

The Application and Impact of AI in Post-photography Processing: A Discussion from Technology to Art

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Abstract: With the rapid development of artificial intelligence technology, its application in the field of post-photography processing has become an important trend. This study aims to explore the application of AI in post-photography processing and its impact on artistic creation from a technical perspective. Firstly, the research background is outlined, that is, the gradual penetration of AI technology into the field of photographic art. Then, it points out the positive applications of AI in post-photography processing, such as automatic editing, style conversion, image restoration and enhancement, etc., and analyzes the potential of these technologies in improving work efficiency and creating new visual languages. However, the study also identifies some challenges faced, such as issues of originality and ownership rights during AI processing, authenticity and credibility issues, as well as ethical and legal challenges. Especially in artistic creation, the involvement of AI has sparked discussions about the originality of works and the ethics of artists. Finally, the study points out that although AI technology has brought significant changes to post-photography processing, the reasonable application and ethical boundaries in artistic creation still need further exploration and clarification.

Keywords: Artificial Intelligence; Post-Photography Processing; Artistic Creation; Ethical Challenges

1. Introduction

Photography art has been closely related to technological progress since its inception.[1] From the initial black and white film to color photography, and then to the popularization of digital photography, each technological leap has greatly expanded the expressive forms and language of photography. Entering the 21st

century, with the rapid development of artificial intelligence technology, AI applications in image recognition, machine learning, and other fields have gradually matured, highlighting its role in post-photography processing. Initially, AI was only used for simple image analysis and correction, but as algorithms and computing power advanced, AI began to undertake more complex tasks such as intelligent cropping, color adjustment, and image synthesis.[2]

With the widespread application of artificial intelligence technology in post-photography processing, we face a series of new challenges and opportunities. This study aims to explore the application of AI in post-photography processing and analyze in depth how these technologies affect artistic creation from a technical perspective. This article will systematically review the specific applications of AI technology in post-photography processing, evaluate its impact on the artistic creation process and final products, and conduct in-depth discussions on related ethical and legal issues.

The core questions of this study include: How does AI assist post-photography processing technically? What role do the efficiency improvement and creative realization brought by AI play in artistic creation? And what ethical and legal issues does the application of AI technology in post-photography processing raise? Through the discussion of these questions, this study reveals the practical role of AI technology in the field of photographic art and its potential transformative effects. Additionally, this research aims to predict the possible future development directions of AI technology in the field of photography and propose countermeasures and suggestions to help photographers, artists, and related industries adapt to the upcoming technological transformations while enhancing public understanding of AI's role in artistic creation and promoting the harmonious integration of

technology and art.

2 Application of AI Technology in Post-Photography Processing

In the current trend, AI technology has been able to achieve more advanced and detailed image processing functions. For example, through deep learning models, AI can imitate the styles of different photographers and apply them to new photographic works, thus creating unique visual works without human intervention. In addition, AI also demonstrates its powerful capabilities in image restoration, enhancing resolution, and 3D modeling.[3]

2.1 Overview of AI

Artificial Intelligence (AI), especially Machine Learning and Deep Learning, has become a key driving force behind modern technological innovation. [4]The application of AI in the field of image processing is based on a series of complex algorithms that can learn from and extract patterns from massive amounts of image data to automatically perform complex image editing tasks. Currently, the mainstream AI technologies mainly include the following four types:

2.1.1 Machine Learning

Machine learning algorithms enable computers to learn through training data and make decisions or predictions without explicit programming instructions. This capability makes machine learning widely applicable in the field of image processing. For example, by using algorithm models such as Support Vector Machines (SVM) and Random Forests, machine learning systems can identify and classify different features in images, such as edges, textures, colors, etc. The identification and classification of these features provide a basis for subsequent image editing and processing. Specifically, machine learning can be achieved through supervised learning and unsupervised learning methods. In supervised learning, the system learns how to recognize specific objects or features in an image through training with labeled datasets. In contrast, unsupervised learning involves discovering patterns and structures within data through unlabeled data. This method excels in tasks such as image segmentation and image clustering, providing more possibilities for image processing.

2.1.2 Deep Learning

Deep learning is an important branch of machine learning that uses deep neural networks to simulate the way the human brain processes data. Deep neural networks consist of multiple layers of interconnected nodes, each responsible for recognizing different levels of features, from simple to complex. This hierarchical structure makes deep learning particularly effective in the field of image processing.

