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AI in MSK MRI

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Artificial intelligence is rapidly transforming musculoskeletal MRI research by moving beyond task-specific solutions toward more generalizable and integrated approaches. Traditional deep learning methods have demonstrated success in image reconstruction, segmentation, and classification, but their dependence on large annotated datasets and limited adaptability across anatomies have hindered widespread clinical translation. Recent advances in foundation models trained on large, heterogeneous MRI datasets now enable robust representation learning that supports few-shot and even zero-shot applications. These models achieve superior performance in label-scarce environments, providing practical benefits for musculoskeletal imaging where expert annotations are often limited. Moreover, the integration of imaging with clinical language has opened the possibility of unified systems capable of handling the entire MRI workflow—from reconstruction and anatomical delineation to abnormality detection, diagnostic reasoning, and automated report generation. Such multimodal frameworks mirror the cognitive processes of radiologists and offer improved reproducibility, efficiency, and scalability across diverse clinical tasks. For musculoskeletal MRI, these developments promise to accelerate biomarker discovery, enhance diagnostic accuracy, and lower barriers to the adoption of AI in routine practice, paving the way for more comprehensive and clinically meaningful applications.

Keywords: Musculoskeletal MRI, Artificial intelligence, Foundation models