flowers: the first one is the morphological gradation of sim-

ilar ice flower patterns at the beginning and end of the growth of ice flowers. There is no necessary causal relationship between the two, but the images formed under the same natural conditions have strong similarity without losing change. The second is the gradient process of the screen layout. The elements of this process are the same, and the interval changes in the layout are relatively obvious changes.

(1) *Gradient of Size.* The effect of changing the size of the ice flower element pattern is obvious. It is limited by natural laws. The gradient of the ice flower size does not undergo

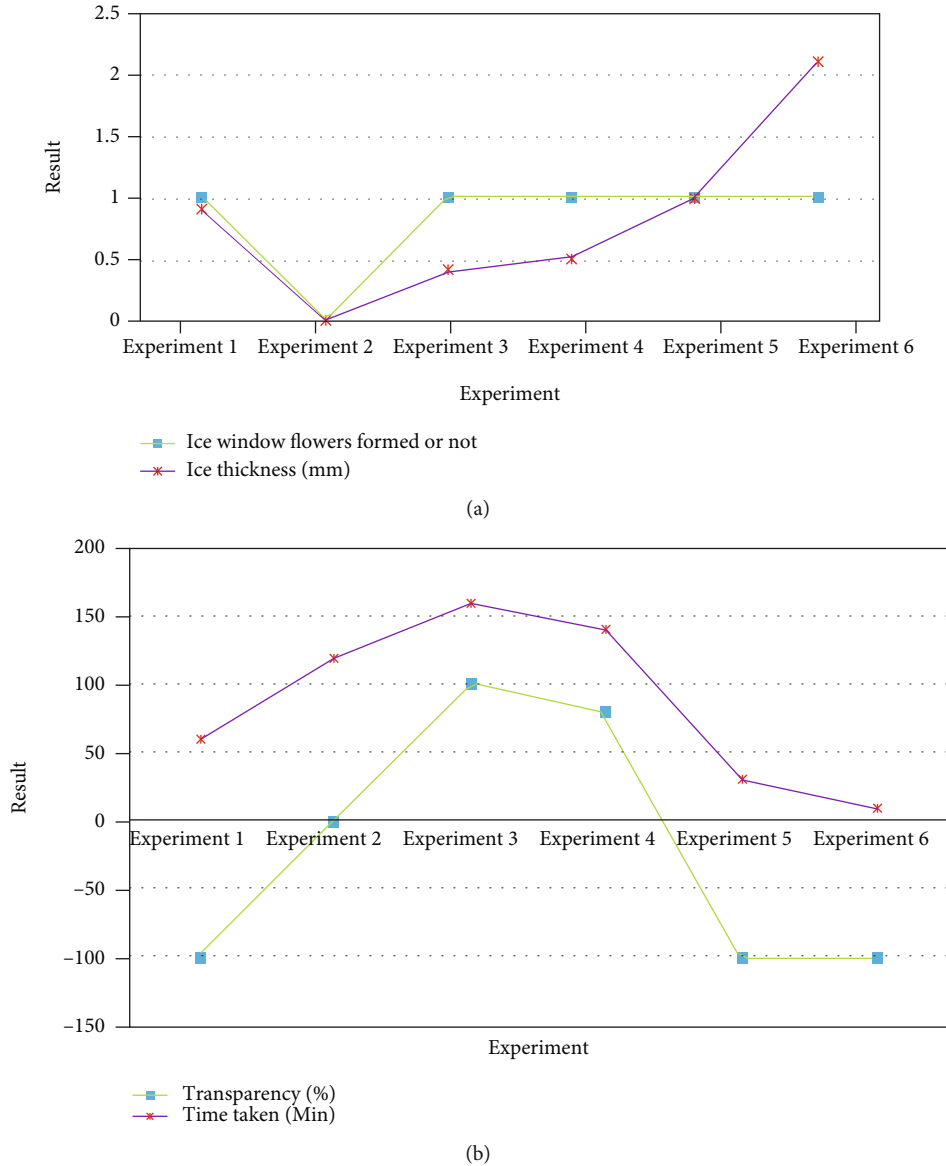


FIGURE 10: Results of the ice window flower experiment.

intermediate transitions, but changes suddenly, and due to the influence of natural factors on its formation, its changing position is often the same. In the graphic design of dew ice flower, following such gradient characteristics, no transition process is required, and it should have a strong sense of contrast and visual impact, arousing people’s interest in appreciation. The particularity in size can strengthen the element image of ice flower and make the elements more prominent and vivid. It is a gradient type that is easier to use and master.

