Unlocking Visual Fidelity : An advanced Self-Attention based Paradigm for Complex Noise Reduction in High Resolution Image Denoising

Image denoising, a rudimentary task in computer vision and image processing, plays a pivotal role in ensuring the quality and utility of visual data across various domains, from medical imaging to remote sensing by reducing noise. The ever-growing demand for higher-quality images, coupled with the inherent complexity of real-world noise patterns, emphasizes the need for innovative techniques in this field. This problem statement aims to address the challenge of image denoising by harnessing the power of self-attention techniques in the context of advanced deep learning models.

Traditional image denoising methods often rely on predefined noise models, which can be limited in their ability to adapt to real-world noise scenarios, where noise can be intricate, spatially variant, and unpredictable. The challenge is to develop advanced image denoising techniques that leverage self-attention mechanisms, which enable models to capture intricate relationships between pixels in an image and recognize noise patterns in a context-aware manner. By learning contextual dependencies across the entire image, self-attention mechanisms offer a unique advantage in identifying and removing noise while preserving essential image details. These mechanisms can adapt to varying noise profiles and complexities, making them ideal for the challenges posed by real-world images.

This PhD research aims to investigate and develop novel self-attention-based techniques for image denoising by developing deep neural networks with self-attention layers to enable context-aware noise reduction, exploring techniques that allow the model to adapt to varying noise profiles and distributions without explicit noise modeling and investigating effective training strategies, including the use of large datasets with diverse noise patterns, and exploring semi-supervised and self-supervised approaches. The research aims to produce advanced image denoising models that are versatile, context-aware, and adaptable to real-world noise patterns.