MyoChallenge 2024: A New Benchmark for Physiological Dexterity and Agility in Bionic Humans

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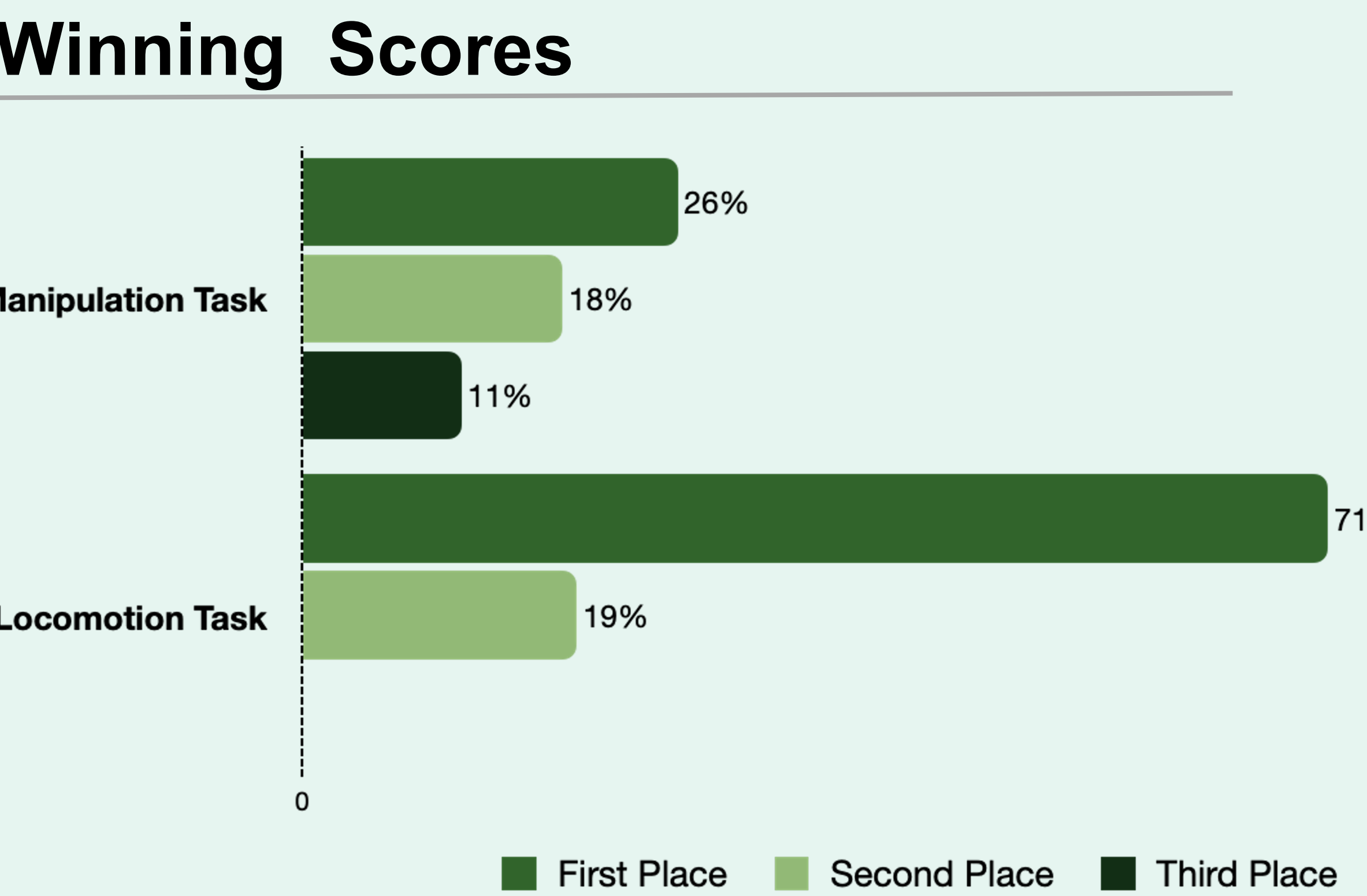## Human-Bionic Interaction:

A new challenge for AI agent

- Real prosthetic users demonstrate rapid adaptation and **broad movement generalization** abilities that current AI systems cannot yet match.
- Real-world testing of prosthesis is expensive and time-consuming
- Current MSK models provide limited support for machine interactions

Track-1: Bimanual Co-manipulation

Coordinate a **musculoskeletal** arm with a **bionic** arm for reaching to grasp, handover and properly maneuvering random objects to move them to a randomized target locations

Track-2: Locomotion Co-control

Control at the same time the biological body and a **BionicMyoLegs** model over randomized terrains.

