International Journal of Cognitive Informatics and Natural Intelligence
Volume 19 • Issue 1 • January-December 2025

Research on the Application of Intelligent Algorithms in Color Matching in Painting

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ABSTRACT

This paper aims to explore the transformation of art creation methods by technology. Color, as the core of visual art, traditionally relies on the artist's personal experience, intuition, and color theory. With the development of artificial intelligence technology, intelligent algorithms have achieved functions such as color intelligent matching, style transfer, and real-time rendering through deep learning and big data analysis, providing new possibilities for artistic creation. Comparative experiments show that intelligent algorithms outperform traditional methods in terms of color harmony, style consistency, and creative efficiency and significantly improve user satisfaction and color matching accuracy.

KEYWORDS

Intelligent Algorithm, Color Matching in Painting, Application Research

INTRODUCTION

Throughout the long development of human civilization, color has always played a crucial role as the core element of visual art (Lu et al., 2020). Color not only enriches the visual experience, but also profoundly influences human emotional expression, aesthetic concepts, and even cultural identity (Qiao & Feng, 2022). However, traditional color matching art is not achieved overnight (Sheng et al., 2019). It requires creators to have a profound theoretical foundation in color, a keen aesthetic perspective, and rich practical experience (Sun et al., 2019). With the rapid development of technology, especially the rise of artificial intelligence technology, intelligent algorithms have gradually penetrated the function of color matching in the field of painting, bringing unprecedented changes to artistic creation (Tian, 2022a). Through deep learning and big data analysis, intelligent algorithms can achieve intelligent color matching, style transfer, and real-time rendering, greatly expanding the possibilities of artistic creation (Tian, 2022b). This article aims to explore the application of intelligent algorithms in color matching in painting in order to reveal their transformation in artistic creation methods. By comparing experimental data, I found that intelligent algorithms exhibit significant advantages over traditional methods in terms of color harmony, style consistency, and creative efficiency. Especially in the subdivision indicators of color harmony, intelligent algorithms outperform traditional methods in brightness, saturation, and contrast matching. In addition, user satisfaction and color matching accuracy have also significantly improved. By studying the application of intelligent algorithms in color matching in painting, this article hopes to provide a new perspective for the practice of artistic creation and aid in the creation of more visually impactful works of art.

DOI: 10.4018/IJCINI.376482

LITERATURE REVIEW

Chen et al.(2024) article analyzed the characteristics and combinations of colors, and explains how to combine colors to express artistic effects. He observed in the article that excellent paintings can quickly enter the audience's sight and leave a first impression. Therefore, the question of how to accurately reflect the concept of a work through color matching has become a focus of modern painting and is one of the key points of this study. Chen et al.(2023) briefly elaborated on the basic characteristics and main forms of expression of modern painting, as well as the aesthetic features of traditional colors, and proposed some ways to better grasp traditional colors in modern painting. The emotional expression of traditional colors in modern painting is similar to the application of intelligent algorithms in style transfer of painting colors mentioned in this study. Deng et al.(2022) took the painting *Thousand Miles of Mountains and Rivers*, by Wang Ximeng, a court painter from the Song Dynasty, as their research object. Based on an improved K-means algorithm, they extracted color features from the painting and used color network models and Hue, Saturation, Value mapping models to complete its color feature analysis and matching design. Their research and analysis methods have provided significant assistance to the author's research, enabling me to gain a deeper understanding of the application of intelligent algorithms in color matching in painting.

Ding et al. (2021) introduced Intelligent Scissors and Intelligent Paint as techniques that utilize a watershed algorithm called “tobogganing” for image segmentation. Intelligent Scissors formulates segmentation as a graph searching problem, while Intelligent Paint uses an adaptive, cost-ordered connected component labeling scheme. Duan et al. (2021) proposed the HSILMD method for lane marking detection, which converts full-color images into the HSI color representation within a region of interest to detect road surfaces. The method records the difference in intensity distribution of pixels within the region of interest and clusters them using a fuzzy c-means algorithm. Gou et al. (2012) presented a generalized color segmentation technique for obstacle recognition in mobile robot navigation. This technique aims to detect obstacles that may not be properly identified by LADAR systems because of shadowing, potentially offering a more versatile and faster approach compared to traditional color segmentation methods.Guo et al. (2022) introduced an adaptive, unsupervised approach for pixel clustering and color image segmentation, focusing on improving the segmentation process. Guo et al. (2020) proposed an algorithm for aerial image segmentation that involves a learning phase and a segmentation phase, utilizing a classification algorithm based on a voting scheme for selected features. Hu et al. (2015) developed a face occlusion detection scheme for intelligent video surveillance systems using skin color ratio and local binary pattern features. The method involves foreground extraction, head detection, feature extraction, and occlusion detection steps. Hua et al. (2023) presented a color transfer pulse–coupled neural network algorithm for enhancing underwater images captured by robotic visual systems in real time. Karimov et al. (2023) introduced a Petri Nets–based generic genetic algorithm framework for resource optimization in business processes. Li et al. (2017) discussed the optimization method in the art painting profession, highlighting the lack of research in this area. Lin (2021) focused on the scientific identification method of painting and calligraphic works of art, proposing a method that combines hyperspectral imaging and Atlas intelligent learning for calligraphy and painting identification using convolutional neural networks.

MATERIALS AND METHODS

Overview of Color Matching in Painting

Color, as the most intuitive and expressive element in visual art, carries rich information and emotions. In painting, color is not only a means of reproducing natural objects, but also an important tool for artists to express emotions, create atmosphere, and guide the audience's gaze (Wang et al., 2024). Its basic elements are shown in Figure 1. Hue, which is the fundamental attribute of color, such as red, yellow, blue, etc., determines the basic appearance of color (Wei, 2021). The saturation