GENERATIVE AI NETWORK FOR IMAGE SYNTHESIS

ABSTRACT :

Generative Adversarial Networks (GANs) have ushered in a new era in artificial intelligence, particularly in the domain of image synthesis, by enabling the creation of visually compelling and highly realistic images. This paper delves into the intricate landscape of generative AI networks tailored specifically for image synthesis tasks. Beginning with an exploration of the fundamental principles of GANs, including their architecture and training dynamics, we elucidate the adversarial interplay between the generator and discriminator networks. Variants of GANs optimized for image synthesis, such as Conditional GANs (cGANs), Progressive Growing GANs (ProGANs), and StyleGANs, are examined for their unique capabilities in generating images conditioned on specific attributes, achieving high-resolution synthesis, and manipulating visual styles. Furthermore, we address key challenges in GAN training, including mode collapse and instability, and discuss strategies such as Wasserstein GANs (WGANs) and regularization techniques to mitigate these issues. Through a survey of diverse applications spanning image-to-image translation, data augmentation, and artistic content creation, we showcase the versatility and potential impact of generative AI networks in various domains. Additionally, we explore the interdisciplinary intersections of generative AI with fields like natural language processing and reinforcement learning, elucidating how hybrid approaches enrich the creative potential of synthesized images. Finally, we outline future research directions and emphasize the transformative role of generative AI networks in advancing the frontier of image synthesis, bridging the realms of realism and creativity.