Learning the Hamiltonian of some classes of mechanical systems

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Neural networks have been proven to be effective as a tool for mathematical modelling and model discovery. In this talk, we go through a possible approach to approximate the Hamiltonian of some classes of mechanical systems.

We start from a (large enough) set of measured trajectories coming from a Hamiltonian system X_H, and we want to obtain an approximation of the Hamiltonian H.

The approach we present is based on Recurrent Neural Networks (RNNs), typically used for time-structured data, as for the trajectories we work with. This framework can be adapted, in principle, to any Hamiltonian system. However, we focus on a class of mechanical systems whose phase space, $T^*Q \subset \mathbb{R}^{2n}$, is a homogeneous manifold. In this setting, we highlight a possible connection between Lie group integrators and this learning framework based on RNNs.