EAI Endorsed Transactions
on Scalable Information Systems
Research Article **EAI.EU**

Visual Design of Digital Display Based on Virtual Reality Technology with Improved SVM Algorithm

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Abstract

INTRODUCTION: With the rapid development of virtual reality (VR) technology, digital displays have become increasingly important in various fields. This study aims to improve the application of virtual reality technology in the visual design of digital displays by improving the support vector machine (SVM) algorithm. The visual design of digital displays is crucial for attracting users, enhancing experience and conveying information, so an accurate and reliable algorithm is needed to support relevant decisions.
OBJECTIVES: The purpose of this study is to improve the SVM algorithm to more accurately identify features related to the visual design of digital displays. By exploiting the nonlinear mapping and parameter optimization of the SVM algorithm, it aims to improve the performance of the model so that it can better adapt to complex visual design scenarios.
METHODS: In the process of achieving the objective, multimedia data related to digital displays, including images and videos, were first collected. Through feature engineering, features closely related to visual design were selected, and deep learning techniques were applied to extract higher-level feature representations. Subsequently, the SVM algorithm was improved to use the kernel function for nonlinear mapping, and the penalty parameters and the parameters of the kernel function were adjusted. Cross-validation was used in the training and testing phases of the model to ensure its generalization performance.
RESULTS: The improved SVM algorithm demonstrated higher accuracy, recall and precision compared to the traditional method by evaluating it on the test set. This suggests that the model is able to capture visual design features in digital displays more accurately and provide more reliable support for relevant decisions.
CONCLUSION: This study demonstrates that by improving the SVM algorithm, more accurate visual design can be achieved in digital displays of virtual reality technology. This improvement provides reliable algorithmic support for the design of digital displays and provides a more prosperous, immersive experience for users. Future research can further optimize the algorithm and iterate with user feedback to continuously improve the visual design of digital displays in virtual reality environments.

Keywords: svm algorithm, virtual reality, digitization, visual design

Received on 29 September 2023, accepted on 4 March 2024, published on 5 March 2024

doi: 10.4108/eetsis.4881

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1 Introduction

In today's digital era, Virtual Reality (VR) technology is gradually coming into its own, bringing unprecedented opportunities to various industries(Lian, 2021). Among them, digital display, as a compelling form, has become an essential medium for information delivery, creative expression and user experience. The success of a digital display depends not only on the content itself but also on the innovation and attractiveness of its visual design(Ek Styvén et al., 2022). With the continuous development of VR technology, traditional digital displays can no longer meet the demand for a more immersive, interactive and engaging experience. Therefore, the question of how to improve the visual design quality of digital displays through virtual reality technology has become a topic of great interest. In this context, the choice and performance of algorithms become crucial(Magistretti et al., 2021). Support Vector Machine (SVM), as a classical machine learning algorithm, is widely used in the field of pattern recognition and data classification. However, in the complex environment of digital displays, traditional SVM algorithms may face challenges in nonlinear relationships and multimedia data processing. To overcome these limitations, this study looks at improving SVM algorithms to enhance their applicability and performance in digital display visual design(Wen et al., 2021). By introducing advanced feature extraction techniques and model optimization strategies, it aims to enable the improved SVM algorithm to capture visual features in digital displays more accurately, thereby enhancing the overall user experience(Xu & Mi, 2021). This research is not only expected to advance the integration of digital displays with virtual reality technologies but also provide designers and developers with more powerful tools to create more creative and engaging digital displays. In this evolving digital landscape, the exploration of this study will help open up new possibilities for merging virtual reality and digital design into a more seamless and awe-inspiring experience.

2. Related work

With the wide application of virtual reality (VR) technology in the digital field, the design and algorithm optimization of digital displays has become a hot research topic. Previous research has focused on the application of virtual reality technology in digital displays(Zhdanov et al., 2023). This includes the use of VR to create immersive digital exhibitions, interactive presentations, and design solutions based on virtual environments(Morcillo Juli et al., 2022). Advanced VR hardware and software have driven the upgrading of the digital display experience. However, challenges still need to be addressed regarding how to optimize the visual design of digital displays. Past research has focused on the broad application of virtual reality technology in the field of digital displays(Zhao, 2022). This work includes the use of virtual reality (VR) to create immersive digital exhibitions, interactive presentations, and design solutions based on virtual environments(Guo et al., 2023). With the continuous development of advanced VR hardware and software, the digital display experience has been significantly enhanced. The introduction of virtual reality has provided audiences with a new perceptual experience, allowing digital content to be presented more vividly and engagingly (Li, 2021). However, despite the rapid development of these technologies opening up new possibilities for digital displays, there is still a challenge: how to optimize the visual design of digital displays better (Bourgeois-Bougrine et al., 2022). Even with the strong support of virtual reality, designers are still faced with the problem of how to combine creativity, user experience and messaging effectively. How to design more engaging and interactive digital displays in virtual environments remains an issue that requires in-depth research(Lin & Chen, 2021). At the root of this challenge is the fact that the success of digital displays depends not only on technological sophistication but also on a deep understanding of user needs and design principles. Digital displays are designed to convey messages, resonate, and provide unique and memorable experiences. Therefore, how to integrate innovative design concepts in digital displays to maximize their presentation in virtual reality environments remains a problem to be solved. Through this study, it is expected to provide a more precise visual design approach to meet the diverse needs of digital displays better.