(2) *Gradient of Interval.* In the arrangement of ice flowers, the gradual change of interval refers to the corresponding changes of elements in the plane composition according to the law, so that it can generate obvious rhythm and movement. The gradual change of interval is a common phenomenon that conforms to the growth law of ice flowers. It is the

same as the gradual change of size and the regular repetition of ice flower pattern elements, which are all orderly gradual changes.

(3) *Gradient of Shape.* The gradient of the shape is rare in the ice flower graphics, and the changes of the two graphics are close or similar in shape. In the natural formation of the ice pattern, the exact same pattern does not exist. Even if the visual effects are the same, their thickness and extension structure are not exactly the same. The feasibility of the gradient design of the shape is based on this theory, which is mainly reflected by the approximate changes of the basic elements. With imaginative planning in the design, the shapes in the picture can be freely changed between shapes. The two shapes with large difference in shape are reconciled and natural through the gradual change process, and “change” is contained in “unity.” The gradual change of

the shape of the ice flower can increase the interest of the image of the ice flower and enrich its shape.

(4) *Divergent*. Divergent is a form of composition in which there is a main axis, and the graphic scene spreads from the main axis to the surrounding. It is also a special gradient method, which is the same as the size gradient and interval gradient, which refers to the orderly changes of the basic elements. This compositional feature can not only focus the viewer's line of sight but also play a role in opening and spreading. This type of arrangement is the most common form in the arrangement of the growth laws of ice flowers. The effect of radiation is an extremely basic graphic growth state for ice flowers, and the divergent pattern state of ice flowers has a strong focus. This focal point is usually located at the edge of the ice window flower picture, giving people a strong sense of spatial depth, so that the ice flower pattern in the picture is concentrated towards the focus or spreads from the focus to the surroundings. The divergent growth of ice flowers often makes the viewers have a strong three-dimensional sense of the graphics, which avoids the compact and simple composition of the graphics, so that it can show a stronger pattern charm. In dew ice flower graphic design, the so-called divergent composition can show strict central symmetry. It can also use a noncentral composition, avoid complete symmetry, and decide according to the needs of the ice flower painting pattern.

4. Visual Tracking Algorithms

The common features of the probability dense model are the local binary pattern (LBP) feature. LBP compares the grayscale of the center pixel ν and the neighborhood pixel μ and performs binary encoding on the neighborhood pixels to obtain the texture feature of the center pixel:

$$\gamma = \sum_{s=0}^{j-1} [(\mu - \nu) \geq 0] \cdot 2^s. \quad (1)$$

The histogram method generally selects the appropriate number of groups and group spacing according to the number of statistical samples and then counts the number of samples in each group:

$$\zeta = \kappa \sum_{t=1}^k \varepsilon[a(r_t) - b]. \quad (2)$$

Using a kernel function to assign weights to each pixel,

$$\xi = \kappa \sum_{t=1}^k \delta(\|p(r_t)\|^2) \varepsilon[a(r_t) - b]. \quad (3)$$

In the formula, $\delta(\cdot)$ is a monotonically decreasing kernel function. $p(r_t)$ represents the coordinate position of sample r_t , and the closer to the center origin, the greater the weight assigned.

The kernel density estimation method is one of the most widely applicable and the most accurate among all the overall distribution estimation methods.

$$\lambda(t) = \sum_{t=1}^k \phi_t \delta(r - r_t). \quad (4)$$

The following is the multitemplate model:

$$H = \sum_{t=1}^k X_t \vartheta_t. \quad (5)$$

In the formula, ϑ_t is the weight coefficient corresponding to the t -th template X_t .

The following is the singular value decomposition of the template matrix:

$$\Gamma = KEM^T. \quad (6)$$

In the formula, K represents the principal component direction of the template matrix Γ ; E is a diagonal matrix.

