



MSK 2

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Generative AI in MR imaging

Dosik Hwang

Yonsei University, Korea

Magnetic Resonance Imaging (MRI) is a cornerstone of modern diagnostics, offering excellent soft tissue contrast and functional imaging without ionizing radiation. Yet, conventional MRI is limited by long acquisition times and the lack of fully sampled, multi-contrast datasets. Recent advances in generative AI provide promising solutions to these challenges.

In this talk, I will present how generative AI models—particularly GANs, VAEs, and diffusion models—can enhance MRI workflows. Focusing on my own research, I will discuss applications in MR image reconstruction from undersampled k-space data and in cross-contrast image translation and synthesis.

First, I will cover generative models for MR reconstruction, which improve image quality and reduce scan time by recovering high-fidelity images from sparsely sampled data. Our recent work combines physics-informed constraints with data-driven priors to achieve strong performance even in highly undersampled regimes.

Next, I will explore multi-contrast conversion and synthetic MR generation, where models learn to produce contrasts like T2-FLAIR from other sets such as T1-weighted images. I will highlight our work with conditional GANs and cycle-consistent architectures that preserve anatomical detail and clinical validity.

Keywords: Generative AI, GAN, Diffusion, MR image reconstruction, Synthesis, Contrast conversion