Yannis Montreuil

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Current Research

I study the theoretical foundations of routing and decision-making under uncertainty, with applications to multi-agent systems. My research centers on *Learning-to-Defer*—a framework where a lightweight model handles most queries, deferring complex cases to a larger offline model to reduce costly errors. I establish *theoretical guarantees* for optimal allocation policies, characterizing when deferral is beneficial and how models can learn to defer in a *provably optimal* way, drawing on tools from statistical learning theory and decision theory.

Education

National University of Singapore — Singapore
Ph.D Computer Science — Jan 2023 - Jan 2027
Awarded the A*STAR Merit Award and AISG–DesCartes Joint Excellence Scholarship.
Research focus: Statistical learning theory, with emphasis on decision-making under uncertainty and Learning-to-Defer frameworks. Applications include routing, deferral policies, and robust multi-agent systems.
Relevant coursework: Algorithms for Machine Learning, Uncertainty Modelling, Trustworthy ML, Theoretical CS, Advanced Probability (Mathematics Dept.).

Arts et Metiers — Paris, France
MSc Mechanical Engineering – Highest Honors — Sep 2019 - Sep 2022
Relevant coursework: Numerical Analysis, Convex Optimization, and Machine Learning.

Sorbonne University — Paris, France
MSc Robotics – Honors — Sep 2021 - Sep 2022
Relevant coursework: Statistics, Probabilities, Control Theory, PDE solving, and Deep Learning.

Sorbonne University — Paris, France
BS Mechanical Engineering — Sep 2015 - June 2019
Relevant coursework: Algebra, Functional Analysis, ODE, and PDE.

Publications

- Yannis Montreuil, Axel Carlier, Lai Xing Ng, and Wei Tsang Ooi (2025). *One-Stage Top-k Learning-to-Defer: Score-Based Surrogates with Theoretical Guarantees.* arXiv:2505.10160
- Yannis Montreuil, Axel Carlier, Lai Xing Ng, and Wei Tsang Ooi (2025). *Why Ask One When You Can Ask k? Two-Stage Learning-to-Defer to the Top-k Experts.* arXiv:2504.12988
- Yannis Montreuil, Axel Carlier, Lai Xing Ng, and Wei Tsang Ooi (2025). *Adversarial Robustness in Two-Stage Learning-to-Defer*: Algorithms and Guarantees. **In Proceedings of the Forty-second International Conference on Machine Learning** (ICML25). OpenReview
- Yannis Montreuil, Yeo Shu Heng, Axel Carlier, Lai Xing Ng, and Wei Tsang Ooi (2025). *A Two-Stage Learning-to-Defer Approach for Multi-Task Learning.* **In Proceedings of the Forty-second International Conference on Machine Learning** (ICML25). OpenReview
- Yannis Montreuil, Axel Carlier, Lai Xing Ng, and Wei Tsang Ooi (2024). *Optimal Query Allocation in Extractive QA with LLMs: A Learning-to-Defer Framework with Theoretical Guarantees.* arXiv:2410.15761

Work Experience

CNRS, National Center for Scientific Research — Singapore
Research Associate — Oct 2022 - Jan 2023

- Conducted research in statistical learning theory, developing provably optimal deferral strategies for decision-making under uncertainty.
- Formulated and analyzed routing problems with theoretical guarantees, enabling hybrid AI systems for applications such as smart cities.
- Collaborated with Prof. Ooi Wei Tsang, Prof. Axel Carlier, and Dr. Lai-Xing Ng.

CEA, The French Alternative Energies and Atomic Energy Commission — Saclay, France
Research Intern — March 2022 - Sep 2022

- Developed deep learning and geometric algorithms for 6-DoF robotic manipulation of deformable objects, achieving improved precision with minimal supervision.
- Designed self-supervised and implicit learning pipelines for 3D point cloud data, leveraging dense local descriptors to enhance cross-object generalization.

ONERA, The French Aerospace Lab Palaiseau, France
Research Intern May 2021 - Aug 2021

- Improved building detection in satellite imagery by optimizing semi-supervised learning algorithms (*Mean Teacher*, *Naive Student*).
- Increased detection accuracy by 30% through data augmentation, architectural refinements, and targeted hyperparameter tuning.

Awards

Research Incentive Award National University of Singapore
Granted to students that have demonstrated good academic standing and research progress. June 2023

Outstanding Academic Achievement Award Arts et Metiers
Recognized among the top students. Jan 2021

Skills

Programming Languages:	Python, C, R, PL/SQL, VBA. Experienced in large-scale machine learning.
Mathematical & Statistical:	Optimization (convex, non-convex), Probability theory, Inference, Statistical learning, Numerical methods, Time-series analysis. Comfortable with formal proofs and algorithm design.
Languages:	Languages: French (native), English (fluent), Spanish (intermediate)
Soft Skills:	Analytical thinker with strong autonomy and project ownership. Able to bridge theory and implementation in collaborative settings. Experienced in mentoring and communicating complex ideas clearly.
Hobbies:	Muay Thai, Tennis, Table Tennis, League of Legends when I got some time.