ID de Contribution: **3** Type: **Poster + lightning talk**

Bayesian neural network for active learning and applications to gravitational-wave source population inference

jeudi 22 mai 2025 10:00 (5 minutes)

LIGO and Virgo have detected about a hundred of merging compact binaries in their first three science runs. This number will grow by a factor of 2 to 3 with the current run O4. This will allow a detailed analysis of the source population and possibly identify their origin and formation channel(s). The complex sequence leading to the formation of a compact binary from an isolated binary of stars can be modeled using hydrodynamic star evolution simulations such as MESA. These simulations have a large computational cost and can typically extend to hours each.

We propose to train a neural network to replace these simulations. Training a neural network with simulated data can be challenging if the computational cost of acquiring a large enough training dataset is high. Often, we rely on training data computed on a regularly spaced grid, or based on an a priori defined scheme. But is there a way to optimize the choice of this training dataset ? Can we maintain the performance, or achieve better results with less training data ?

Active learning aims at efficiently sampling the training dataset for machine learning applications. We start with a small pool of points that is progressively extended with samples that are “most informative” for the model. Our approach is to use the uncertainty estimation produced by a Bayesian neural network to choose which new point should be simulated and included within the updated training set.

We will propose first preliminary results on synthetic data. In the future we plan to apply this on MESA simulations of massive stellar couples.

Author: COURTY, Theo (Université Paris Dauphine)

Co-auteurs: CHASSANDE-MOTTIN, Eric (CNRS AstroParticule et Cosmologie); PALUD, Pierre (APC); Prof. CHATY, Sylvain (Université Paris Cité)

Orateur: COURTY, Theo (Université Paris Dauphine)

Classification de Session: Flash talks #2

Classification de thématique: Time Domain Astrophysics