Redefining MRI:
From Image to Insight

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Low-Field MRI: Opportunities, Challenges, and AI-Driven Approaches

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Recent advances in low-field magnetic resonance imaging (MRI) have renewed interest in affordable, portable, and accessible imaging systems. Compared with conventional high-field MRI, low-field MRI offers advantages in terms of reduced cost, improved safety, lower susceptibility artifacts, and the potential for point-of-care deployment. However, the reduced magnetic field strength also leads to fundamental challenges, including decreased signal-to-noise ratio (SNR), lower spatial resolution, longer acquisition times, and increased sensitivity to image degradation.

Recent developments in artificial intelligence (AI) have shown considerable promise in addressing these limitations. Deep learning-based reconstruction, denoising, super-resolution, and generative modeling techniques have demonstrated the potential to enhance image quality and accelerate acquisitions, thereby narrowing the performance gap between low-field and high-field MRI systems. At the same time, important challenges remain regarding model generalization, robustness, uncertainty estimation, and clinical reliability.

This presentation provides an overview of the opportunities and challenges associated with low-field MRI and reviews recent AI-driven approaches for image reconstruction and enhancement. Particular emphasis will be placed on deep learning models for improving image quality, as well as emerging directions toward reliable low-field MRI systems.

Keywords: *Low-field MRI, Image reconstruction, Denoising, Deep learning*