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Transforming Sports Medicine with Deep Learning and Generative AI: Personalized Rehabilitation Protocols and Injury Prevention Strategies for Professional Athletes

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Deep learning and generative AI are revolutionizing sports medicine by enabling personalized rehabilitation protocols and advanced injury prevention strategies for professional athletes. This study explores how AI-driven models analyze biomechanical data, medical histories, and performance metrics to tailor rehabilitation programs, optimize recovery timelines, and minimize reinjury risks. Generative AI enhances injury prediction by simulating stress factors on the body, providing real-time feedback, and recommending data-driven interventions. Additionally, AI-powered motion analysis and wearable sensor integration improve athlete monitoring, allowing for early detection of musculoskeletal imbalances and fatigue patterns. The research examines key challenges such as data privacy, ethical considerations, and the integration of AI with existing sports medicine practices. By leveraging deep learning and generative AI, sports medicine can move towards a more proactive, precise, and athlete-centric approach, ultimately enhancing performance longevity and overall well-being in professional sports.