Ludovic Stephan

Employment

- 2024– Assistant Professor, CREST lab, ENSAI, Rennes, France
- 2021–2024 **Post-doc**, Information, Learning and Physics (IdePHICS) Team, EPFL, Lausanne, Switzerland *Topic: Statistical physics approaches of Machine Learning theory* Advisor: Florent Krzakala

Education

- 2018–2021 Applied Mathematics and Computer Science Thesis, *PhD*, Inria Paris – DYOGENE Team, DI ENS, Sorbonne Université, Paris, France *Topic: Inference in random graphs and the stochastic block model.* PhD advisor : Laurent Massoulié.
- 2017–2018 Master's Degree in Probability and Statistics, M2, Paris-Saclay University, Orsay, France Specialized in Statistics and Machine Learning. First class honours.
- 2014–2015 **Bachelor's Degree in Mathematics**, *L3*, École Normale Supérieure, Paris, France
- 2014–2015 **Bachelor's Degree in Computer Science**, *L3*, École Normale Supérieure, Paris, France

Teaching Experience

- 2024 **Teacher, "Elements of Statistics for Data Science**", École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland Bachelor level course.
- 2018–2021 **Teaching assistant, "Network Models and Algorithms"**, École Normale Supérieure, Paris, France Master's degree course taught by Ana Busic.
- 2014–2019 Association TALENS, École Normale Supérieure, Paris, France Taught mathematics courses for high school students from underprivileged areas.

Supervision of students

- 2023 Hugo Koubbi, Master's internship.
- 2023 Aurélien Minguella, Master's internship.Won the École Polytechnique research internship prize for the results obtained.

Administrative experience

2019 Administrative assistant for the ENS entrance exam, École Normale Supérieure, Paris, France Co-organized the Computer Science portion of the ENS entrance exam, with a

focus on the oral examinations.

2017–2018 **Délégation Générale de l'ENS**, École Normale Supérieure, Paris, France Management of ENS students' housing organization, and mediation with the ENS administration. Revised the ENS' storage room system, and supervised ongoing works on ENS' housing facilities.

Talks & Posters

- Jan. 2024 TAU seminar, Gif-sur-Yvette, France
- Dec. 2023 PizzaMa seminar, Orsay, France
- Dec. 2023 CELESTE seminar, Orsay, France
- Oct. 2023 Machine Learning and Signal Processing seminar, Lyon, France
- Oct. 2023 Analytical Approaches for Neural Network Dynamics, Paris, France
- Aug. 2023 Statistical physics & machine learning back together again, Cargèse, France
- Jun. 2023 INFORMS Applied Probability Society Conference, Nancy, France
- Jun. 2023 **High Dimensional Statistics and Random Matrices**, Porquerolles, France
- May 2023 Machine Learning and Signal Processing seminar, Lyon, France
- Mar. 2023 LMO Probability seminar, Orsay, France
- Feb. 2023 Towards a theory of artificial and biological neural networks, Les Houches, France
- Nov. 2022 UCSD Probability seminar, San Diego, USA
- Nov. 2022 UCI Probability seminar, Irvine, USA
- Oct. 2022 Foundations of Computer Science (FOCS), Denver, USA
- Jul. 2022 Summer school on Statistical Physics & Machine learning, Les Houches, France
- Jun. 2022 Youth in High-Dimensions: Recent Progress in Machine Learning, High-Dimensional Statistics and Inference, SISSA, Trieste, Italy
- Jan. 2021 SPOC seminar, EPFL, Lausanne, Switzerland
- Oct. 2020 DYOGENE working group on random graphs, Inria, Paris, France
- Oct. 2019 Networking Days, Paris-Saclay University, Paris, France
- Jun. 2019 Conference on Learning Theory (COLT), Phoenix, USA
- Jun. 2019 DYOGENE seminar, Inria, Paris, France

Oct. 2018 Networking Days, Paris-Saclay University, Paris, France

Reviewing

- Journals SIAM Journal on Mathematics of Data Science, Random Structures and Algorithms, IEEE Transactions on Signal and Information Processing over Networks, IEEE Transactions on Information Theory, Annals of Statistics
- Conferences NeurIPS (Best Reviewer Award), ICML, ICLR, ALT

Bibliography

Preprints

Luca Arnaboldi, Yatin Dandi, Florent Krzakala, Luca Pesce, and Ludovic Stephan. Repetita iuvant: Data repetition allows sgd to learn high-dimensional multi-index functions. May 2024. eprint: 2405.15459 (stat.ML).

