

ALESSANDRO FAVERO

CONTACT INFORMATION	EPFL Institute of Physics Institute of Electrical Engineering CH-1015 Lausanne, Switzerland	<i>Phone:</i> +41-21-693-98-00 <i>E-mail:</i> alessandro.favero@epfl.ch <i>Website:</i> alesfav.github.io <i>LinkedIn:</i> linkedin.com/in/alesfav/
RESEARCH INTERESTS	Theory & science of deep learning: generalization, infinite-width limits, task and data structure, geometric priors, inductive bias, scaling laws. Foundation models: diffusion models, vision-language models, multi-modal LLMs, post-training, model editing, model merging, robustness.	
EDUCATION	EPFL , Lausanne, Switzerland Ph.D., Physics and AI 2025 Advisors: Prof. Matthieu Wyart (Physics), Prof. Pascal Frossard (Engineering). Sorbonne Université , Paris, France M.S., Fundamental Physics, Specialization in Complex Systems 2020 <i>Mention très bien</i> (highest honors). SISSA, ICTP, Politecnico di Torino , Trieste-Torino, Italy M.S., Physics of Complex Systems, Mathematical Modeling for Engineering 2020 <i>110/110 cum laude</i> (highest honors). Politecnico di Torino , Torino, Italy B.S., Engineering Physics, Information Engineering 2018	
INDUSTRY EXPERIENCE	Amazon Web Services Artificial Intelligence (AWS AI) , Santa Clara, California Applied Scientist July to October 2023 <ul style="list-style-type: none">• Internship at AWS AI Labs working on the alignment and robustness of large multi-modal models with the fundamental research team led by Prof. Stefano Soatto.	
ACADEMIC EXPERIENCE	EPFL , Lausanne, Switzerland Predoctoral Research Scholar November 2020 to April 2021 <ul style="list-style-type: none">• <i>Master's valorization</i> research scholarship (18,000 USD) on the statistical physics of deep learning systems in the Institute of Physics. Visiting Master's Thesis Student April 2020 to October 2020 <ul style="list-style-type: none">• Thesis project "<i>Spectral analysis of infinitely-wide convolutional neural networks</i>" in the Physics of Complex Systems Laboratory led by Prof. Matthieu Wyart. INRiM – Italian National Metrology Research Institute , Torino, Italy Undergraduate Research Intern October 2017 to January 2018 <ul style="list-style-type: none">• Internship on space-time quantum correlations in the Quantum Optics Laboratory led by Prof. Marco Genovese.	
REFEREED PUBLICATIONS	See also my Google Scholar and Semantic Scholar profiles. * <i>denotes co-first authorship.</i> [1] Hazimeh*, A., Favero*, A. and Frossard, P., 2024. Task Addition and Weight Disentanglement in Closed-Vocabulary Models. In ICML 2024 Efficient Systems for Foundation Models Workshop .	

