Thomas Guilmeau

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https://tguilmeau.github.io/

I am a PhD student working on the study and design of sampling-based schemes in variational inference, adaptive importance sampling, and global optimization. I do so using ideas from information geometry and non-Euclidean optimization. I also study the behavior and control of biological models.

EDUCATION

PhD in applied mathematics, *Université Paris-Saclay, INRIA, CentraleSupélec* October 2021 - present
Stochastic algorithms for global optimization. Part of the project ERC MAJORIS. Under the supervision of E. Chouzenoux and V. Elvira.

MSc in applied mathematics, *Université Paris-Saclay* 2018 - 2020
M2 Optimization: optimal control, continuous optimization (theoretical and numerical aspects), stochastic optimization, game theory, calculus of variations, and tropical algebra.

Engineering degree, *ENSTA Paris, Institut Polytechnique de Paris* 2017 - 2020
Major in applied mathematics: discrete and continuous optimization, control theory, statistics, probability, dynamical systems, and partial differential equations.

EXPERIENCES

Research stays, *School of Mathematics (UoE), Edinburgh, Scotland* February - May 2023, March 2024
Exploration of the connections between variational inference and adaptive importance sampling, leading to novel adaptive importance sampling algorithms. With V. Elvira and N. Branchini.

Research engineer, *OPIS team (INRIA), Palaiseau, France* December 2020 - September 2021
Stochastic algorithms for non-convex optimization. Part of the project ERC MAJORIS. Under the supervision of E. Chouzenoux and V. Elvira.

Research engineer, *LBE (INRAE), Narbonne, France* October - November 2020
Development of a Matlab code to simulate metabolic transitions at a finer scale in microbial populations. Part of the projects HME 3BCAR and ANR JANUS.

Master thesis, *INRAE, Montpellier, France* April - September 2020
Determination of the optimal periodic control for a scalar problem, with applications to the chemostat model and water bioremediation processes. Study of the multiple species case. Under the direction of A. Rapaport.

Research intern, *UTFSM, Valparaíso, Chile* May - August 2019
Derivation of continuity properties and analysis of the sensitivity with respect to the initial conditions of the set of sustainable thresholds for a discrete-time controlled system. Under the direction of C. Hermosilla.

PUBLICATIONS

Journal papers

P. Gajardo, T. Guilmeau, and C. Hermosilla. **"Sensitivity analysis of the set of sustainable threshold"**. *Set-Valued and Variational Analysis*, vol. 32(18), 2024.

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"On variational inference and maximum likelihood estimation with the λ-exponential family"**. *Foundations of Data Science*, vol. 6(1), pp. 85-123, 2024.

T. Guilmeau and A. Rapaport. **"Multiplicity of neutrally stable periodic orbits with coexistence in the chemostat subject to periodic removal rate"**. *SIAM Journal on Applied Mathematics*, vol. 84(1), pp. 39-59, 2024.

T. Guilmeau and A. Rapaport. **"Singular arcs in optimal periodic control problems with scalar dynamics and integral input constraint"**. *Journal of Optimization Theory and Applications*, vol. 195, pp. 953-975, 2022.

Conference papers

T. Guilmeau, N. Branchini, E. Chouzenoux, and V. Elvira. **"Adaptive importance sampling for heavy-tailed distributions via α-divergence minimization"**. *Proceedings of the International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024.

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"Adaptive simulated annealing through alternating Rényi divergence minimization"**. *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2023.

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"Proximal-based adaptive simulated annealing for global optimization"**. *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2022.

F. Dupeuble, A. Rapaport, T. Guilmeau, J. Tchouanti, B. Enjalbert, C. Bideaux, J.-P. Steyer, A. Feddaoui-Papin, and J. Harmand. **"Deterministic models to decipher the lag phase duration during diauxie"**. *IFAC-PapersOnLine*, 2022.

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"Simulated annealing: a review and a new scheme"**. *Proceedings of the IEEE Statistical Signal Processing Workshop (SSP)*, 2021.

Preprints

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"A divergence-based condition to ensure quantile improvement in black-box global optimization"**. `http://arxiv.org/abs/2402.01277`, 2024.

T. Guilmeau, E. Chouzenoux, and V. Elvira. **"Regularized Rényi divergence minimization through Bregman proximal gradient algorithms"**. `https://hal.science/hal-03927834v1`, 2022.

TEACHING

Teaching assistant, *STA101 - ENSTA Paris* Spring 2024

A 3rd year introductory course on statistics, focusing on parameter estimation and hypothesis testing.

Teaching assistant, *AO101 - ENSTA Paris* Spring 2024

A 3rd year introductory course on optimization, with a special focus on the quadratic case and including algorithmic aspects.

Teaching assistant, *OPT201 - ENSTA Paris* Fall 2023

A 4th year course on differentiable optimization, including optimality conditions, sub-differentiability, and duality theory.

Teaching assistant, *Optimization - CentraleSupélec* Spring 2020 and Spring 2021

A 4th year course covering linear and convex optimization, integer programming, and introducing some iterative algorithms.

OUTREACH

RJMI, *INRIA Paris* 2022, 2024

The RJMI is a two-days research-based event aimed at girls in high school. I helped a group of students carry a research program over an open problem in mathematics.

Science fair, *Université Paris-Saclay* 2022, 2023

Scientific workshops open to the public are held over two days, and I helped animate the INRIA workshops about algorithms and cryptography.

Maths week, *Académie de Créteil* 2022

Presentation to high school students about my work, and how research is organized as a whole.

Documentary about IA, *with students of BUT MMI* 2022

These students have to create a documentary from scratch each year, including writing, filming, and editing. I introduced the students to artificial intelligence (this year's theme) and organized interviews with researchers.

OTHER ACADEMIC EXPERIENCES

Reviewing, *Bernoulli* 2023

MSc student supervision, *INRIA Saclay* 2023

LANGUAGES

French: Native speaker
English: Fluent (TOEIC: 990/990)
Spanish: Intermediate level

CODING SKILLS

Advanced: Julia, Python, Matlab, LaTeX
Basic level: C, C++, HTML, CSS

Last edited on May 30, 2024.