As a robust machine learning algorithm, SVM has been widely used in the fields of image processing and pattern recognition(Qiu et al., 2021). However, traditional SVMs may exhibit certain limitations when dealing with large-scale and high-dimensional multimedia data, especially in modeling nonlinear relationships(Urmanova & Khamraeva, 2021). Support vector machine (SVM), as a superior machine learning algorithm, has long occupied an essential position in the fields of image processing and pattern recognition(Bo, 2021). In previous studies, scholars have focused on the excellent performance of SVM in image classification, target recognition and feature extraction. Its powerful classification ability and generalization have enabled SVM to achieve remarkable success in processing various forms of visual data(Wan et al., 2021). Despite the excellent performance of SVM in traditional image processing tasks, with the development of digital display and other fields, it is gradually realized that traditional SVM may face certain limitations when dealing with large-scale and high-dimensional multimedia data. In digital displays, complex nonlinear relationships and highly abstract feature representations are usually faced, which are beyond the processing scope of traditional SVM(Chang et al., 2022). Especially when dealing with visual design tasks in digital displays, the need for more complex and richer feature representations becomes more and more significant. Traditional SVMs are inadequate in modeling nonlinear relationships and thus need to be improved to accommodate the complexity of these multimedia data(Kang et al., 2021).

By introducing a more flexible model structure and advanced feature extraction techniques, it is expected to overcome the challenges of traditional SVM in handling digital presentation tasks, thus improving the applicability and performance of the algorithm(Dangi et al., 2021). This is the motivation for working on improving SVM algorithms.

In order to capture visual features in digital displays more accurately, researchers have explored advanced feature engineering techniques and deep learning methods. Deep learning architectures such as convolutional neural networks (CNNs) have been introduced to extract higher-level, semantically rich feature representations(Dubey et al., 2021). These approaches help improve model performance but also present challenges in terms of computational complexity and data requirements(Silva et al., 2021). Several studies focus on user experience and design evaluation of digital displays. Through user surveys, eye tracking, and other methods, researchers have explored the influences on the design of digital displays. However, at the algorithmic level, there still needs to be a gap in how to automate the design optimization.

3. Introduction to the research methodology

3.1 SVM algorithm

Support Vector Machine (SVM) is a robust supervised learning algorithm widely used in classification and regression problems. The main goal of SVM is to find an optimal hyperplane in the feature space that effectively separates data points of different classes.

SVMs were initially conceived to solve linearly separable problems, which describe an ideal situation where two different classes of samples can be completely separated from each other by a hyperplane. This hyperplane is an n-1 dimensional linear subspace, where n represents the number of sample features. In two dimensions, this hyperplane is a straight line; in three dimensions, it is a plane. In higher dimensions, this hyperplane becomes an abstraction of the data feature space with dimension n-1. The choice of this hyperplane is not unique, and the goal of the SVM is to find the hyperplane with the maximum interval, i.e., the maximum distance from the nearest sample points of the two categories. This distance is called the interval (margin). By optimizing this hyperplane, SVM not only achieves good classification of the training data but also enhances its ability to generalize to new samples. The key concept is that SVM is not just concerned with correctly classifying samples but also with the fact that any new samples can be correctly classified on one side of the hyperplane. This focus on intervals makes the SVM robust to noise and outliers.

In SVM, support vectors are the training sample points closest to the hyperplane. These key sample points are crucial for defining the hyperplane and decision boundaries, as they directly affect the performance and generalization ability of the final model. Support vectors have the unique property that they lie just between two different classes of data points with the closest distance to the hyperplane. This distance is known as the support vector-to-hyperplane interval, and it is one of the essential goals of optimization in SVM. By maximizing these support vector-to-hyperplane intervals, SVM is able to create a more robust classification model. The support vectors are not only crucial for defining the location of the hyperplane, but they also directly affect the decision boundary of the SVM. In SVM, the decision boundary is determined by the support vectors, which is a crucial concept. Because these vectors are the closest points to the hyperplane, their location and distribution determine the model's classification decisions for new samples. The performance and generalization ability of a well-trained SVM model relies heavily on these key support vectors, which is why SVMs remain effective when dealing with large-scale datasets, as the focus of attention is primarily on the support vectors. By focusing on these key sample points, SVM achieves a high degree of optimization for decision boundaries, making the model more robust and better able to adapt to new data. Support vectors thus play an indispensable role in the successful application of SVM, providing a solid theoretical foundation for its excellent performance on classification problems. The SVM classification schematic is shown in Figure 1.

