MyoAssist: An Innovative AI-Based, User-Driven Exoskeletal Assistive Control System for Individuals With Movement Disabilities

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Nearly 1 in 8 people in the U.S. suffer from movement disorders, significantly impacting their quality of life. Neuromuscular disabilities cost the healthcare system $420 billion annually. Despite this, current solutions remain ineffective, with 45% of assistive device users reporting no improvement. Existing technologies cannot proactively monitor neuromuscular health for the elderly and disabled, and offer limited adaptability to varying muscular conditions. To address this gap, MyoAssist—a novel, user-driven, 3-in-1 assistance system—is developed. MyoAssist detects movement disabilities, evaluates their extent, and mitigates neuromuscular impairments through dynamic, proactive assistive intervention. The system leverages advanced AI-algorithms and state-of-the-art physics-based neuromechanical simulation models that have been validated against clinical data, making the process computationally efficient and widely accessible. It incorporates a two-agent, Proximal Policy Optimization-based deep reinforcement learning framework that captures user intent in real time through electromyography (EMG) signals. When tested for sarcopenia and neurodegenerative conditions across standardized biomechanics tasks, MyoAssist was robust in providing precise compensatory assistance to mimic near-healthy movement (99.2% accuracy). Additionally, MyoAssist effectively evaluated the level of disability based solely on user movement. This eliminates the need for complex biological imaging and provides a non-invasive early detection method to monitor and assess neuromuscular disease progression. MyoAssist is a cost-effective scalable advancement in AI-based, user-centric assistive technology that will revolutionize the field of medical robotics and improve overall quality of life.

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