A Comparison of Image Denoising Techniques Using Traditional Filters and Deep Learning

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ABSTRACT

One of the most important tasks in computer vision and image processing is image denoising, and it is essential for improving the quality of images captured in noisy environments or transmitted over noisy channels. This work presents a comparative study of image denoising techniques, focusing on traditional filtering methods and deep learning approaches. Traditional filtering methods, such as median filtering, Gaussian filtering, and bilateral filtering, have been widely used for noise reduction due to their simplicity and efficiency. These techniques rely on predefined mathematical operations to smooth or enhance certain image features, making them suitable for various noise types and levels. On the other hand, deep learning methods have gained significant attention in recent years for their ability to automatically learn noise patterns from data. Convolutional Neural Networks (CNNs) and auto encoders have shown remarkable denoising capabilities by training on large datasets to capture complex noise structures and restore images to their pristine quality. This comparative study evaluates the performance of traditional filtering methods and deep learning models in terms of denoising effectiveness, computational efficiency, and adaptability to various noise scenarios. We analyze their strengths and weaknesses, highlighting scenarios where one approach may outperform the other. Additionally, we explore hybrid approaches that combine traditional filters with deep learning to harness the strengths of both paradigms. The results of our study provide insights into the state-of-the-art image denoising techniques, assisting practitioners in choosing the most suitable method for their specific applications. We discuss the potential for further research in optimizing and combining these methods to achieve even more robust and efficient image denoising solutions, contributing to advancements in image processing and computer vision.

Keywords: Image Denoising, Deep Learning, Traditional Filter

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