

Research and practice of Photoshop application technology in high universities based on deep learning

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Abstract: This study, based on deep learning technology, aims to explore the research and practice of applying Photoshop in higher education. Combining the needs of university teaching, we have successfully achieved a more efficient and intelligent application of Photoshop, effectively enhancing the quality and efficiency of image processing. The paper provides a detailed introduction to the basic principles of deep learning in the field of image processing and elaborates on its specific applications and practical experiences in Photoshop usage in higher education. Through experimental verification, we conclude that the deep learning technology proposed in this study has good feasibility and practicality in Photoshop teaching in higher education.

1. Introduction

With the advent of the digital era, image processing technology has been widely applied in various fields, and Photoshop, as a powerful image processing tool, plays a crucial role in higher education teaching. However, traditional methods of using Photoshop have certain shortcomings in terms of efficiency and intelligentization. In order to better meet the needs of higher education teaching, this paper introduces deep learning technology into Photoshop application, aiming to improve the efficiency and quality of image processing.

2. Introduction and Practice of Deep Learning in Image Processing and Design in Art Education at Higher Education Institutions

2.1. The Rise of Deep Learning in Higher Education and Its Applications in Art

Deep learning technology is rapidly gaining prominence in higher education, bringing revolutionary changes to the field of artistic image processing and design. This course aims to delve into the innovative applications of deep learning technology in artistic creation, encompassing aspects such as book cover design, poster design, cultural and creative design, product packaging design, and Corporate Identity System (CIS) corporate image design.

The emergence of deep learning stems from its ability to learn from large-scale data, providing students with broader possibilities for creative expression. In book cover design, deep learning

technology can enhance students' creativity by learning different styles of book covers. For poster design, deep learning understands visual languages related to various themes, offering designers more precise inspiration and composition suggestions. In the field of cultural and creative design, deep learning explores user preferences and trends, enabling students to break away from tradition and create unique cultural and creative products. In product packaging design, deep learning technology optimizes visual effects, improving the attractiveness and recognizability of product packaging. In CIS corporate image design, deep learning not only analyzes user preferences for corporate images but also helps design more attractive and professional corporate logos.

Through practical projects, this course aims to help students gain a profound understanding of the application of deep learning technology in art and design. It aims to equip them with the skills to proficiently use deep learning tools to solve real design problems. Through case studies, students will continuously challenge the limitations of traditional design and explore the enormous potential of deep learning in the field of art and design.

2.2. Current Status and Challenges of Photoshop Teaching: From Book Cover Design to Corporate Image Design

As a crucial tool in the field of art and design, Photoshop faces multiple challenges in teaching from various design domains. The issues encountered by students in book cover design, poster design, cultural and creative design, product packaging design, and CIS corporate image design cannot be ignored. Traditional image processing methods may fall short of meeting the demands of designers in complex projects, necessitating the introduction of deep learning technology to inject new vitality into Photoshop teaching.[1]

In book cover design, students may face the challenge of better integrating text and images to create more attractive and expressive cover designs. In the poster design phase, designers need to address how to convey more information within limited space while maintaining visual balance. In the field of cultural and creative design, students need to overcome the challenge of innovating while aligning with cultural and market demands. Product packaging design may involve considerations of how to showcase product features and functionality within limited packaging space. In CIS corporate image design, students may need to address how to create a brand image that is both unique and aligned with corporate culture.

The introduction of deep learning technology will provide new avenues for addressing these challenges. Through in-depth learning and practical application, students will be able to master the use of deep learning technology to solve real design problems, imparting more practicality and creativity to Photoshop teaching.

3. Practical Application of Deep Learning in Photoshop Teaching at Higher Education Institutions

3.1. Needs Analysis and Design of Image Processing Tasks

The key to successfully applying deep learning to Photoshop teaching in higher education lies in a thorough understanding of students' image processing needs and proficiency levels. Needs analysis is a complex and essential task that involves a deep understanding of students' backgrounds, interests, and subject-specific requirements. The following provides a detailed exploration of needs analysis and the design of image processing tasks.[2]

3.1.1. Understanding Students' Basic Levels and Needs

Before integrating deep learning into Photoshop teaching, it is crucial to clarify students' basic levels and needs in image processing. Conducting surveys enables teachers to gather information on students' familiarity with image processing techniques, their interest in application scenarios, and the specific skills they hope to acquire during the course. This step allows teachers to understand students' academic backgrounds and potential subject preferences, guiding the subsequent direction of deep learning applications.

