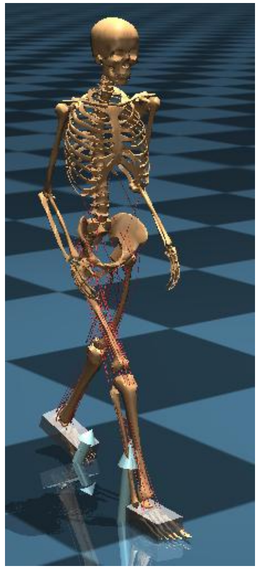
Sim-To-Real Exoskeleton Control using Machine learning

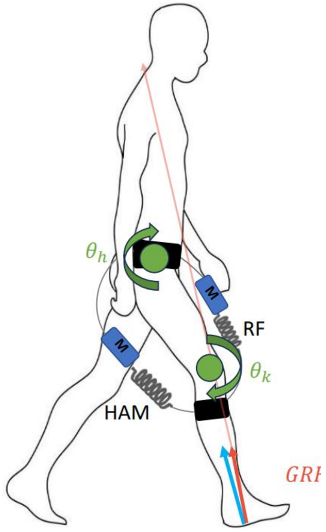
TECHNISCHE UNIVERSITÄT DARMSTADT

Master Thesis

Project Description:

Exoskeletons are wearable devices that assist or enhance movement, helping people with mobility issues and reducing strain in industrial jobs. Advanced control strategies optimize their performance by improving movement and saving energy. Simulation allows for quick and safe testing of these strategies, without the need for physical trials. It also helps ensure that exoskeletons work effectively and safely. This approach ensures better results before real-world implementation.





Task:

Adding an active exosuit to the simulation of LocoMojoco and developing a control strategy for that exosuit. The results can afterward be implemented in the real-world exosuit to verify these results.

1. Use purely the imitation learning
2. Adding another network to cover the inputs of the exosuit while the Imitation learning will take care of keeping the walking human-like

References:

1. F. Al-Hafez, G. Zhao, J. Peters, and D. Tateo, LocoMuJoCo: A Comprehensive Imitation Learning Benchmark for Locomotion, 6th Robot Learning Workshop, NeurIPS, 2023, 2311.02496
2. GAIL algorithm: J. Ho and S. Ermon, Generative Adversarial Imitation Learning, 2016, arXiv, 1606.03476
3. Drewing et al. (2024). Comparison of Empirical and Reinforcement Learning (RL)-Based Control Based on Proximal Policy Optimization (PPO) for Walking Assistance: Does AI Always Win?. Biomimetics, 9(11), 665.

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