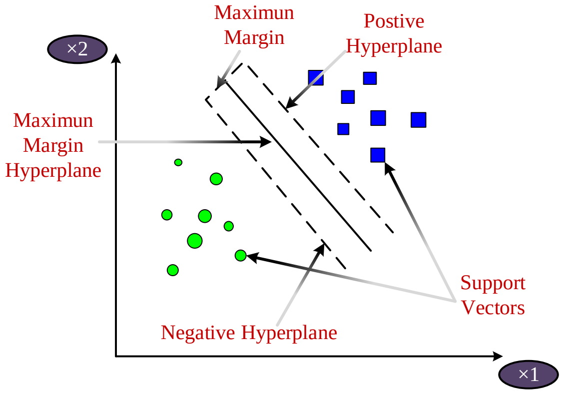

Figure 1 Schematic diagram of SVM classification

In Support Vector Machines (SVMs), the central goal is to find a hyperplane such that the distance (called the interval) to this hyperplane is maximized for two support vectors of different classes. This hyperplane divides the different classes of data points in the feature space, and the support vectors are the closest sample points to this hyperplane. The core idea of this concept is to improve the generalization performance of the model, i.e., its ability to classify new samples, by maximizing the distance from the support vector to the hyperplane. During training, maximizing the spacing is equivalent to having the model avoid as much noise and variation in the training data as possible by placing the decision boundary furthest away from the category boundary. Such a model is more likely to classify accurately when confronted with unseen data because it is trained to be more sensitive to the essential structure of the data rather than relying too heavily on specific features of the training data. By maximizing the spacing, SVM is not just an effective classifier but also has strong generalization properties, which makes SVM a powerful tool for linearly differentiable and nonlinear problems, setting the stage for its successful application in a variety of fields. The power of SVM lies in its ability to handle nonlinear problems. By using kernel functions, SVMs can map input features to higher dimensional spaces, making nonlinear problems linearly differentiable in higher dimensional spaces. Commonly used kernel functions include linear kernels, polynomial kernels, and radial basis function (RBF) kernels. Data are usually not entirely linearly differentiable. To deal with noise and outliers, SVMs introduce soft intervals that allow some sample points to lie within the interval. The regularization parameter is used to balance the trade-off between maximizing the interval and tolerating the error. The training process of SVM can be transformed into a convex optimization problem. By minimizing the regularization and error terms, the optimal hyperplane parameters can be obtained. For multiclass classification problems, the SVM can be extended to the multiclass case using a one-to-one (One-vs-One) or one-to-rest (One-vs-Rest) strategy.

$$\begin{aligned} &For\ all\ the\ Red\ points\ \vec{\omega}.\vec{X}+b\leq -1 \\ &For\ all\ the\ Red\ points\ \vec{\omega}.\vec{X}+b\geq -1 \end{aligned} \quad (1)$$

Obtain the optimization function, consider that way to compute the distance, and any positive or negative points cannot cross the edge line. Classify each point correctly, as shown in the optimization function and its constraint graph in Figure 2.

$$y_i(\vec{\omega}.\vec{X}+b)\geq 1 \quad (2)$$

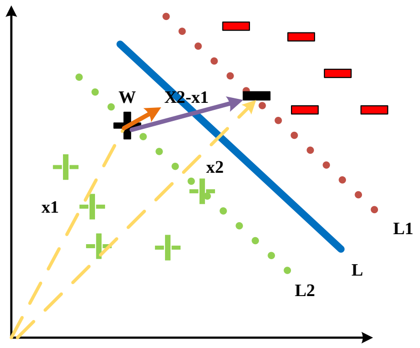

Figure 2 Optimization function and its constraint graph

SVM is well known for its ability to handle linear and nonlinear problems in high-dimensional spaces and its contribution to generalization performance. It has achieved remarkable success in areas such as image recognition, text categorization, and bioinformatics. Although the theory of SVM is more complex, its intuitive geometric interpretation and good generalization performance make it one of the essential algorithms in the field of machine learning.

3.2 Virtual Reality Technology and Visual Design

A methodology for integrating computer graphics and intelligent connectivity is proposed from basic concepts and features. This integrated technology includes mouth technology, sensing technology and network technology. A virtual reality (VR) system should have the ability to interact with the user with real-time feedback and anti-interference features, such as immediate response to interactive results. Therefore, a general-purpose VR system is mainly composed of a professional graphics processing computer, an application software system, an input/output device and a database. Figure 3 shows the composition of the virtual reality system.

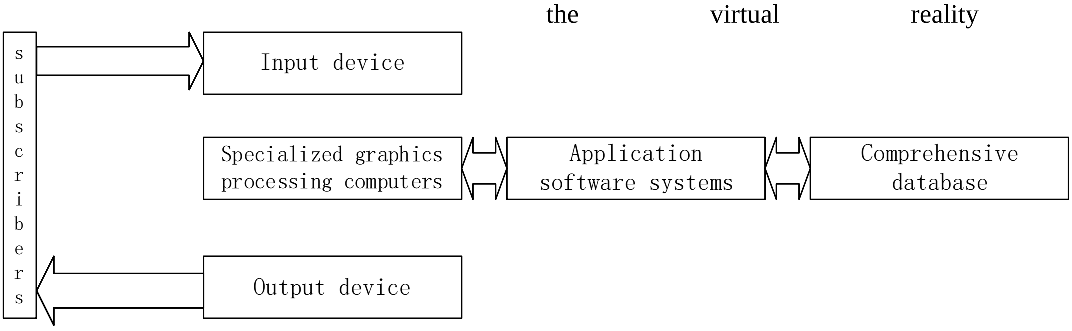

Figure 3 Components of the virtual reality system

Virtual Reality (VR) technology is a computer-generated virtual environment simulated through computer technology that enables users to feel an immersive experience.VR technology simulates the virtual world through computer-generated images, sounds, and other sensory stimuli to make the user feel as if they are in a natural or fictional environment. Virtual reality emphasizes the interactivity of the user with the virtual environment, enabling the user to interact with the virtual world in real-time through head tracking, gesture recognition, and other technologies.VR technology strives to create a strong sense of immersion, enabling the user to be completely immersed in the virtual environment and ignore the natural world around them. Virtual Reality systems need to provide instant and precise feedback to ensure that the user's movements and sensations in the virtual environment are responded to in a timely manner, enhancing the sense of realism. By combining multiple senses, such as vision, hearing, and touch, virtual reality technology attempts to provide a more realistic and comprehensive perceptual experience. Virtual reality usually requires specialized hardware devices, such as head-mounted displays (VR headsets), joysticks, sensors, etc., to provide user interaction with virtual environments.VR technology has been applied in a variety of fields, including, but not limited to, gaming, healthcare, education, military, and architectural design, to provide users with brand-new experiences and training environments. Only virtual reality technology still faces some challenges, such as solving technical problems in motion sickness, improving the realism of images and sounds, and reducing the cost of equipment. Overall, virtual reality technology is constantly developing and evolving to provide people with more affluent, immersive and interactive experiences, expanding the application prospects of many industries.

