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Abstract:

Recent observational efforts such as Gaia or SKA are leading us toward a new era of data abundance which offers us an incredible opportunity for discovering new physics. Thanks to recent advances in the field of machine learning, it is possible to extract valuable information from the colossal amount of data now available.

In particular, auto-differentiation allows us to get a better grasp of galactic dynamics. It might even enable us to capture a precise and agnostic map of the gravitational potential of the Milky-Way and the underlying dark matter distribution from a mere snapshot of stellar positions and velocities.

However, machine learning in the context of physics is both plagued and blessed by one of its most powerful components: neural networks, which are extremely powerful and flexible for modeling physical systems but largely consist in non-interpretable black boxes. Thus, a complementary approach based on symbolic regression and reinforcement learning is currently being built in the goal of mimicking or surpassing physicists in some tasks of symbolic modeling and symbolic computation. We will present a preliminary study of this new approaches.