

# DARIO SHARIATIAN

Paris, France

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I am interested in researching efficient ML algorithms and designing innovative, ambitious systems as a result. I am currently working on modern generative techniques (e.g., diffusion models).

## EDUCATION

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### INRIA, Paris

October 2023 - now

**PhD Student**, supervised by Umut Simsekli and Alain Durmus

- Deep Learning topics. Currently working on deep generative models and novel approaches.

### University of Oxford, United Kingdom (*Distinction*)

2022 - 2023

- MSc in Mathematics - Part C (OMMS program). Main interests in ML/deep/stats, broadening courses in pure math
- Algorithmic foundation of learning, deep learning, random matrices, networks, differential geometry, algebraic topology

### Ecole Polytechnique, France (*Top 20%*)

2019 - 2022

- Master's level program in applied maths (stats, probability, data science). Minor: pure maths, CS, Physics, humanities
- After an initial focus in computer science and system design, I specialised in applied mathematics and data science.

### Lycee Saint-louis, Preparatory Program MPSI/MP\*, Paris, France

2017 - 2019

- Classical french 2 years preparation for Grandes Ecoles. Advanced maths, physics, CS, humanities.

## WORK EXPERIENCE

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### Squarepoint Capital, London, United Kingdom

March-August 2022

**Quantitative research intern**, supervised by Dr. Asgeir Biriksson

- Quantitative hedge fund focused on a collaborative approach
- Worked in equities, mid-frequency. Developed predictive mathematical models for stock market.
- Introduced a specific strategy to other teams and management, in an accessible manner, to be put in production.

### Ledger, Paris, France

June-September 2021

**Firmware engineer intern**, supervised by Mr. Raphael Geslain

- World leader in cryptocurrency hardware wallet market
- Wrote emulator for flagship product Ledger Nano X, enabling easier debugging and faster development time
- Study of product architecture (SOC ARM Secure Element) and emulation techniques on qemu. Secure OS (BOLOS)

### Gendarmerie Elite Unit (GIGN), Versailles, France

November-April 2020

**R&D intern**

- Selected to lead a small team to develop projects aimed at helping elite army unit
- Developed and deployed programs and techniques like noise reduction in audio files, object detection etc.
- Cooperated with field agents, teams and french institutions

## SKILLS

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### Programming/IDE

C/C++, Python, q/KDB, Java, Ocaml, SQL

### API, Tools, Softwares

PyTorch, Anaconda/Jupyter, Qt, git, gdb, OpenGL, qemu

## LANGUAGES

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English (*fluent*), French (*native*), Spanish (*intermediate*), Persian (*notions*)

## VARIOUS

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### Music

- Guitar, bass, drums. I enjoy playing funk/rock, with my band or during jam sessions.

### Sports

- Kung-fu (**ASCAM**) assistant teacher (traditional weapon courses : nunchaku, wood stick), volley-ball, ski, surf, sky-diving

### Community Involvement

- Rehabilitation of Chateau de Guedelon in France

## PUBLICATIONS

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### Denoising Lévy Probabilistic Models (DLPM)

**Shariatian, D.**, Simsekli, U., & Durmus, A.O. (2024). Denoising Lévy Probabilistic Models. ArXiv, abs/2407.18609.

- This paper introduces a novel framework to use heavy-tailed noise in the denoising diffusion paradigm, which constitutes a generalization of the original diffusion method (DDPM). Using heavy-tailed noise is shown to bring benefits in various contexts: heavy-tailed data distributions, better robustness to class imbalance, and smaller computational time.

### Piecewise Deterministic Generative Models

Bertazzi, A., Durmus, A.O., **Shariatian, D.**, Simsekli, U., & Moulines, É. (2024). Piecewise deterministic generative models. ArXiv, abs/2407.19448.

- This paper introduces a novel class of generative models based on piecewise deterministic Markov processes (PDMPs), which combine deterministic motion with random jumps. Like diffusions, PDMPs can be reversed in time. We derive explicit expressions for jump rates and kernels in the time-reversed processes and propose efficient training methods and approximate simulation techniques. Additionally, we provide bounds on the total variation distance between the data and model distributions, supported by promising numerical simulations..

## PRE-PHD (SELECTED) RESEARCH/ PROJECT WORK

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**Department of Statistics, University of Oxford**

*December - April 2023*

**An Alternative to the Log-Likelihood (Master Thesis)**, supervised by Dr. Gonzalo Mena

- Introducing an alternative to log-likelihood with tools inspired by entropic optimal transport (Sinkhorn EM). We focus on the asymptotic regime for parameter estimation and possible performance/stability/robustness gains
- In-depth study in the case of model misspecification shows improvement in this context.

**Department of Mathematics, University of Oxford**

*March 2023*

**Discrete Morse Theory for Relative/Persistent Cosheaf Homology**, supervised by Dr. Vidit Nanda

- Small study applying discrete Morse theory to vastly speed up homology computations in various contexts

**Department of Mathematics, University of Oxford**

*November - December 2022*

**Can Neural ODEs Offer Free Robustness?**, supervised by Dr. Jared Tanner

- Small theoretically backed study exploring the robustness/expressivity properties of neural ODEs, supporting use of SDEs as an effective regularization method.

**Center for Applied Mathematics, Ecole Polytechnique**

*2021*

**Risk analysis and portfolio management on a financial market**, supervised by Prof. Gregoire Loeper

- Research project based on Derman & Kani's paper "*The Volatility Smile and its Implied Tree*".
- Stochastic calculus, approximation schemes, binomial/trinomial trees, extensive study of Black-Scholes formula

**Center for Applied Mathematics, Ecole Polytechnique**

*2021*

**Monte-Carlo methods for simulations challenges**, supervised by Prof. Emmanuel Gobet

- Provided efficient benchmarks on variance reduction and control functions for systems under random perturbations
- Non-linear stochastic processes, optimisation on finite linear space, neural networks, GANs

**Space Center of Ecole Polytechnique**

*2020-2021*

**Team leader of the On-Board Computer of a nano-satellite (IONSAT project)**

- Aiming at breaking world record of Very Low Earth Orbit.

- Lead the student team designing the architecture for the flight software (firmware written in C, FPGA)
- Trained with the CNES (French Space Agency) on robust flight software using multiple cores, a GPU and an FPGA
- Presented in Dubai IAC 2021

**Lycée Saint-Louis**

*2018-2019*

**Elliptic Curves on Finite Fields and Algorithms**

- Research project on elliptic curves on finite field, from basic properties to Hasse theorem and Schoof's algorithm
- Wrote fast C++ library with GMP implementing these results