Winning Scores

Manipulation Task
- First Place: 26%
- Second Place: 18%
- Third Place: 11%

Locomotion Task
- First Place: 71%
- Second Place: 19%

Legend: First Place, Second Place, Third Place

First Place Manipulation: Team Muscles Head (UCL)
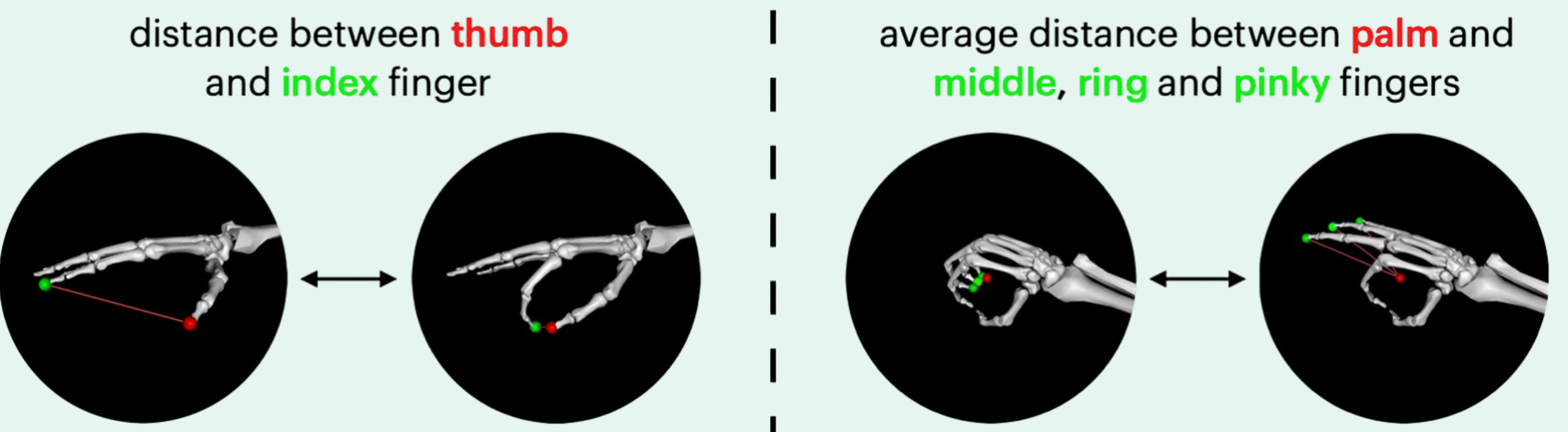**First Place Locomotion:** Team MSKBioDyn (KAIST)

Physiological Award: Team LocoUSCD (UCSD)
Student Award: Team LNSGroup (Tsinghua University)