Virtual Reality (VR) technology presents unique challenges and opportunities in the field of visual design. Here are the key factors to consider when practicing visual design: the look and feel of the virtual environment is critical to the user experience. Designers need to consider factors such as color, lighting, and texture to create a pleasing and realistic virtual scene. In virtual reality, the design of the user interface needs to consider maneuverability and visibility in three-dimensional space. The rational arrangement of menus, buttons and interactive elements ensures that users can easily and intuitively interact with the virtual environment. As users can move freely in the virtual environment, designers need to consider how to guide users' eyes and movements to ensure that they can easily understand and explore the virtual space. The use of animation and transition effects can enhance the realism of the virtual environment and make user interactions smoother. However, overuse may lead to a sense of motion sickness and, therefore, needs to be used with caution. If the virtual scene contains objects, buildings, or other elements, the designer needs to pay attention to their appearance, size, and interactivity. Make sure that the virtual object feels consistent and natural in its interaction with the environment and the user. In virtual reality, the user's feeling and experience directly affects their engagement.

Designers should consider how to provide real-time and realistic feedback through visual means, such as dynamic shadows and material changes. Since virtual reality usually requires a lot of computation and graphic processing, designers need to optimize graphic elements and effects to ensure that they run smoothly on a variety of hardware devices, and it is crucial to conduct user testing after the design is complete. Gathering user feedback on how they feel in the virtual environment allows for further improvement and optimization. Visual design for virtual reality technology involves more dimensions and complexity, requiring designers to constantly learn and adapt to new tools and techniques in order to create engaging and stunning virtual experiences.VR sales are shown in the figure.

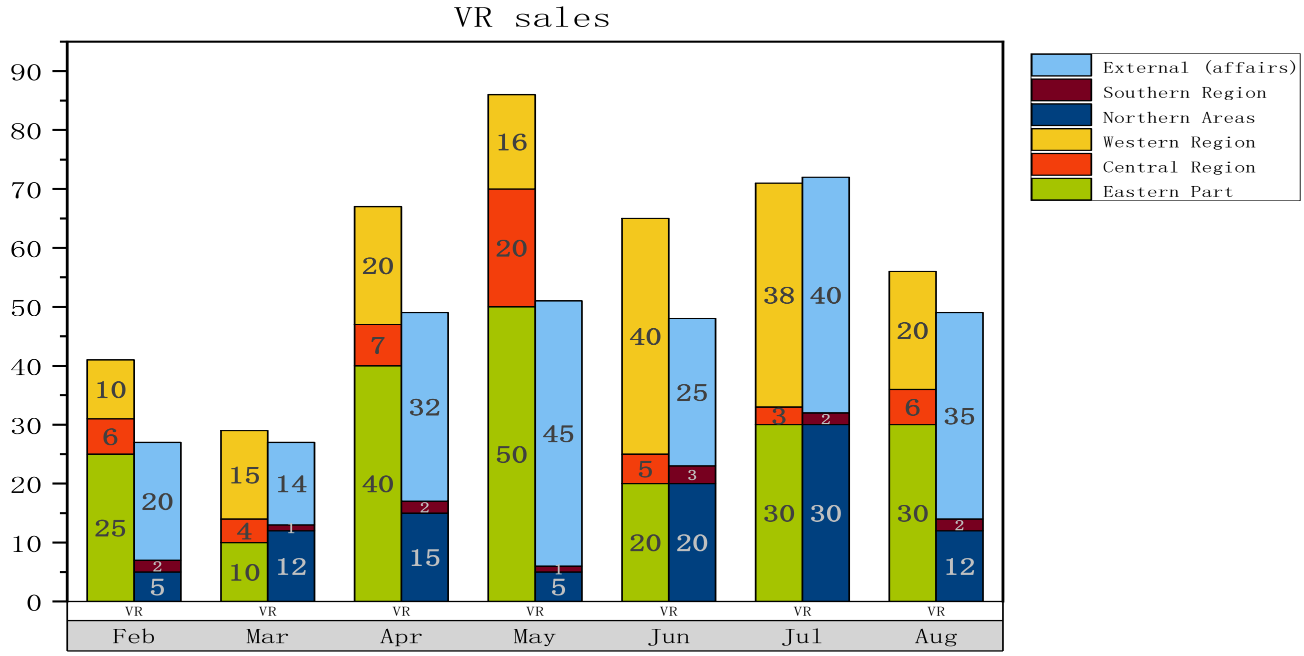

Figure 4 VR Sales Chart

4 SVM algorithm design results

4.1 Empirical evidence of SVM algorithm results

This project proposes to experimentally select three different virtual sampling parameters to construct virtual samples and verify the improvement in recognition performance of the proposed virtual sampling method by comparing it with the original training set of 1:1 and the training set with noise added. The research object of this project is the publicly available ORL visual design library. Based on this, multiple virtual samples will first be generated from the original data, and their dimensionality will be approximately reduced. A spatial correlation will be introduced on this basis. The training samples will be dimensionally reduced and introduced into the recognition model to model and train them. In this study, PCA is used as the principal component analysis as the feature extraction method. SVM is used as the classifier to select more than 90% of the principal components, and a radial basis function of 0.35 is used for the recognition.