Luca Arnaboldi[†], Florent Krzakala, Bruno Loureiro, and **Ludovic Stephan**. Escaping mediocrity: how two-layer networks learn hard single-index models with SGD. May 2023. arXiv: 2305.18502 [stat.ML].

Simon Coste and Ludovic Stephan. A simpler spectral approach for clustering in directed networks. Feb. 2021. arXiv: 2102.03188 [cs.LG].

Published works

Luca Arnaboldi, Yatin Dandi, Florent Krzakala, Bruno Loureiro, Luca Pesce, and Ludovic Stephan. Online Learning and Information Exponents: The Importance of Batch size & Time/Complexity Tradeoffs. *Proceedings of the 41st International Conference on Machine Learning*. July 2024.

Federica Gerace[†], Florent Krzakala, Bruno Loureiro, **Ludovic Stephan**, and Lenka Zdeborová. Gaussian universality of perceptrons with random labels. *Phys. Rev. E* (3 Mar. 2024).

Ludovic Stephan and Yizhe Zhu. A non-backtracking method for long matrix and tensor completion. *Proceedings of Thirty Seventh Conference on Learning Theory*. June 2024.

Ludovic Stephan and Yizhe Zhu. Sparse random hypergraphs: non-backtracking spectra and community detection. Information and Inference: A Journal of the IMA (Feb. 2024). Also appeared in Symposium on Foundations of Computer Science (FOCS), 2022.

Luca Arnaboldi[†], Florent Krzakala, Bruno Loureiro, and **Ludovic Stephan**. Escaping mediocrity: how two-layer networks learn hard generalized linear models. *NeurIPS 2023* Workshop on Optimization for Machine Learning (OPT). Dec. 2023.

Luca Arnaboldi[†], **Ludovic Stephan**[†], Florent Krzakala, and Bruno Loureiro. From highdimensional & mean-field dynamics to dimensionless ODEs: A unifying approach to SGD in two-layers networks. *Conference on Learning Theory (COLT)*. July 2023. Yatin Dandi, Florent Krzakala, Bruno Loureiro, Luca Pesce, and Ludovic Stephan. How Two-Layer Neural Networks Learn, One (Giant) Step at a Time. *NeurIPS 2023* Workshop on Mathematics of Modern Machine Learning (M3L). Also submitted to Journal of Machine Learning Research. Nov. 2023.

Yatin Dandi[†], **Ludovic Stephan**[†], Florent Krzakala, Bruno Loureiro, and Lenka Zdeborová. Universality laws for Gaussian mixtures in generalized linear models. *Conference* on Neural Information Processing Systems (NeurIPS). Feb. 2023.

Luca Pesce[†], Florent Krzakala, Bruno Loureiro, and **Ludovic Stephan**. Are Gaussian Data All You Need? The Extents and Limits of Universality in High-Dimensional Generalized Linear Estimation. International Conference on Machine Learning (ICML). July 2023.

Ludovic Stephan[†] and Laurent Massoulié. Non-backtracking spectra of weighted inhomogeneous random graphs. *Mathematical Statistics and Learning* (Dec. 2022).

Rodrigo Veiga[†], **Ludovic Stephan**[†], Bruno Loureiro, Florent Krzakala, and Lenka Zdeborová. Phase diagram of Stochastic Gradient Descent in high-dimensional two-layer neural networks. Advances in Neural Information Processing Systems (NeurIPS). Nov. 2022.

Laurent Massoulié[†], **Ludovic Stephan**[†], and Don Towsley. Planting trees in graphs, and finding them back. Conference on Learning Theory (COLT). June 2019.

Ludovic Stephan[†] and Laurent Massoulié. Robustness of Spectral Methods for Community Detection. Conference on Learning Theory (COLT). June 2019.