• Convolutional Neural Networks (CNNs)

Convolutional Neural Networks (CNNs) are among the most commonly used models in deep learning, especially suitable for processing pixel data. CNNs extract local features from images through convolution operations and reduce data dimensions through pooling layers, finally classifying or regressing through fully connected layers. This structure enables CNNs to effectively recognize and process specific parts or features in images, such as edge detection and object detection.[5] In addition, Recurrent Neural Networks (RNNs) and Long Short-Term Memory Networks (LSTMs) are also applied in image processing. By introducing the concept of time series, they can handle the correlation between video frames, achieving analysis and understanding of video content.

2.1.3 Generative Adversarial Networks (GANs)

GANs consist of two parts: the generator and the discriminator. The generator creates data (such as images), while the discriminator evaluates the authenticity of the data. This architecture shows great potential in creating new image content and image style transfer. Generative Adversarial Networks (GANs) are a powerful model in deep learning, consisting of a generator and a discriminator. The task of the generator is to create data (such as images) as realistically as possible, while the discriminator evaluates the authenticity of this data. Through this adversarial process, GANs can generate high-quality new image content and show great potential in tasks such as image style transfer. In GANs, the generator usually employs Multilayer Perceptrons (MLP) or CNNs to capture the complexity of data distributions. The discriminator also adopts a similar structure but aims to distinguish between real and generated data. By alternately training the generator and discriminator, both gradually reach a balance

state, allowing the generator to create increasingly realistic images.

GANs are particularly noteworthy in the field of artistic creation. Artists use GANs to generate unique artworks, such as stylized portraits and landscapes. Additionally, GANs play an important role in image restoration and image generation, providing photographers and designers with more creative tools and sources of inspiration.

2.2 Specific Applications of AI in Post-Photography Processing

Leveraging the aforementioned technologies, AI can perform various functions in post-photography processing, including but not limited to:

2.2.1 Automated editing

AI can automatically adjust the brightness, contrast, saturation, etc., of an image and even provide different editing suggestions based on content. For example, AI can analyze the lighting conditions in a photo and automatically adjust underexposed or overexposed areas, thereby saving photographers time and effort in manual adjustments during post-processing. Additionally, AI can recognize and optimize the color distribution in photos, making the final images more vivid and balanced.

2.2.2 Image restoration and reconstruction

AI technology can restore old, damaged images to their original quality and even enhance images with insufficient resolution. Through deep learning models, AI can fill in missing parts of photos, such as restoring torn or faded areas in old photographs. This technology is also commonly used to improve resolution, allowing standard definition pictures to reach high-definition standards, especially suitable for applications requiring high-quality prints.

2.2.3 Content recognition and replacement

AI can identify specific objects or backgrounds in an image and intelligently replace or modify them according to user needs. This functionality is not limited to simple object recognition but can also perform complex scene analysis, such as automatically removing unnecessary elements or people from photos or changing backgrounds based on the shooting environment. The application of this technology greatly enhances the operational freedom and creative expression of

photographers during the creation process.

2.2.4 Style transfer

By learning different artists' or photography styles, AI can apply these styles to new photographic works, creating images with unique visual styles. AI algorithms can analyze the style of famous artists' works, extract key visual elements and techniques, and then replicate these styles onto new pictures. For instance, applying Van Gogh's oil painting style to a modern photograph creates unique cross-era artworks. This provides photographers with an innovative way to explore and expand their artistic expression.

2.3 AI Post-Photography Processing Tools

With the continuous advancement of AI technology, several tools and software utilizing AI for post-photography processing have emerged on the market.[6] These tools help photographers achieve higher quality image processing results in a shorter amount of time. Here are some of the currently popular AI post-photography processing tools:

2.3.1 Adobe Photoshop's Sensei

Sensei within Adobe Photoshop is an integrated AI technology that provides various machine learning-based functions, such as automatic object selection, skin smoothing, and intelligent background removal. These features greatly simplify the image editing process, allowing photographers to complete complex editing tasks quickly and precisely. During a major news event, due to poor lighting and harsh shooting conditions, the original photo quality was subpar. The photographer used Adobe Photoshop's Sensei to repair and enhance the photo. Through AI technology, noise in the photo was effectively removed, details were restored, and the overall image quality significantly improved. This made the news report more vivid and realistic, enabling viewers to better understand the situation at the event.