On this basis, three virtual sample interpolation algorithms based on resampling are proposed. Among them, the nearest-neighbor interpolation method produces intermittent jagged texture on the resulting virtual sample images; the bilinear interpolation algorithm is more computationally intensive and can effectively suppress the jagged effect, but its characteristics make it lose some high-frequency components during processing; the quadratic interpolation method can process the sample data very accurately, but the computational effort is significant. From the ORL visualization design database, 2-5 pictures are randomly selected as training samples, and the remaining pictures are test samples to decide the interpolation parameter values in the resampling virtual sample method. On this basis, three different interpolation algorithms are extended in the ratio of 1:1 and co-trained with the original samples to study their effects on the training results. Based on this, principal component analysis is downscaled, and a support vector machine is used for its training and identification. The final result is the average value after 5 times of re repetition. As shown in Figure 5.

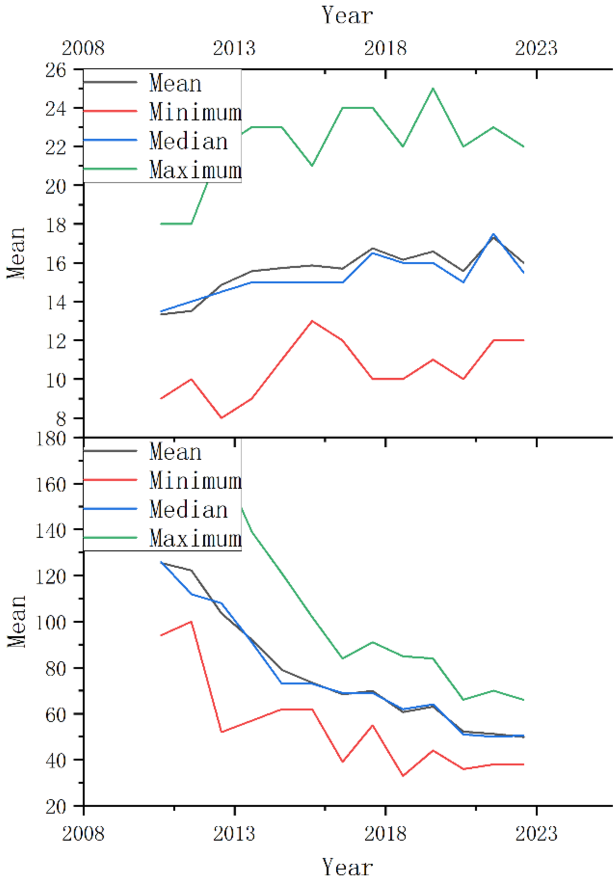

Figure 5 SVM algorithm results.

Figure 6 shows the European mean of the feature vectors of the training and test sets after different resampling. From the results in Figure 6, it can be seen that the virtual sampling constructed by adding the three interpolated resampling virtual sampling methods has the Euclidean distances between the feature vectors closer to each other than the original training samples and the amount of mutual information between the feature vectors have been improved. The experimental results show that the method is effective, that the mean value of the Euclidean distance is minimized, and that the value of the mutual information is maximized when the bilinear interpolation method is used. This is also consistent with the identification results. Based on this, a resampling virtual sample interpolation method based on bilinear interpolation is proposed.

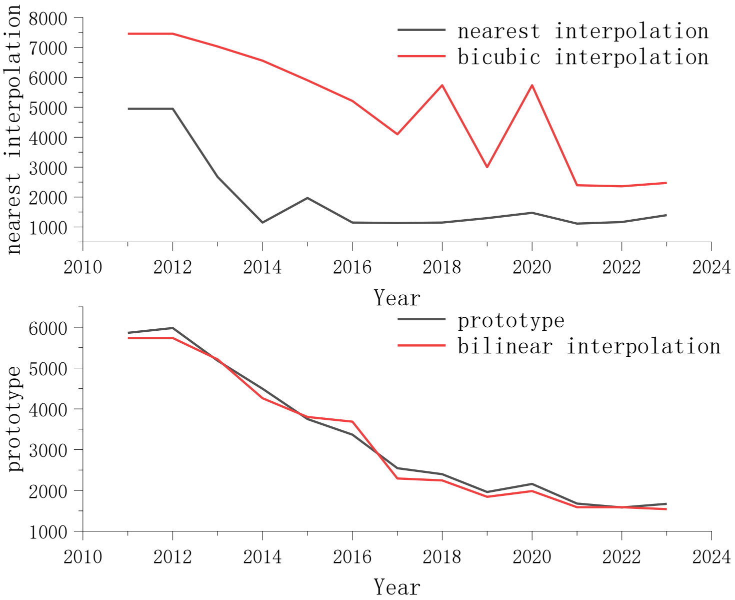

Figure 6 Comparison of mean Euclidean distance between different interpolated resampled sample feature vectors

The following is the process of PSO-SVM parameter optimization:

(1) Initialization. Initialize the constants such as d,1c,2c, etc., and choose the penalty parameter C and the parameter g of the radial basis function as the coordinates of the particles.

