Reinforcement Learning for Locomotion in Muscle-Driven Robotic Systems

cbb Computational Biophysics and Biorobotics

Institute for Modelling and Simulation of Biomechanical Systems

Background

Biological systems have evolved over millions of years to develop highly adaptable and efficient control mechanisms for muscle-driven movements. By studying these systems, we can apply artificial learning methods to computational models of the musculoskeletal system, potentially unlocking advancements in robotics. Despite the progress in robotics and especially Reinforcement Learning (RL), current RL techniques struggle with the complexity of muscle-actuated systems.

Project description

To address the challenges of muscle-actuated systems in RL, we propose a bioinspired curriculum learning approach. This method involves learning tasks with increasing complexity, enabling agents to systematically acquire skills in a structured and efficient manner, akin to biological development. Students will focus on developing and implementing automatic curricula inspired by human developmental stages, such as growth, to enhance locomotion in muscle-actuated systems. Additionally, the project seeks to refine the reward mechanisms within the RL algorithm to better reflect the dynamics of muscle-driven control.

This project offers an opportunity to enhance technical and software skills, while working on cutting-edge research in biomechanics, robotics, and artificial intelligence. Depending on the student's role and interest, specific research questions can be addressed to deepen their learning experience.

Supervisor:
Syn Schmitt

Advisor:
Nadine Badie

Type:
Master's Thesis,
Research Thesis,
Student Assistant

Research Area:
Reinforcement learning,
Biomimetics

Skills:
Reinforcement learning,
Programming (python),
Git

Language:
English, German

Term:
WS 24/25

Please contact us for more information:

E-Mail:
nadine.badie@imsb.uni-stuttgart.de

Webpage:
https://www.imsb.uni-stuttgart.de/de/