Vincent Counathe

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EDUCATION

Cornell University — United States
Ph.D. in Machine Learning — *Aug. 2025 – Present*
- Advisor: Chris De Sa
- Awarded Cornell University Fellowship; advanced standing via transferred credits
- Research: generative modeling and large-scale ML efficiency, with emphasis on discrete diffusion and latent reasoning mechanisms

Université Paris-Saclay (Institut de Mathématiques d'Orsay) — France
M.Res & M.Sc in Statistics & Machine Learning (Highest Honors) — *Sep. 2023 – Aug. 2025*
- Advisors: Florent Krzakala, Lenka Zdeborová, Christophe Giraud
- Rank 2 in cohort
- Focus on ML theory, discrete probability, stochastic processes, and high-dimensional statistics. *Full list at the end of CV.*

HEC Paris & Lycée Louis-le-Grand — France
Grande École Program & Preparatory Class (Mathematics & Quantitative Finance) — *Sep. 2014 – Jun. 2019*
- Specialization in mathematics, probability and statistics
- Ranked top 0.8% nationwide in competitive entrance exams
- Visiting student, University of Tokyo – Graduate School of Economics (Fall 2018)

RESEARCH EXPERIENCE

Cornell University — United States
Ph.D. Researcher (Advisor: Prof. Chris De Sa) — *Aug. 2025 – Present*
- Research on generative modeling and large-scale ML efficiency, focusing on discrete diffusion and latent reasoning mechanisms in transformers.
- Combining probabilistic modeling and distributed systems engineering (PyTorch, JAX, multi-GPU training).
- Goal: unified probabilistic frameworks for efficient reasoning and generation in large models.

EPFL — Switzerland
Graduate Researcher (Advisors: Prof. Florent Krzakala and Prof. Lenka Zdeborová) — *Apr. 2025 – Aug. 2025*
- Developed a unified framework for generalized feature-augmented stochastic block models. Derived sharp information-theoretic and computational thresholds for community detection. Techniques: high-dimensional probability, spectral methods, approximate message passing, low-degree polynomial methods for computational hardness. [Under review at COLT]

Université Paris-Saclay (Institut de Mathématiques d'Orsay) — France
Graduate Researcher (Advisor: Prof. Christophe Giraud) — *Apr. 2024 – Sep. 2024*
- Analyzed statistical risk for genealogical reconstruction on random recursive trees under various attachment models, establishing non-asymptotic upper and lower bounds for a risk functional associated with a Jordan-ordering estimator. Techniques: analytic combinatorics, martingale concentration. Applications to inference in networked data. [Link]

SELECTED PROJECTS

Convolutional Neural Network from scratch in C++: Implemented a CNN from scratch in C++ (no external libraries) for image classification (CIFAR-10).

Localization Schemes for Mixing Bounds in Markov Chains: Wrote an expository report on the framework developed by Chen & Eldan, detailing techniques to analyze mixing times and spectral gaps of Markov chains, with applications in high-dimensional sampling. [Link]

Community Detection in Random Graphs: Wrote an expository note on spectral methods for community detection using perturbation theory, concentration inequalities, and ϵ-net arguments to bound misclassification rates. [Link]

Workshops

Cargese Scientific Institute — France
Machine Learning & Statistical Physics Workshop (Selected Participant) — *Aug. 2025*

Hausdorff Center for Mathematics, University of Bonn — Germany
Statistical Mechanics of Spin Glasses, Neural Networks and Learning (Selected Participant) — *Jun. 2025*

EPFL — Switzerland
LemanTh: Machine Learning and Neural Network Theory (Selected Participant) — *May 2025*

Les Houches Physics School — France
Workshop: Towards a Theory for Typical-Case Algorithmic Hardness (Selected Participant) — *Jan. 2025*

Professional Experience

Clayton Dubilier & Rice — United Kingdom
Investments — *Jul. 2019 – Sep. 2023*

Skills & Coursework

Programming: Python, C++, Java

Frameworks: PyTorch, TensorFlow, JAX, NumPy, Pandas, Scikit-Learn, HF Transformers, CUDA

Coursework

– *Statistics & Machine Learning*: High-Dimensional Statistics, Nonparametric Bayesian Statistics and Applications, Statistical Learning, Optimal Transport, Generalization Properties of Algorithms in ML, Stochastic Optimization, Sequential Learning, Mathematics of Deep Learning, Inference in Large Random Graphs, Kernel and Operator-theoretic Methods in ML, Time Series

– *Mathematics & Probability*: Functional Analysis, Topology and Metric Spaces, Convex Analysis, Brownian Motion & Stochastic Calculus, Local Times & Excursion Theory, Concentration of Measure, Random Matrix Theory, Random Graphs, Ising Model, Markov Chains, Martingales

– *Optimization & Computing*: Differentiable Optimization, Operational Research, C++

Languages: French (Native), English (Fluent), Italian (Fluent), German (Conversational), Portuguese (Conversational), Japanese (Elementary)