Taking the first g larger singular values d_t and their corresponding principal components K_t to reconstruct the target, namely,

$$Z = \sum_{t=1}^g K_t d_t. \quad (7)$$

Multikernel density estimation function is given a sample set in dimensional Euclidean space:

$$\varphi(r) = \frac{1}{ef^q} \sum_{t=1}^k \vartheta_t w \left(\left\| \frac{r - r_t}{f} \right\|^2 \right). \quad (8)$$

In the formula, ϑ_t represents the weight of the t -th sample; $w(r)$ is the kernel function; f is the bandwidth of the kernel function.

The mean shift of the variable r at each iteration is

$$\bar{r} = \frac{\sum_{t=1}^k r_t \vartheta_t \omega(\|(r_0 - r_t)/f\|^2)}{\sum_{t=1}^k \vartheta_t \omega(\|(r_0 - r_t)/f\|^2)}. \quad (9)$$

The following is the LK algorithm:

$$\operatorname{argmin}_r \sum [p(N(r, \rho + \Delta\rho)) - M(r)]^2. \quad (10)$$

In the formula, r represents the coordinate position of each pixel in the template M ; ρ is the transformation parameter in the change N .

$p(N(r, \rho + \Delta\rho))$ is expanded by the first-order Taylor formula, and its objective function is rewritten as

$$\sum_r \left[p(N(r, \rho)) + \nabla p \cdot \frac{\partial N}{\partial \rho} \Delta\rho - M(r) \right]^2, \quad (11)$$

where ∇p represents the gradient of the image p .

The sparse representation expresses the target with the following formula:

$$\Phi = \sum_{t=1}^O \tau_t \omega_t \text{ s.t. } \min \|\omega\|_0, \quad (12)$$

where ω_t represents the sparse coefficient.

According to the dictionary, reconstruct the signal:

$$\min \|\omega\|_0 \text{ s.t. } \|\Phi - \tau\omega\| \leq \chi. \quad (13)$$

The BP algorithm adopts the relaxation method:

$$\min \|\omega\|_1 \text{ s.t. } \|\Phi - \tau\omega\| \leq \chi. \quad (14)$$

The similarity function is

$$\psi(\tau, \rho_t) = \exp\left(-\frac{\|\tau - \rho_t\|^2}{2I^2}\right) \quad t = 1, 2, \dots, n. \quad (15)$$

The classifier function obtained by training the SVM classifier can be defined as

$$\Lambda(r) = \sum_{t=1}^k \beta_t \kappa(r, r_t) + a. \quad (16)$$

Given a model U of the target, it is necessary to find a set of overcomplete atoms b to linearly represent:

$$U = \sum_{t=1}^k b_t r_t + y = BR + y. \quad (17)$$

After the target dictionary is determined, the reconstruction coefficients must also be sparse when reconstructing the signal for each frame; its constraints are

$$\begin{aligned} & \arg \min |R| \text{ s.t. } U = BR + y, \\ & \arg \min_v \|x^0 v - p\| \text{ s.t. } \Omega_{\text{down}} \leq v \leq \Omega_{\text{up}}. \end{aligned} \quad (18)$$

Using Taylor's formula for the first-order approximate expansion of the observed term, we can get

$$\arg \min_{\Delta v} \|x^0 v_0 + E\Delta v - p\|_1 \text{ s.t. } \Omega_{\text{down}} \leq v \leq \Omega_{\text{up}}. \quad (19)$$

The results of KCF, Struck, CNSGM, and method under the DP(%) criterion are shown in Tables 1 and 2.

Tables 1 and 2 show that tracking results combined with deep features perform the best, with an overall average of

66.95%. The closer the tracking sample is to the real target, the better the tracking performance can be guaranteed. This also proves the effectiveness of using the characteristics of deep features to select candidate samples related to the target and also proves that deep features are more robust in dealing with various challenging factors.

The tracking attribute test results of the tracking algorithm using the OPE evaluation method on OTB100 are shown in Figure 7.

