

Modelling partially observed dynamical systems with continuous-depth models

Overview This internship is part of a larger project dedicated to building a bridge between Machine Learning and Dynamical Systems : inferring models more robust and less data hungry thanks to physics-based constraints, inspecting the behavior of the models, providing some online guarantees, and relating Physics and computational regularities to improve the model understanding and assessment. The connection between Physics and Machine Learning is nowadays considered in both directions and the scientific construction of this domain is underway. The internship will focus on developing new approaches of modelling dynamical systems as a whole. For the first part of the internship, the intern will get up to speed with continuous-depth models like [neural ODE](#) and [augmented Neural ODE](#). For the second part of the internship, new research ideas will be explored like [delayed differential equations](#). The candidate is expected to be proactive and have a keen sense of critical thinking. The aim of the internship will be to publish the work in a conference/journal.

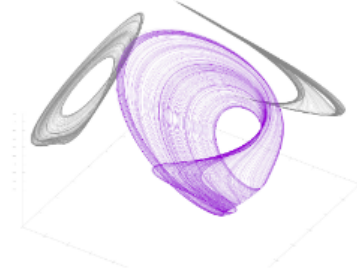


Figure 1: 2-D projections of the Lorenz 9-D attractor

Student profile The candidate should have a solid background in statistics, machine learning and/or applied maths; knowledge in Python language is required with frameworks like Pytorch/ Tensorflow/JAX. Some background in physics is appreciated too since the intern will train models on datasets from numerical simulations of physical systems. Any knowledge and experience in functional programming is a bonus.

Research environment The internship will be carried on-site with work from home possibilities, at [LISN-CNRS](#) on the campus of Universite Paris-Saclay. The intern will be mentored by the PhD team and will have recurrent feedbacks, code-reviews. Some bi-weekly meetings with permanent researchers are expected too. Pursuing a PhD in the lab is a possibility starting in September/October 2024.

Internship take-aways At the end of the internship, the intern will master many technical skills like : training AI models on clusters, multi-GPU training, becoming more proficient in git, coding, AI modelling...

Advisors T. Monsel, L. Mathelin ,O. Semeraro and G. Charpiat at LISN.

How to apply ? Please send your resume, grades and github username (if any) to thibault.monsel@universite-paris-saclay.fr, lionel.mathelin@universite-paris-saclay.fr, onofrio.semeraro@universite-paris-saclay.fr and guillaume.charpiat@inria.fr.

Compensation The scholarship amount is about 614.26 euros/month, funded by [ANR](#) + 50% of public transport reimbursement. The internship is 5-month long and ideally starting in March 2024.