2.3.2 Topaz Labs AI

Topaz Labs offers several AI-driven image processing applications, such as Topaz Adjust AI and Topaz DeNoise AI. [7] These tools use AI to optimize image color, detail, and noise treatment, helping photographers elevate photo quality to near-perfect states. In a shoot for a well-known international fashion magazine, the photographer used Topaz Labs AI for style transfer, transforming an ordinary model photo

into a work with Renaissance painting style. This creative attempt not only received high praise from readers but also attracted widespread attention on social media. Through AI technology, the photographer successfully combined modern fashion elements with classical art styles, creating unique visual effects.

2.3.3 Skylum luminar

Skylum's Luminar software utilizes AI technology to provide a range of smart templates and filters, such as AI sky replacement and AI structure recognition.[8] These tools enable users to easily apply complex visual effects without needing to deeply understand the details of image processing. A large sports brand used Skylum Luminar AI for content recognition and replacement in its latest advertising campaign. Through AI technology, athletes in the advertisement were accurately separated from complex backgrounds and placed into different sports scenes. This seamless scene switching not only showcased the product's versatility but also enhanced the ad's visual impact and appeal.

2.3.4 DxO PhotoLab

DxO PhotoLab is equipped with PrimeX technology, an AI-based image processing engine specifically designed for image denoising, sharpening, and light recovery. It can automatically analyze photo content and optimize processing strategies to suit different scenes and device types.

2.3.5 ON1 Photo RAW

ON1 Photo RAW is another image processing software integrated with AI technology, featuring AI match characteristics, AI masking, and AI-enhanced image repair tools. This software aims to simplify the operation process, enabling users to quickly achieve professional-level editing effects.

These tools are constantly being updated and improved to adapt to the rapidly developing AI technology and the growing user demands. With the help of these AI tools, photographers can focus more on creativity and artistic expression rather than time-consuming manual editing processes.

3. The Impact of AI from Technology to Art

With the continuous advancement of AI technology, its application in post-photography processing has become an essential tool for

enhancing efficiency and visual effects. [9]AI not only accelerates traditional image editing processes but also provides photographers with unprecedented creative possibilities.

3.1 Enhancing Artistic Creation through Technology

By using AI-integrated tools such as Sensei in Adobe Photoshop, photographers can significantly simplify complex editing tasks like automatic object selection, skin smoothing, and intelligent background removal. These machine learning-based functions reduce the need for manual operations, allowing photographers to complete more work in less time. For instance, software like Topaz Labs AI and Skylum Luminar offer one-click optimization filters and presets, significantly shortening editing times and enabling users to quickly achieve professional-level results.

AI technology also enhances the visual effects of photographic works, especially in detail restoration, color optimization, and dynamic range management. AI algorithms can automatically analyze and adjust the color distribution in photos, optimize light and shadow details, and even improve images with insufficient resolution. Additionally, AI's style transfer capabilities allow photographers to apply different artistic styles to their works, creating images with unique visual styles.

3.2 AI and the Creativity of Photographers

Despite the powerful tools and functionalities provided by AI, it cannot fully replace the creativity of photographers. AI can serve as a co-pilot to help photographers realize their creative visions, but ultimately, creative decisions still require the intuition and experience of human photographers. For example, while AI can generate aesthetically pleasing images, it cannot fully understand or convey the emotions and stories that photographers wish to communicate.

3.3 The Different Impacts on Professional and Amateur Photography

In the professional photography field, AI-driven post-processing tools offer a means to standardize and enhance output quality, especially in fashion, commercial, and news photography. Professionals often use these tools to improve work efficiency and expand creative boundaries. In contrast, in amateur

photography, AI technology enables enthusiasts to easily achieve near-professional editing levels, lowering the barrier for high-quality photography. This allows more people to participate in the creation of photographic art and enjoy the creative process.

Overall, the application of AI in post-photography processing has significantly improved efficiency and enhanced visual effects. However, although AI is a powerful tool, it serves more as an aid to the creativity of photographers rather than a replacement. Whether in professional or amateur photography fields, the reasonable application of AI technology can greatly enrich photographers' workflows and the final image results.

