

ETICS 2022

École Thématique sur les Incertitudes en Calcul Scientifique Research School on Uncertainty in Scientific Computing

<https://www.gdr-mascotnum.fr/etics.html>

October, 2-7, Belhambra, Belgodère Golfe de Lozari , France -
<https://www.belambra.com/club-belgodere-golfe-de-lozari/summer>



Source : voyage-prive.com

Objectives

The goal of this school is to develop the skills of researchers and engineers in the domain of uncertainty management of computer codes and machine learning techniques in support to engineering studies. Lectures will be followed by practical computer works. Discussions and poster sessions will promote exchanges between participants. The prerequisites to possess are the mathematical bases of the uncertainty quantification science.

Lecturers

- Prof. [Danica J. Sutherland](#) (University of British Columbia): About kernel methods in statistical learning
- Prof. [Anthony Nouy](#) (Ecole Centrale de Nantes): About high-dimensional approximation theory and tensor networks
- Prof. [Gabriel Peyré](#) (CNRS/Ecole Normale Supérieure): Computational optimal transport
- Several lectures from participants and PhD students

Organization

CEA DAM



EDF R&D



Centre Borelli
ENS Paris
Saclay



Under the scientific labeling of the GdR



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Registration: <https://www.gdr-mascotnum.fr/eticsregister22.html>. Registration fees (825€, taxes included) include accommodation, meals and transport by bus from and to the airport.

Schedule

Sunday, October, 2d: Bus from Bastia airport to Belhambra Belgodere at 15:30-16:00

Monday, October, 3d:

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|-----------------|---|------------------------------------|
| 9:00 - 9:15 | Opening and Welcome speech | Bertrand Iooss Claire Cannamela |
| 9:15 – 12:30 | High-dimensional approximation I | Anthony Nouy |
| 14:00 – 17:30 | Modern Kernel Methods in Machine Learning I | Danica Sutherland |
| 19 :00 – 20 :00 | Apéritif | All |

Tuesday, October, 4th:

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| 9:00 – 12:30 | Modern Kernel Methods in ML II | Danica Sutherland |
| 14:00 – 17 :30 | High-dimensional approximation II | Anthony Nouy |

Wednesday, October, 5th:

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| 9:00 – 12:30 | 2 lectures 3d-year PhD students (30' each): C. Gauchy – C. Hardy 6 lectures from PhD students (20' each): I. Cardoso – G. Chennetier – T. Defontaine – J. Demange-Chryst – E. Fekhari – N. Fellman | PhD |
| 14:00 – 20 :00 | Free afternoon | |
| 19 :00 – 20 :00 | Apéritif | All |

Thursday, October, 6th:

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|---------------|------------------------------------|---------------|
| 9:00 – 12:30 | Computational optimal transport I | Gabriel Peyré |
| 14:00 – 17:30 | Computational optimal transport II | Gabriel Peyré |

Friday, October, 7th:

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| 8:30 – 9:50 | 4 lectures from PhD students (20' each): M. Il Idrissi – M. Saldanha – B. Sow – C. Surget | PhD |
| 9:50 – 10:30 | Two applications of Stepwise Uncertainty Reduction strategy for excursion set estimation | Delphine Sinoquet |
| 10:45 | Bus to Bastia airport | |

Coffee breaks of 30mn every day at 10:30 and 15:30

ABSTRACTS

Prof. [Anthony Nouy](#) (Ecole Centrale de Nantes): High-dimensional approximation, tensor networks and beyond

The approximation of high-dimensional functions is a typical task in computational science. Examples of such problems can be found in physics, machine learning and uncertainty quantification. These tasks require the introduction of suitable approximation tools (or model classes) that are able to exploit some specific structures of functions. In this course, we will first introduce some concepts from approximation theory and information based complexity to quantify the best we can expect when we try to approximate functions from some function class using linear or nonlinear approximation tools, and using different types of information. Then we will review some classical high-dimensional approximation tools, including sparse approximation, dimension reduction methods, tensors and neural networks. We will finally focus on tree tensor networks, provide theoretical results in approximation and learning, and present some algorithms for solving approximation or learning tasks using these model classes.

Prof. [Gabriel Peyré](#) (CNRS and Ecole Normale Supérieure): Computational Optimal Transport

Optimal transport (OT) is a fundamental mathematical theory at the interface between optimization, partial differential equations and probability. It has recently emerged as an important tool to tackle a surprisingly large range of problems in data sciences, such as shape registration in medical imaging, structured prediction problems in supervised learning and training deep generative networks. This course will interleave the description of the mathematical theory with the recent developments of scalable numerical solvers. This will highlight the importance of recent advances in regularized approaches for OT which allow one to tackle high dimensional learning problems. Material for the course (including a small book, slides and computational resources) can be found online at <https://optimaltransport.github.io/>

Prof. [Danica J. Sutherland](#) (University of British Columbia and Amii): Modern kernel methods in machine learning

Kernel methods were previously the dominant paradigm of machine learning, but have somewhat fallen out of favor with the advent of deep learning. This course will demonstrate how insights from kernel methods can still be beneficial in modern deep learning settings, assuming no prior knowledge of kernels. We will begin with basic formulations of kernel spaces and learning with kernels, including their core theoretical justifications, and with a particular focus on kernel mean embeddings of distributions for various applications. We will then discuss the end-to-end learning of kernels within a deep learning framework, including when we expect this to be useful, with practical examples worked out in interactive sessions.

Lectures from PhD students’:

- Clément Gauchy, Estimation of seismic fragility curves by sequential design of experiments (third year PhD)
- Clément Hardy, Off-the grid learning of sparse mixtures from a continuous dictionary (third year PhD)
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- Inês Cardoso, Model Order Reduction and Bayesian Optimization for MDO problems
- Guillaume Chenetier, Adaptive importance sampling for reliability assessment of a Piecewise Deterministic Markov Process
- Théo Defontaine, Flood forecasting with Machine Learning in a scarce data layout
- Julien Demange-Chryst, Shapley effect estimation in reliability-oriented sensitivity analysis with dependent inputs by importance sampling
- Elias Fekhari, Sequential reliability analysis for offshore wind turbine fatigue Assessment
- Noé Fellmann, Sensitivity Analysis on excursion sets
- Marouane Il Idrissi, Robustness assessment using quantile-constrained Wasserstein projections
- Matthéo Saldanha, Using Generative Adversarial Networks to constrain inverse problems resolution
- Babacar Sow, Gaussian processes indexed by clouds of points: a study
- Charles Surget, Sensitivity to statistical estimation uncertainties and probabilistic model identification

Lectures from participants:

Dr. [Delphine Sinoquet](#) (IFPEN): Two applications of Stepwise Uncertainty Reduction strategy for excursion set estimation