54   15+   292   14k

Manipulation Track

Locomotion Track

Join us at MyoSymposium 2025 on Dec 6th!
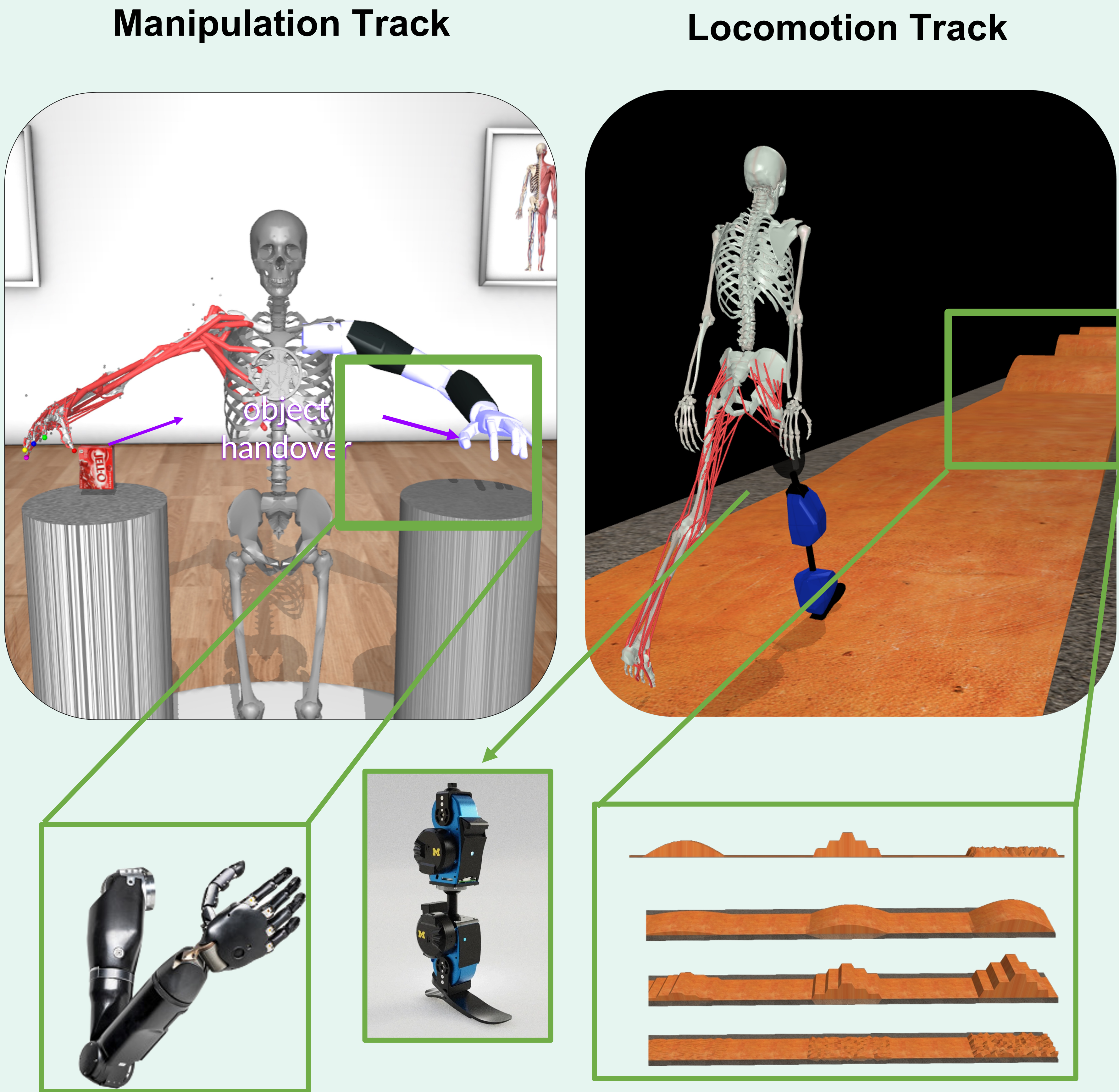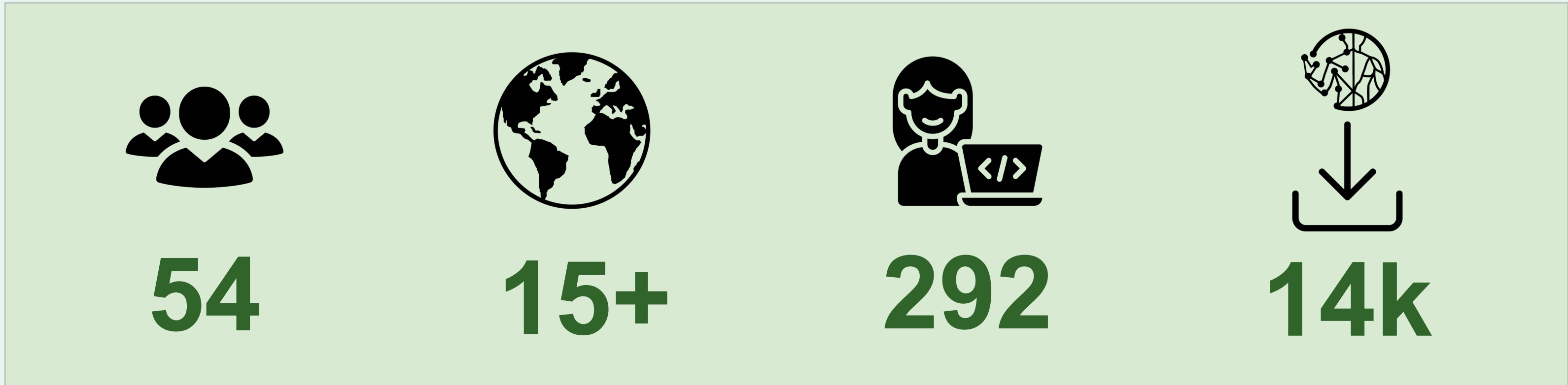
Manipulation Track Takeaways

Muscle Synergy

Akin to biological systems, synergy-based control of muscle activations overcomes dimensionality challenges, enabling natural movement in complex biomechanical systems.

distance between **thumb** and **index** finger

average distance between **palm** and **middle**, **ring** and **pinky** fingers

First place solution grasping variables to control the muscle that modulate the distance between thumbs and index, as well another group for distance between palm and fingers.