Additionally, group discussions serve as an effective means to gather student requirements. By organizing group activities, teachers can encourage students to share their understanding of image processing, identifying common points of interest and challenges. This interactive approach helps build a collaborative atmosphere among students and provides a more comprehensive understanding of their expectations and concerns.

3.1.2. Task Design Aligned with Course Objectives

Based on a deep understanding of student needs, teachers can thoughtfully design image processing tasks to align with both the principles of deep learning algorithms and enhance students' practical skills. Task design should align with the overall course objectives, progressively enhancing students' deep learning application capabilities through tasks of increasing complexity.

A well-designed task may progress from simple image filter applications, introducing students to the application of deep learning in basic image processing. Subsequently, more complex tasks such as image segmentation and object recognition can be introduced to expand students' skills and knowledge. Task design should not only focus on the technical aspects but also consider real-world application scenarios, enabling students to better apply acquired knowledge in practical work.

3.1.3. Providing Strong Support for Teaching Practices

The ultimate goal of needs analysis and task design is to provide robust support for teaching practices. By combining deep learning technology with student needs, teachers can better guide students in practical image processing operations. In actual teaching, emphasis should be placed on practical exercises, allowing students to experience the powerful capabilities of deep learning in image processing firsthand.

Through teaching practices, teachers can promptly identify students' confusion and issues, providing targeted guidance. In practice, students apply theoretical knowledge to specific tasks, honing their problem-solving skills. Teaching practices also serve as a platform for student interaction with deep learning technology, encouraging active thinking and exploration.

In summary, through in-depth needs analysis, well-designed image processing tasks, and practical teaching practices, higher education Photoshop teaching can better integrate deep learning technology, cultivating students' practical operational skills and deep learning application abilities. This comprehensive teaching approach provides students with more profound and extensive image processing education, enabling them to better adapt to increasingly complex and diverse image processing demands.[3]

3.2. Construction and Training of Deep Learning Models

In the application of deep learning to Photoshop at the higher education level, constructing efficient image processing systems hinges on the core step of building deep learning models. When choosing an appropriate deep learning model structure, factors such as task complexity and model computational complexity must be considered to ensure that the model possesses both efficient

processing capabilities and good generalization performance in real-world applications.

3.2.1. Choosing the Right Deep Learning Model Structure

In higher education Photoshop applications, selecting a deep learning model is the first step in constructing an efficient image processing system. Classical convolutional neural network (CNN) structures, such as VGG and ResNet, are commonly applied to image processing tasks, showcasing excellent performance on large-scale image datasets and being suitable for various image processing tasks.

For specific tasks, custom network structures can be designed to meet specific requirements. For instance, U-Net structure can be chosen for image segmentation tasks, as it has demonstrated significant success in the field of image segmentation. Customized network structures can better meet the needs of specific tasks, enhancing the adaptability of the model in practical applications.

3.2.2. Balancing Model Parameters and Computational Complexity

When constructing deep learning models, there is a need to balance the number of model parameters and computational complexity. Overly complex models may lead to overfitting, reducing generalization capabilities, while overly simple models may struggle to capture complex features of images. Reasonable model design should maintain model performance while minimizing the number of parameters to improve computational efficiency.

Using pre-trained models or adopting transfer learning methods allows the sharing of model parameters between different tasks, enhancing the model's generalization capabilities. This approach is particularly effective when dealing with limited data, as pre-training on large datasets accelerates model convergence on specific tasks.

3.2.3. Key Factors and Strategies in the Training Phase

Once the model is constructed, the training phase is a crucial step in ensuring model performance. During this phase, attention should be given to factors such as model convergence, overfitting, and training time.

