Dauphine | PSL
UNIVERSITÉ PARIS

Research Statement

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Keywords

Machine Learning · Optimization · Operations Research · Healthcare

Motivation

My academic passion lies at the fertile intersection of **mathematical modeling**, **optimization**, and **machine learning**. This interest is not purely theoretical; it is profoundly driven by the potential to apply these quantitative disciplines to solve high-impact, real-world challenges.
My primary motivation stems from the field of **healthcare/biomedical**. While my path did not lead to a medical career, my aspiration to advance human well-being remains a core driver. From projects in CT image analysis of pulmonary nodules to the identification of sepsis subphenotypes, I have consistently pursued research questions where computational methods can make tangible contributions to medicine. At the same time, I also remain open to applications in areas such as **finance and economics**, where optimization and machine learning can provide scalable solutions to complex decision-making problems.

Research Directory

My research interests are broad and evolving. The following categories represent my current focus, though I remain flexible to adapt under the guidance of my supervisor as long as the main direction is aligned.

Theoretical Foundations

- **Data-Efficient and Generalizable Learning:** My current research, initiated during an internship at IBISC Laboratory (Université Paris-Saclay), investigates how **geometric priors** can enhance model performance in data-scarce environments. The objective is to develop robust and generalizable models that learn effectively from limited yet valuable datasets.
- **Combinatorial Optimization and Game Theory:** This interest lies in the computational complexity of **NP-hard combinatorial optimization** problems and their interplay with **strategic behavior in game-theoretic settings**. I aim to investigate the limits of efficient computation through approximation algorithms, parameterized complexity, and hardness of approximation, while also exploring the emerging paradigm of **Algorithms with Predictions**, where learning-based side information can provably improve algorithmic performance. By bridging classical complexity-theoretic analysis with modern machine learning tools, I seek to develop frameworks that address both worst-case guarantees and data-driven adaptability.
- **Explainable AI (XAI):** In critical domains such as healthcare, model transparency is paramount. My research aims to develop methods that enhance the interpretability of complex machine learning models without compromising their predictive accuracy.

Application Domains

- **Operations Research in Healthcare:** I am keen to apply optimization and machine learning to address critical healthcare challenges. Specific areas of interest include **Kidney Exchange** optimization, equitable **Healthcare Resource Allocation**, and the development of data-driven **Clinical Decision Support Systems**.
- **Quantitative Finance and Risk Analysis:** My interests also extend to applying quantitative methods to decision-making under uncertainty in finance. This includes areas such as **portfolio optimization**, **credit risk modeling**, and the analysis of **systemic risk in financial networks**.

Future Plans

My academic plan for the coming year is strategically designed to strengthen my theoretical foundation and expand my research experience, paving the way for a seamless transition into a PhD program. It consists of two main components:

Foundational Coursework: M2 MODO Program at Dauphine–PSL

In the forthcoming academic year, I will pursue the **M2 MODO (Modélisation, Optimisation, Décision et Organisation)** program at Université Paris Dauphine–PSL. I have deliberately chosen this program because its curriculum is highly aligned with my research interests. Advanced courses in **combinatorial optimization**, **game theory**, and **data-driven modeling** will not only deepen my existing knowledge but also equip me with the rigorous mathematical and computational tools required for high-level doctoral research. I view this Master's program not merely as a degree, but as a critical preparatory stage to sharpen the skills necessary for my future research endeavors.

Bridging Theory and Practice: The Capstone Research Internship

The M2 MODO program culminates in a mandatory six-month research internship, which I plan to begin in Spring 2026. I see this as a pivotal opportunity to **connect theoretical advances with real-world applications**. I aim to secure an internship at a leading university lab or an industrial research-focused group, working on challenging problems in domains such as **healthcare operations research** or **financial risk modeling**.

My objective for this internship is twofold: (i) to contribute meaningfully to an ongoing research project, and (ii) to use this experience to refine my own research agenda. Ideally, this work will serve as the preliminary step toward my doctoral dissertation, enabling me to enter a PhD program with both a clear research direction and a well-defined proposal.