Foundation models for primate locomotion

Description: The long-term aim of the Dynamics of Neural Systems Laboratory (gosztolai-lab.org) is to develop robotic simulations that can be driven by neural recordings in higher brain regions. This is a very important problem for neuroscience and neuroprosthetic devices. To this end, we collaborate with a monkey research lab and have obtained a large dataset of macaque locomotion containing motion capture and neural recordings in multiple brain regions. It is a dream dataset that will allow us to make discoveries about the hierarchical control of locomotion in primates. The project would entail the analysis of this data, where the student would use computer vision and neural data processing techniques. Then, we would proceed to develop an embedded physics simulation. An ambitious student would then train a generative foundation model (using diffusion and transformer architectures) that learns the rigid body physics and produces realistic kinematics.

Supervisor: Dr. Adam Gosztolai

Skills: The required skillset for this project involves strong Python programming skills and exposure to ML libraries such as PyTorch. Everything else can be picked up. Experience in computer vision, neuroscience or robotics is a bonus but not required.