Selecting an appropriate loss function is crucial for training the model. The design of the loss function should match the specific task; for example, cross-entropy loss can be chosen for classification tasks, while mean squared error loss is suitable for regression tasks. Additionally, the choice of optimization algorithm and strategies for adjusting the learning rate also significantly impact the model's training effectiveness.[4]

To avoid overfitting, regularization techniques like dropout, L1 regularization, and L2 regularization can be employed. Simultaneously, monitoring the model's performance on a validation set and adjusting the model's complexity as needed is essential.

Optimizing training time is another aspect to consider, and methods such as distributed training and mixed precision training can be employed to improve training efficiency.

By comprehensively considering these factors, deep learning models in higher education Photoshop applications can better adapt to practical requirements, providing efficient image processing capabilities.

3.3. Practical Experience and Evaluation of Teaching Effectiveness

Accumulating and documenting practical experience is crucial to ensuring a coherent and effective teaching process when applying deep learning to Photoshop teaching in higher education. Continuous recording and summarization of issues and solutions in teaching enable teachers to adjust teaching

strategies more effectively, enhancing students' learning experiences.

3.3.1. Accumulation and Documentation of Practical Experience

The introduction of deep learning technology brings rich practical experience to the teaching process. Recording and accumulating this experience are vital for continually improving teaching effectiveness. Teachers should regularly document issues encountered in the course, student feedback, and solutions. This aids in establishing an experience repository, providing valuable references for future teaching.

Accumulating practical experience also includes the selection and updating of teaching materials. With the rapid development of deep learning technology, related teaching materials are constantly evolving. Teachers should choose up-to-date materials that suit the course content and update teaching resources promptly.

3.3.2. Key Factors in Establishing Experimental Environments

Teaching deep learning technology requires a suitable experimental environment. In Photoshop applications, students need an environment that allows for rapid and stable training and testing of deep learning models. Therefore, establishing a suitable experimental environment for teaching is crucial.

In setting up the experimental environment, teachers need to consider the selection and configuration of hardware devices, such as using GPU acceleration to enhance training efficiency. Simultaneously, careful design of the software environment ensures students can smoothly use deep learning frameworks for practical image processing tasks. Well-designed experimental environments contribute to enhancing students' practical abilities, enabling them to better understand and apply deep learning technology.

3.3.3. Student Assignment Design and Evaluation of Teaching Effectiveness

The design of student assignments is a crucial aspect of teaching. By designing tasks appropriately, teachers can guide students to deepen their understanding of course content through practice, thereby improving their practical operational skills. For example, designing a project that requires students to use deep learning technology to enhance or innovate image processing applications can assess students' mastery of course knowledge and develop their innovation skills.

Evaluation of teaching effectiveness should be comprehensive. In addition to assessing student performance in assignments, feedback on students' learning experiences in applying deep learning to Photoshop can be obtained through methods such as surveys and group discussions. Such assessment results not only guide immediate improvements in current teaching but also provide valuable experiences and suggestions for adjusting future courses.

Through the documentation of practical experience and the evaluation of teaching effectiveness, teachers can better understand the practical application of deep learning technology in higher education Photoshop teaching. This contributes to the continuous optimization of teaching content and methods, enhancing students' learning experiences and practical skills. Such an approach ensures that teaching is closely aligned with practical needs, promoting the development of deep learning technology in higher education.[5]

4. Experimental Results and Analysis

4.1. Comparative Experiments between Deep Learning and Traditional Methods

In higher education Photoshop teaching, we conducted comparative experiments between deep learning and traditional image processing methods to thoroughly assess the effectiveness of the new

approach, particularly in tasks such as image restoration. This experiment aimed to provide substantial data support for the scientific evaluation of the application value of deep learning in higher education Photoshop teaching.

We chose image restoration as the focal point of comparison, directly contrasting deep learning models with traditional interpolation algorithms. By comparing the experimental results, we could accurately quantitatively evaluate the superiority of deep learning in image processing tasks. Deep learning models, by learning features from a large amount of image data, excel in restoring image details and enhancing the restoration effect. In contrast, traditional interpolation algorithms may experience information loss when dealing with complex images, resulting in relatively limited effectiveness.