(2) A genetic algorithm based on genetic algorithm is proposed and optimized. On this basis, an adaptive function based on least squares support vector machine is proposed. The algorithm takes the current position of the particle as the individual minima and its maximum value as the initial global minima.

(3) According to

The equation $V_{id}^{k+1} = \omega V_{id}^{k} + c_1 r_1 (P_{id}^{k} - X_{id}^{k}) + c_2 r_2 (P_{bd}^{k} - X_{id}^{k})$ is the same as

style $X_{id}^{k+1} = X_{id}^{k} + V_{id}^{k+1}$

An iterative calculation is performed to update the position and velocity of each particle.

(4) The fitness value of the iteration point is derived using the fitness function;

(5) When the adaptation value of the particle is more significant than its maximum value, the maximum value is updated, and if not, the previous maximum value is kept. When the adaptation value of the particle is greater than the global extremum, the global extremum is updated, and if not, the original optimal solution is maintained.

(6) Determine whether the end condition is satisfied. When satisfied, the operation ends. Otherwise, go to step (3) and perform the operation.

(7) On this basis, build the support vector machine.

Figure 7 shows the optimal fitness curves of contour area, contour extension length, and spot area features based on the DRLSE model with the maximum fitness value of the particle population as the average fitness. The optimal recognition rate of the algorithm reaches 91.547% during 20 iterations, in which the penalty value C=14.2154 and the RBF kernel function g=1.124.Comparing Figs. 7 and 6, it can be seen that when searching for the optimal parameter of the SVM, the fluctuation of the average fitness of the algorithm using the PSO algorithm is more significant than that of the GA-SVM, and its optimal fitness is lower than that of the GA-SVM. SVM is lower.

On this basis, a new training set was added in a 1:1 ratio. However, in practical applications, the ratio of virtual samples added is necessary to be explored. In this section, two machine learning methods, namely, Support Vector Machines and DBNs, will be utilized to examine the effect of virtual samples added on the recognition effect. Based on this, five images will be randomly selected from the training set. Three different virtual samples will be used to expand the 1, 2, 3, 4, and 5 images to form the corresponding virtual images. Five trials will be conducted together with the training set, and finally, the average value will be taken. In Figure 7, the results of other trials using SVM are illustrated. It is shown that if different ratios of virtual samples are added to the image, it will affect the final recognition result to some extent. The recognition rates of the three virtual samples did not monotonically increase and decrease after adding different ratios but fluctuated in the range of 1% to 2%. However, the 1:1 ratio does not achieve the highest recognition rate, and this experiment shows that there is a specific ratio for adding virtual samples, and the ratios for adding virtual samples produced by different methods are different. The specific appropriate ratios need to be further investigated.

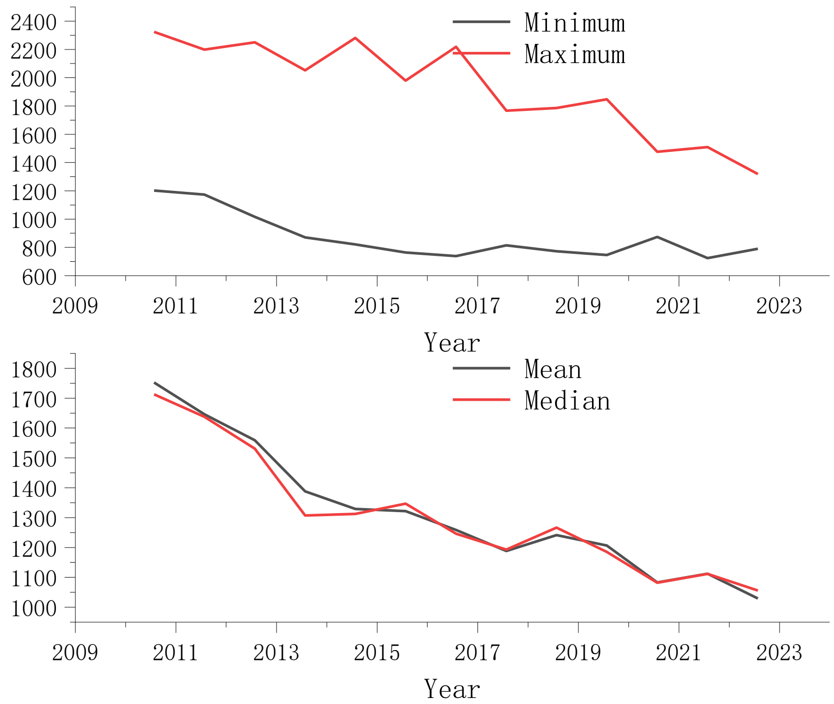

Figure 7 Characteristic PSO-SVM-based fitness optimization curve

4.2 Visual Design Strategies for VR Technology

In graphic design, designers use depth information to represent the spatial positional relationship between 2D elements, usually by using perspective angles, size, occlusion (lack of contour), and color changes caused by shadows. These kinds of cues are generally based on ordinary phenomena in nature to fit the corresponding visual illusion sensory information, which allows people to quickly perceive the back-and-forth relationship between the target and the target. Therefore, in a virtual reality environment, users can directly perceive the distance and distance of static optic elements through a variety of depth cues, in addition to observing changes in the stereoscopic perspective of different objects through their movements.

