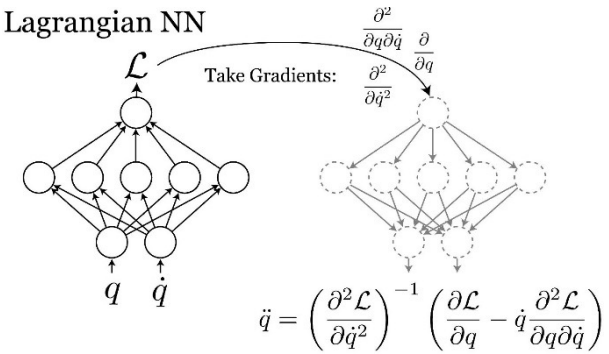
Learning of robot dynamics using Lagrangian Neural Networks

TECHNISCHE UNIVERSITÄT DARMSTADT

Master‘s Thesis

Accurate dynamical models are crucial for the simulation of systems and control design. There exist several methods to obtain such models. One can, for example, derive a model according to physical principles and estimate the unknown parameters by means of system identification, which can be complex if the system requires a sophisticated model. Alternatively, the model can be learned using machine learning techniques. This approach has the advantage that it is almost purely data-based, i.e., no complicated modeling. However, such models often lack physical consistency, which causes the model to be less accurate. It is therefore desirable to enforce these physical constraints in the learning process.

A Lagrangian neural network is a type of network used for modeling Lagrangian Systems, e.g., mechanical systems. These networks enforce that the learned dynamics are consistent with the energy conservation property. Thus, the performance of the learned model increases significantly. Ultimately, your task will be to learn a dynamical model of a 7-degree-of-freedom robotic manipulator using Lagrangian neural networks.



Requirements:

- High proficiency in Python
- Basic knowledge C++
- Some experience dynamical systems (e.g., control lectures)

Your tasks will be:

- Literature research modeling of robotic manipulators
- Learn robot dynamics
- Performance comparisons to the baseline model

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