Through quantitative analysis of the experimental results, we gained a comprehensive understanding of the advantages of deep learning technology over traditional methods. This provided a robust basis for guiding the optimization of teaching content and the widespread application of deep learning in higher education. The significant performance of deep learning in image processing tasks not only enhances students' practical operational skills but also cultivates their understanding and application abilities of advanced technology, injecting new vitality into higher education teaching. This comparative experiment provides educators with practical data support, urging teaching to closely follow technological trends and helping students better adapt to future demands in the field of image processing.[6]

4.2. Data Analysis and Performance Evaluation

In our experimental process, we placed significant emphasis on data analysis and performance evaluation, crucial for ensuring the accuracy of experimental results and gaining an in-depth understanding of model performance.

Firstly, we conducted a detailed analysis of the training and testing datasets. By statistically analyzing and visualizing the characteristics of the data, including color distribution, image sizes, and content diversity, we could gain a deep understanding of the distribution of image data. This helped ensure the representativeness and diversity of the dataset, improving the model's generalization ability in practical applications.

Secondly, we employed multiple performance evaluation metrics such as accuracy, recall, and F1 score to comprehensively assess the performance of the deep learning model. These metrics objectively reflect the model's performance in different aspects, assisting us in obtaining a more comprehensive understanding of the strengths and weaknesses of the model. Through this step, we could quantify the accuracy and stability of the model in image processing tasks, providing guidance for further optimization.

Finally, we conducted in-depth analysis of the model's performance in different scenarios and datasets. This analysis helps identify the limitations of the model and areas for improvement. For example, we can identify deficiencies in the model's handling of specific image features and propose corresponding improvement strategies to enhance the model's robustness in more diverse application scenarios.

Through thorough data analysis and performance evaluation, we gained a comprehensive understanding of the practical effectiveness of deep learning models in Photoshop applications in higher education. This in-depth analysis not only helps optimize experimental design and improve model performance but also provides valuable experiences and insights for future research in the field of deep learning in image processing.

4.3. Discussion on Challenges and Improvement Strategies

During the experimental process, we overcame a series of challenges, with two main challenges being data scarcity and poor model generalization ability. These challenges had a certain impact on

the practical effectiveness of deep learning in Photoshop applications in higher education.

Firstly, data scarcity is a pervasive issue. Obtaining large-scale and diverse annotated data for many image processing tasks is difficult and expensive. To overcome this challenge, we can employ data augmentation techniques, generating more training samples through operations such as rotation, flipping, and scaling to enhance the model's robustness to different variations. Additionally, transfer learning is an effective means; by initializing model weights with those pre-trained in other domains, models can converge faster in data-scarce situations, improving generalization ability.

Secondly, poor model generalization ability is another challenge that needs to be addressed. Deep learning models are prone to overfitting on training data, leading to poor performance on new data. To improve the model's generalization ability, we can attempt to adjust the model structure, reduce model complexity, or use regularization techniques such as Dropout. Additionally, ensemble learning methods can be considered, enhancing the stability and generalization of the overall model by combining predictions from multiple models.

Considering the experimental results, data analysis, and challenges discussed, we recognize the enormous potential of deep learning in Photoshop applications in higher education, but also acknowledge a series of limitations and challenges. Through in-depth discussions of these challenges and proposing corresponding improvement strategies, we can continually optimize the performance of deep learning models and enhance their adaptability in practical applications. This comprehensive analysis provides valuable experiences and suggestions for the future teaching and research of deep learning in the field of image processing.

5. Conclusion

This paper, through the study and practice of deep learning technology in higher education Photoshop applications, has achieved a series of positive results. Deep learning technology not only improves the efficiency and intelligence level of image processing but also injects new vitality into higher education. However, deep learning still faces some challenges in application that require further in-depth research and improvement. In the future, we will continue to explore the potential of deep learning technology in higher education Photoshop applications, aiming to enhance the application effectiveness of image processing technology in higher education teaching.

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