Static information refers to visual information with graphical elements as the main content and the design of graphical elements is to represent the semantics of the corresponding information visually on the application logic layer. The original abstract logical relationships are transformed into graphics so that users can cognize and interact normally. The main attributes of graphical elements are shape, size, orientation, color, and material.

(1) Shape. The form of a graphic is a specific, finite visual shape with certain spatial limitations. The basic units of graphics are zero-dimensional, one-dimensional, surface, and three-dimensional. Among them, the point forms a line, the line forms a surface, the surface forms a body, and the body element design is essential in the virtual reality world.

(2) Size. The scale of a graphic is a specific description of the length, width, and height of a graphic in a particular unit. In graphic design, the larger the size of a graphic, the larger the field of view it represents, which means a better visual effect or better visual orientation.

(3) Color. Color is the human eye's perception of light waves, leaving a subjective image on the retina; color has three essential elements: hue, brightness, and purity. Purity is used to indicate the brightness of the color, brightness is used to indicate the brightness and darkness of the color, and hue is used to differentiate the wavelength of the color. Great color design can convey different emotions.

(4) Texture. The texture of a graphic is an overlay, or an additional coded index, on a graphic of a particular shape, size, and color. In a virtual scene, dynamic effects, like flames, can also be considered textures.

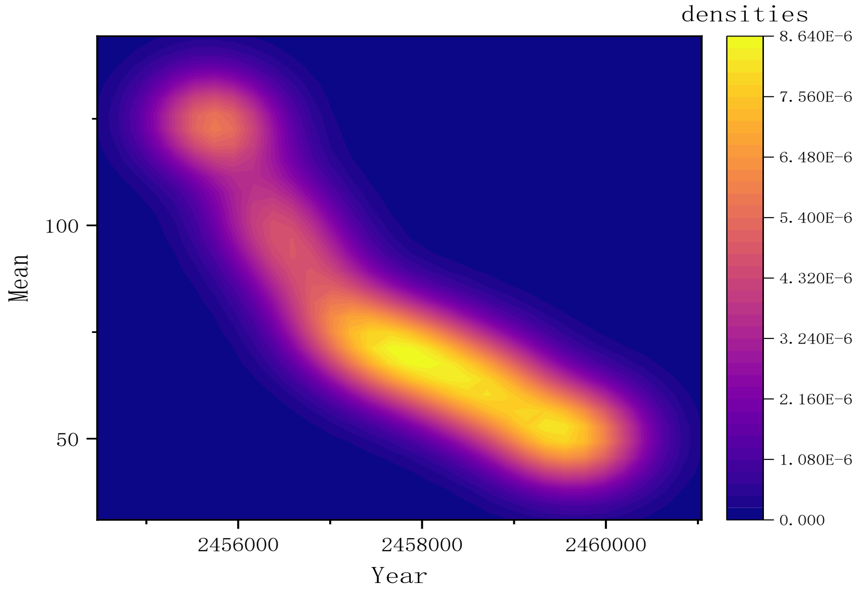

Figure 8 VR thermal perception map

Figure 8 shows a diagram of thermal sensing for VR, which is a technology that enhances the virtual experience by sensing and modeling heat. The following are some of the possible aspects involved: some VR devices may be equipped with thermal feedback technology that allows the user to feel the difference in temperature of objects in the virtual world. This can be achieved by embedding heating or cooling elements in the device. Algorithms at the software level can simulate the temperature of different areas in the virtual environment. This involves modeling the thermal properties of objects, surfaces, and environments in the virtual world in order to simulate realistic thermal sensations. Some systems may utilize the user's physiological responses, such as heart rate, skin temperature, etc., to adjust the perception of temperature in the virtual environment, which may be used to enhance the user's emotional experience or to create a more realistic virtual experience. Thermal sensing technology may also be used in the medical field, for example, to simulate temperature perception in surgery or training. Such applications can provide a more realistic training experience and help professionals better prepare for real-life situations.

After choosing VR technology for the creation, various virtual software provides technical and functional support for the creation. The first thing he has to do, in the process, is to build a 3D model that can be easily modified using digital tools. And it is also possible to change people's form to people's liking. Moreover, the created graphic can be viewed on the computer using a virtual space to see the effect of the design from multiple angles. In the graphics, it is also possible to pre-predict all the elements needed in the environment to be placed, such as characters, backgrounds, lighting, sound effects, etc., that are equated with real life, using digital pre-positioning. In addition, since the materials in the industry are now quite mature, with the soft mapping effect, advanced 3D printers can be used to accomplish the desired effect. It will not mess up everything just because of the specificity of the materials and tools. The use of virtual technology in art design is both convenient and efficient.

Interactivity is the most prominent feature of virtual reality technology and also its most significant advantage. VR technology can let every sense of the audience be integrated into the game so that the audience can feel the uniqueness and charm of the art and thus get a unique visual experience, which is also the most prominent feature of VR technology. In addition to visual feeling, other sense organs can also get the intuitive feeling, which is incomparable to traditional artworks. Digital display can make the relationship between people and art change so that the two are no longer strangers and there is no barrier; the audience can not only have a direct view of the work but also, through the interactive function, participate in this activity, learn more and get more information. In traditional art communication, the best form of expression is to put the works there and, at the same time, put a short video or sound introduction; the audience can only get the information corresponding to it through hearing and vision, the sense of smell, touch and so on have not been fully mobilized. VR public art not only breaks through the limitation of time and space but also allows the audience to have an immersive feeling as if they are standing on an actual stage. In the natural stage, the audience's curiosity can be stimulated entirely, and all senses can be activated. Virtual reality brings the distance between the audience and the work very close so that the audience can see and feel it immersively.

