Department of Physics

UNIVERSITY OF OXFORD

Machine Learning and Physics Seminar Series

Thursday, 31 October 2019 at 2.30pm
Dennis Sciama Lecture Theatre, Denys Wilkinson building

Neural likelihood-free inference

Professor Gilles Louppe
University of Liege

In many scientific fields such as particle physics, climatology or epidemiology, simulators often provide the best description of real-world phenomena. However, they also lead to challenging inverse problems because the density they implicitly define is often intractable. In this talk, we will present a suite of simulation-based inference techniques (frequentist and bayesian) that go beyond the traditional Approximate Bayesian Computation approach, which typically struggles in a high-dimensional setting. We will cover inference methods that use surrogate models based on modern neural networks, including variants of likelihood-ratio estimation algorithms, MCMC sampling techniques or probabilistic programming inference engines. We will also show that additional information, such as the joint likelihood ratio and the joint score, can often be extracted from simulators and used to augment the training data for these surrogate models. We will demonstrate that these new techniques are more sample efficient and provide higher-fidelity inference than traditional methods.

Gilles Louppe is an associate professor in artificial intelligence and deep learning at the University of Liège (Belgium). He was previously a postdoctoral associate at New York University with the Physics Department and the Center for Data Science, with close ties with the ATLAS experiment at CERN. His research sits at the intersection of machine learning, artificial intelligence and physical sciences, with the far ambition of unlocking discoveries of a new kind by making artificial intelligence a cornerstone of the modern scientific method. His present research interests include the use and design of new machine learning algorithms to approach data-driven problems from fundamental sciences in new and transformative ways.