4. AI Ethics in Post-Photography Processing

With the widespread application of artificial intelligence technology in post-photography processing, a series of ethical and legal issues have also emerged. This chapter will explore these issues from three aspects: originality and ownership issues, authenticity and credibility issues, as well as moral and legal challenges.

4.1 Originality and Ownership Issues

The application of AI technology has blurred the originality in the process of creating artistic works. The definition of originality for images generated by AI or significantly modified by AI has become an issue. For example, applying the style of different photographers to new works through AI, does this style transfer constitute copyright infringement on the original photographer's work? Additionally, as a tool, who owns the automatically generated images by AI? Is it the developer of the AI, the AI itself, or the photographer using the AI? These questions require clear definitions through legal and industry guidelines.[10]

4.2 Authenticity and Credibility Issues

In the fields of news photography and documentary photography, the authenticity of pictures is crucial. However, the powerful editing capabilities of AI technology, such as "deepfake" technology, can easily modify photo content, creating highly realistic fake images. This not only threatens the authenticity of photographic works but also

causes misinformation in social information dissemination. Therefore, how to ensure the authenticity of photographic works and prevent the abuse of technology has become a problem that must be faced.[11]

4.3 Moral and Legal Challenges

The application of AI in post-photography processing also involves multiple moral and legal issues. For example, images produced by AI may unintentionally copy elements of copyrighted works, triggering legal disputes. Meanwhile, photos processed by AI may reshape portraits, even changing expressions and backgrounds, which could violate personal privacy or portrait rights. Additionally, the development and application of AI technology must follow principles of fairness and transparency to avoid algorithmic bias affecting the impartial presentation of works.

In summary, the application of AI technology in post-photography processing has brought innovation and convenience but is also accompanied by complex ethical and legal issues. Faced with these challenges, it is necessary for the industry, academia, and legal community to work together to develop clear norms and standards to promote the healthy development of AI technology in the field of photography.

5. Research Conclusions

5.1 Summary of the Study

This paper delves into the application of artificial intelligence in post-photography processing and its impact on art and technology. By analyzing the basic working principles of AI technology, we understand how algorithms such as machine learning and deep learning are integrated into various post-processing tools, greatly improving editing efficiency and expanding creative possibilities. However, the introduction of AI technology also brings a series of ethical and legal issues, including disputes over originality and ownership, challenges to authenticity and credibility, as well as complex moral and legal problems.

On the artistic level, although AI cannot fully replace the creativity of photographers, it has become a powerful auxiliary tool that helps photographers achieve more precise visual expression and greater creative freedom. From

a technological perspective, the application of AI has already and will continue to drive the rapid development of photography technology, making image processing more efficient and advanced.

5.2 Future Outlook

Looking forward, the application of AI in the field of photography is expected to continue to deepen and expand. As technology further develops, we can foresee the following trends and suggestions:

5.2.1 Enhanced Collaboration and Innovation

Future AI tools will emphasize more on collaborative work with photographers, not just as tools, but as partners in the creative process. This will require developers to consider users' creative needs and operational habits more when designing AI systems, to promote a better integration of technology and art.

5.2.2 Improved Transparency and Controllability

To address ethical and legal challenges, it is crucial to improve the transparency and controllability of AI systems. Future AI applications need to clearly demonstrate their decision-making processes, allowing users to understand how AI affects image processing results, thereby increasing users' trust and acceptance of AI processing outcomes.[12]

5.2.3 Strengthened Ethical and Legal Frameworks

As AI technology is increasingly applied in the field of photography, establishing and perfecting related ethical and legal frameworks becomes inevitable. This includes ensuring the protection of intellectual property rights, establishing reasonable ownership rules, preventing the generation and dissemination of misleading content, etc. The industry, academia, and legal community should work together to develop clear norms and standards.

5.2.4 Exploring New Creative Boundaries

The development of AI technology has opened up new possibilities for photographic art. Photographers and artists should continuously explore new methods of creating with AI, innovate, and constantly expand the boundaries of photographic art. At the same time, they should also cultivate critical

thinking to evaluate how the application of AI technology can better serve artistic creation.

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