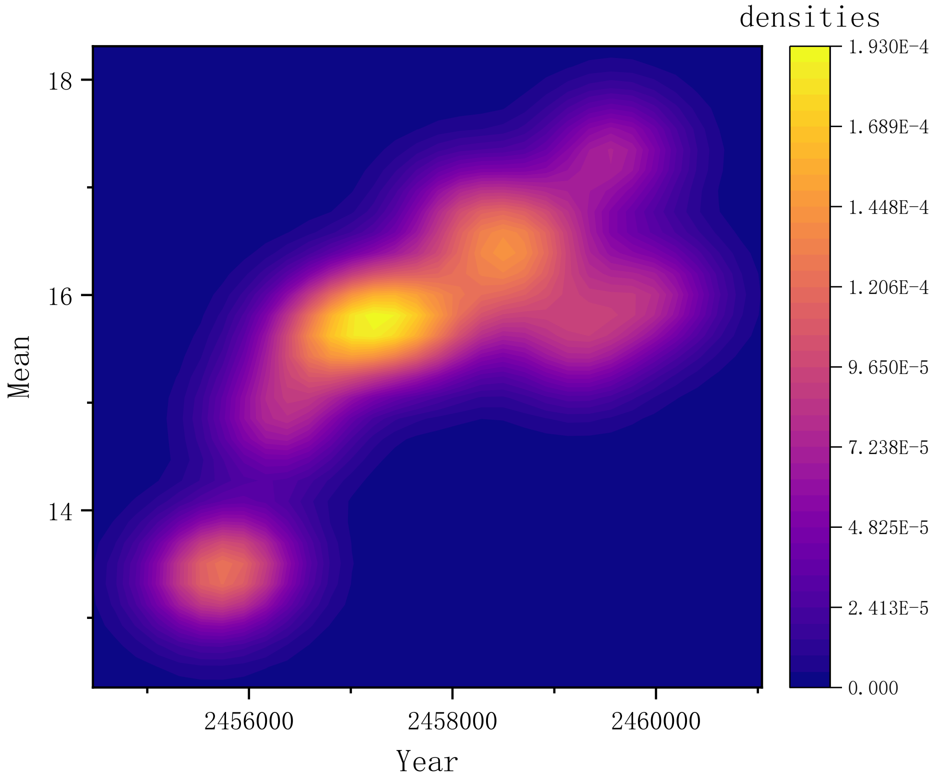

Figure 9 VR visual perception

Virtual Reality (VR) visual perception is the ability to perceive and experience in a virtual environment through the visual system. Here are some of the main aspects related to VR visual perception: High-resolution displays, and realistic graphics are essential parts of VR visual perception. Higher resolution provides a more explicit, more realistic virtual scene and improves user immersion. Field of view is the extent of the user's visible field of view in a VR head-mounted display. A larger field of view enhances the virtual reality experience, making it feel more accurate and comprehensive to the user, and a high frame rate is critical to avoid motion blur and provide a smooth visual experience. Higher frame rates reduce vertigo and discomfort and improve the user's visual perception.VR devices are often equipped with sensors and tracking technology to enable spatial localization and motion tracking of the user in the virtual environment, which helps to ensure that the user's virtual and real-world movements are synchronized to enhance immersion. With stereo audio and 3D sound, VR can provide a more realistic perception of sound, enabling the user to perceive and locate sound sources in the virtual environment. Some advanced VR systems are equipped with eye-tracking technology that detects the user's gaze point and eye movements, which can be used to improve user interface, interaction and depth perception. Simulating real-world lighting and shadow effects in VR can increase the realism of a virtual scene and improve the user's perception of depth and spatiality. The goal of VR visual perception is to create a realistic, immersive, and enjoyable virtual experience where the user feels as if they are in an environment that is similar to, or completely different from, the real world. Ongoing advances in technology will continue to drive improvements in VR visual perception.

5 Conclusion

In terms of the visual design of digital displays for virtual reality technology based on the improved Support Vector Machine (SVM) algorithm, the following conclusions have been drawn from the research and implementation methods. First, the research proved that the improved SVM algorithm has significant benefits in the visual design of digital displays for virtual reality technology. By using the optimized SVM algorithm, the accuracy and efficiency of digital displays were successfully improved. This algorithm improvement provides more powerful classification and decision support for virtual reality design, presenting users with a more in-depth and realistic experience. Second, the visual design of digital displays focuses not only on the improvement of technical performance but also on the improvement of user experience. The approach goes beyond improving the accuracy of algorithms to better integrate visual elements from virtual reality to create engaging and immersive digital displays. This provides users with a richer, more vivid visual experience. In addition, research has shown that improvements to SVM algorithms have made virtual reality technology more adaptable and customizable. This flexibility means that the needs of different application areas and user groups can be better met. This opens up new possibilities for the widespread use of digital displays in various industries and scenarios. In summary, significant results have been achieved through the visual design of digital displays based on virtual reality technology with improved SVM algorithms, contributing valuable experience and insights to the development of the virtual reality field. In the future, it is expected to continue to advance the research on this basis further to improve the digital display level of virtual reality technology and make more contributions to create more engaging virtual experiences.

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