Designing controllers for dynamical systems is typically a two-step process: First, the system to control is modeled mathematically, e.g. by differential equations. Subsequently, this model is used to find a suitable controller, which stabilizes the system or let it follow a given reference trajectory. Both of these steps require specific domain and engineering knowledge. An exciting area of research is to learn a model of the system and a controller purely by interacting with the system and recording it’s response to the applied excitations. Existing work represents the system’s responses by low-dimensional sensory data such as angles, positions, and velocities. In this master’s thesis project, novel ways of learning control from high-dimensional data (images, videos) are to be investigated.

Motivating example

Consider the following motivational example: An inverted pendulum mounted on a cart (C) is to be stabilized in its upright position. Therefore, a controller (A) sends motor torques to the cart, moving it left and right. The torques are determined using a learnt dynamics model of the system and observations from a camera (B). The dynamics model is learnt from observations of the system when stimulated with known motor torques.

We are looking for an outstanding Master student in computer science, physics, mathematics, electrical or control engineering from any institution who is eager to do an internship or Master thesis on this project. The project duration is 6 months and will be conducted at the Max Planck Institute for Intelligent Systems (MPI-IS) located in Tübingen. Note that depending on their study programme regulations, students interested in writing a Master thesis at the MPI might have to find a supervisor/examiner at their home institution who is willing to support the Master thesis.

Prerequisites
High motivation, excellent skills in computer science, a solid background in mathematics and hands-on experience with deep learning are prerequisites. Furthermore, good software engineering skills in Python are required. Experience in modeling dynamical systems and control engineering are a strong plus.

Embodied Vision Group
The project will be carried out at the Max Planck Institute for Intelligent Systems (MPI-IS) located in Tübingen within the Embodied Vision Group headed by Dr. Joerg Stueckler. The group investigates fundamentals of embodied intelligent agents such as robots that learn to perceive and act within their environment. Further information on the group can be found at [https://ev.is.mpg.de](https://ev.is.mpg.de).

Contact
Do not hesitate to contact us (see contact details below) if you are interested in doing your internship or Master thesis on this project. Applications should be sent in a single pdf (max. 10MB) per email and include a CV, a short motivation letter (why are you a good fit for the position), current transcripts of BSc/MSc studies, and optionally other documentation helpful to evaluate your background (BSc thesis, project reports, public code repositories, ...).

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