Locomotion Track Takeaways

Motion Data & Imitation Learning

A small amount of human motion data mitigates the search and credit-assignment challenges in high-dimensional control, removing the need for reward engineering and yielding locomotion strategies that generalize to unseen terrains and tasks.
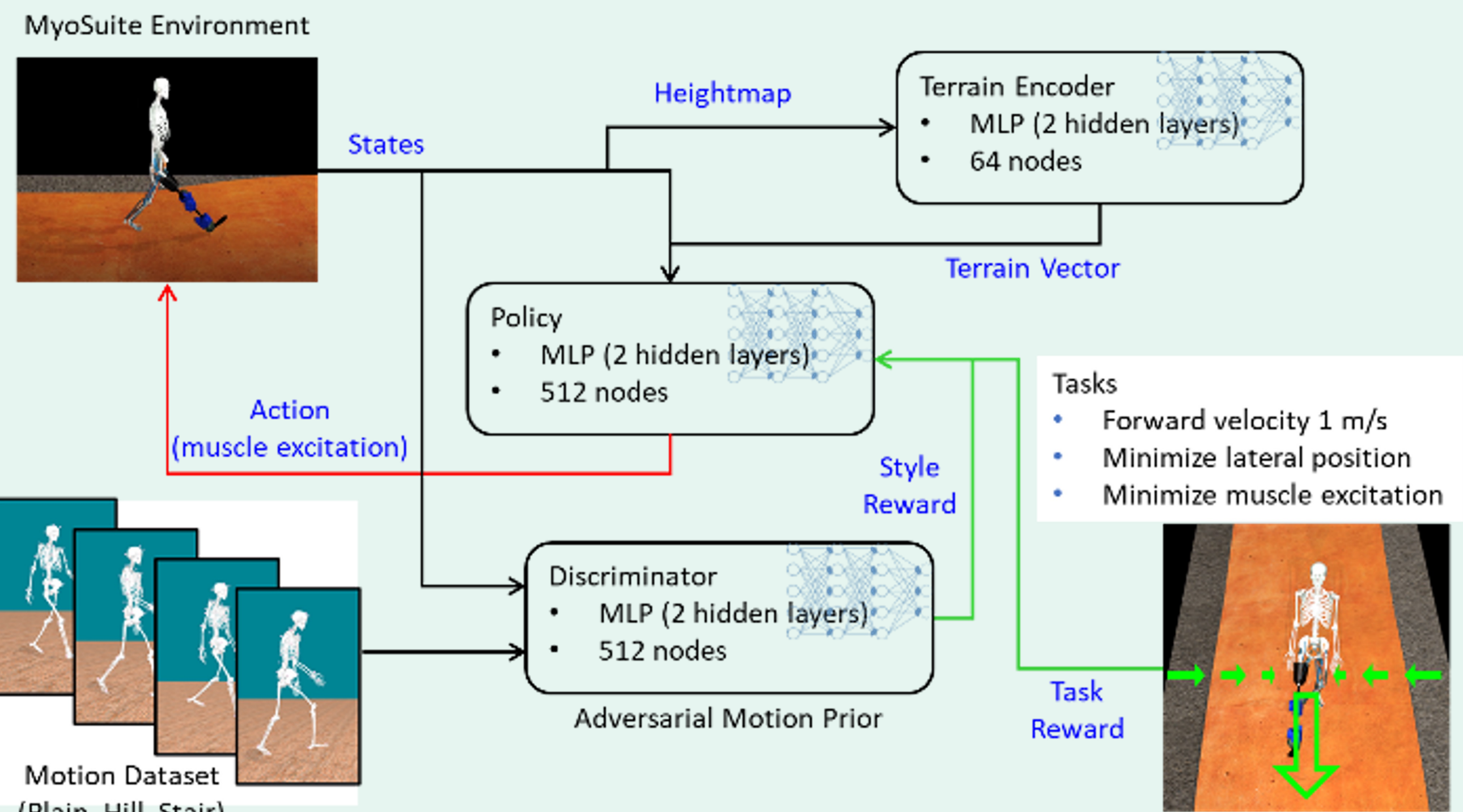
First place solution uses uses dataset contains full-body kinematics from 120 individuals walking on flat ground, stairs, and slopes, representing various walking styles and terrain conditions.