Figure 7 shows the average tracking accuracy and average tracking success rate of the DET algorithm and some mainstream tracking algorithms on 11 target tracking attributes. Tracking properties include Illumination Variation (IV), In-Plane Rotation (IPR), Out of View (OV), Occlusion (OCC), Deformation (DEF), Out-of-Plane Rotation (OPR), Scale Variation (SV), Motion Blur (MB), Fast Motion (FM), Background Clutter (BC), and Low Resolution (LR). Figure 7 shows that the tracking algorithm in this paper shows good tracking accuracy and tracking success rate on 11 tracking attributes, and it is significantly ahead of the second-place comparison algorithm in tracking performance. This verifies that the algorithm in this paper has good tracking robustness and can perform long-term tracking of targets under complex conditions.

The results of KCF, Struck, CNSGM, and this algorithm under the OP(%) criterion are shown in Tables 3–5.

Tables 3–5 show that the OP results of algorithm are not optimal, but the algorithm is optimal overall.

Figure 8 shows the overall comparison of various tracking methods for SRE and TRE.

Figure 8 shows that the algorithm in this paper ranks first in the SRE comparison results and second in the TRE three-dimensional comparison results. Although the robustness of the algorithm is proved, there is still room for improvement.

The experimental parameters of the ice window grille formation conditions are shown in Figure 9.

Figure 9 shows the environmental parameters of this experiment: the outdoor temperature is $-40 \sim -17^\circ\text{C}$, the indoor temperature is $16 \sim 22^\circ\text{C}$, and the indoor relative humidity is $35\% \sim 60\%$.

The results of the ice window grill formation condition experiment are shown in Figure 10.

In the data result of whether the ice window flower is formed or not in Figure 10(a), 1 indicates that the ice flower is formed, and 0 indicates that the ice flower is not formed. Figure 10 shows that the higher the indoor temperature, the glass is less likely to be frosted. Regardless of other factors, from the point of view of temperature alone, the lower the outdoor temperature, the thicker the ice formation and the faster the time. The higher the indoor humidity, the more transparent the formation of ice flowers, and the time is relatively fast.

5. Discussion

Computer vision is to use various imaging systems to replace the visual organ as an input-sensitive means, and the computer replaces the brain to complete processing and

interpretation. The “visual touch” in this paper is based on computer vision to realize the perception of the target.

All elements of ice flower are derived from objective existence, and there are many changes in graphic contrast, which gives us a variety of feasible ways of expression and also requires us to achieve the unity of image characteristics. Unity is a reflection of the spiritual outlook of ice flower, it embodies the cohesion and visual effect of an ice flower painting and determines the beauty of the painting. In the creation and design of the dew ice flower graphics, the image of the ice flower is derived from the laws and innovations of various forms of beauty. The design not only conforms to the law of ice flower graphics but also conforms to the new visual image of aesthetic feeling. Designers need to carefully figure out the ice flower pattern, combine the compositional changes of the composition, strengthen the characteristics of the ice flower, and pay attention to the unity of the image characteristics of the ice flower. The design graphics that are visually beautiful and easily accepted by the appreciators are produced to promote the shape of ice flowers, so that the appreciators can have artistic resonance and visual enjoyment in spiritual and aesthetic aspects.

6. Conclusion

Through the research on the natural conditions and human factors of the formation of ice window flowers, we can find the basis for the pattern distribution principle of ice window flowers and also provide theoretical support for the feasibility of artificial creation of ice window paintings. The beautiful graphics created by the joint efforts of nature and human beings provide ideas and creative ways for the original graphics of ice window grilles. In the promotion of dew ice flower’s graphic creativity, the specific application method of the graphic distribution law of ice window flowers in the creation of visual graphics is studied, in line with the style of balanced elements, and the repetition, arrangement, and contrast changes of dew ice flower graphic elements are emphasized, pay attention to the unity, and change of the image characteristics of the design graphics. People understand the spirituality of water and ice through perception and feeling of ice flowers. Only after there are people and windows can nature create a canvas for the painting of ice window flowers. People and nature live in harmony to create a wonderful natural landscape. In life, people need to have the eyes and ability to discover beauty, listen to the voice of nature, feel the subtle connection between nature and people, communicate and cooperate with nature more, and create more beautiful works that conform to the laws of nature. This research is only for the research object of ice flower, the research of artistic visual image design, so it can be extended to other research objects to carry out the research of artistic visual image design.

Data Availability

No data were used to support this study.

Conflicts of Interest

These are no potential competing interests in my paper. I confirm that the content of the manuscript has not been published or submitted for publication elsewhere.

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