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GANs in Medical Imaging: Synthesizing of Realistic Images for Analysis

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Abstract: *Generative Adversarial Networks (GANs) have emerged as a revolutionary tool in the field of medical imaging, offering solutions to long-standing challenges such as the scarcity of annotated datasets and variability in image quality. This study investigates the application of GANs, particularly Deep Convolutional GANs (DCGANs), in synthesizing realistic brain MRI images. The primary objective is to augment existing datasets, thereby enhancing the performance of machine learning algorithms used in medical diagnosis and treatment planning. By employing a dataset of brain MRI scans, the DCGAN model is trained to generate high-resolution, realistic images. The quality of the synthesized images is evaluated using quantitative metrics such as Structural Similarity Index Measure (SSIM) and Fréchet Inception Distance (FID), as well as expert visual inspection. The results demonstrate that GAN-generated images can significantly improve the accuracy of tumor detection and segmentation models. This research highlights the potential of GANs to address data limitations in medical imaging and underscores their clinical relevance, paving the way for more accurate and efficient diagnostic tools.*

Keywords: Generative Adversarial Networks (GANs), Deep Convolutional GANs (DCGANs), Medical imaging, Brain MRI, Synthetic images, Dataset augmentation, Tumor detection, Segmentation models, Structural Similarity Index Measure (SSIM), Fréchet Inception Distance (FID), Machine learning, Diagnostic tools, High-resolution images, Clinical relevance, Image quality evaluation]