- [2] Cagnetta, F., Petrini, L., Tomasini, U.M., Favero, A. and Wyart, M., 2024. How Deep Neural Networks Learn Compositional Data: The Random Hierarchy Model. In [Physical Review X](#), 14(3), p.031001.
- [3] Favero, A., Zancato, L., Trager, M., Choudhary, S., Perera, P., Achille, A., Swaminathan, A. and Soatto, S., 2024. Multi-Modal Hallucination Control by Visual Information Grounding. In [Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition](#), pp.14303-14312.
Also presented at MMFM2: The 2nd Workshop on What is Next in Multimodal Foundation Models?, Seattle, WA, 2024.
- [4] Ortiz-Jimenez*, G., Favero*, A. and Frossard, P., 2023. Task Arithmetic in the Tangent Space: Improved Editing of Pre-Trained Models. In [Advances in Neural Information Processing Systems](#), 36, pp.66727-66754.
Oral (top 0.54%).
- [5] Barak, B., Carrell, A., Favero, A., Li, W., Stephan, L. and Zlokapa, A., 2024. Computational complexity of deep learning: Fundamental limitations and empirical phenomena. In [Journal of Statistical Mechanics: Theory and Experiment](#), 2024(10), p.104008.
- [6] Cagnetta*, F., Favero*, A. and Wyart, M., 2023. What Can Be Learnt With Wide Convolutional Neural Networks?. In [Proceedings of the 40th International Conference on Machine Learning](#), PMLR 202, pp.3347-3379.
Included in the 2024 special issue on the Statistical Physics aspects of Machine Learning, [Journal of Statistical Mechanics: Theory and Experiment](#), 2024(10), p.104020.
- [7] Favero*, A., Cagnetta*, F. and Wyart, M., 2021. Locality defeats the curse of dimensionality in convolutional teacher-student scenarios. In [Advances in Neural Information Processing Systems](#), 34, pp.9456-9467.
Included in the 2022 special issue on the Statistical Physics aspects of Machine Learning, [Journal of Statistical Mechanics: Theory and Experiment](#), 2022(11), p.114012.
- [8] Petrini, L., Favero, A., Geiger, M. and Wyart, M., 2021. Relative stability toward diffeomorphisms indicates performance in deep nets. In [Advances in Neural Information Processing Systems](#), 34, pp.8727-8739.
Included in the 2022 special issue on the Statistical Physics aspects of Machine Learning, [Journal of Statistical Mechanics: Theory and Experiment](#), 2022(11), p.114013.
- PRE-PRINTS [9] Sclocchi*, A., Favero*, A., Levi*, N. I. and Wyart, M., 2024. Unraveling the Latent Hierarchical Structure of Language and Images via Diffusion Models. arXiv preprint arXiv:2410.13770.
Workshop version accepted at the NeurIPS 2024 Workshop on Scientific Methods for Understanding Deep Learning. **Oral.**
- [10] Wang, K., Dimitriadis, N., Favero, A., Ortiz-Jimenez, G., Fleuret, F. and Frossard, P., 2024. LiNeS: Post-training Layer Scaling Prevents Forgetting and Enhances Model Merging. arXiv preprint arXiv:2410.17146.
- [11] Sclocchi, A., Favero, A. and Wyart, M., 2024. A Phase Transition in Diffusion Models Reveals the Hierarchical Nature of Data. arXiv preprint arXiv:2402.16991.
- CONFERENCE ABSTRACTS [12] Favero, A., Cagnetta, F. and Wyart, M., 2023. Statistical Mechanics of Infinitely-Wide Convolutional Networks. [Bulletin of the American Physical Society](#).
- [13] Petrini, L., Favero, A., Geiger, M. and Wyart, M., 2023. Diffeomorphisms invariance is a proxy of performance in deep neural networks. [Bulletin of the American Physical Society](#).
- SELECTED TALKS **IBM Research**, IBM Accelerated Discovery Seminar, Zurich, 2024. *Task arithmetic in the tangent space of pre-trained models.*
- EPFL Center for Intelligent Systems**, NeurIPS Regional Post-Event, Lausanne, 2023. *Task arithmetic in the tangent space: Improved editing of pre-trained models.*

	<p>37th Conference on Neural Information Processing Systems, LLM Oral Session, New Orleans, 2023. <i>Task arithmetic in the tangent space of pre-trained models.</i></p> <p>Amazon AI Labs, 2023. <i>Task arithmetic in the tangent space of pre-trained models.</i></p> <p>MIT Center for Biological and Computational Learning, Boston, 2023. <i>Deep convolutional networks in kernel regimes: invariances, locality, and compositionality.</i></p> <p>NYU Center for Data Science, New York, 2023. <i>Generalization properties of deep convolutional networks in kernel regimes.</i></p> <p>American Physical Society March Meeting, Statistical Physics Meets Machine Learning, Las Vegas, 2023. <i>Statistical mechanics of infinitely wide convolutional networks.</i></p> <p>EPFL Institute of Physics, Seminars in Physics of Bio/Complex Systems, Lausanne, 2023. <i>Symmetry, locality, and hierarchy in artificial neural networks.</i></p> <p>Rice University, Workshop on the Theory of Overparameterized ML, 2022. <i>Locality defeats the curse of dimensionality in convolutional teacher-student scenarios.</i></p>
SELECTED POSTERS	<p>Flatiron Institute, Center for Computational Neuroscience, New York, 2024. <i>Hierarchies and compositionality in diffusion models.</i></p> <p>Oxford Department of Statistics, Workshop on Robustness in LLMs, Oxford, 2024. <i>Multi-modal hallucination control by visual information grounding.</i></p> <p>Princeton University ORFE Department, Princeton, 2022. <i>How wide convolutional neural networks learn hierarchical tasks.</i></p> <p>Simons Foundation, Simons Collaboration on Cracking the Glass Problem Meeting, New York, 2022. <i>Spatial locality and translational invariance in machine learning.</i></p>
MEETINGS AND SCHOOLS	<ul style="list-style-type: none"> • Mathematics of machine learning, Italian National Institute for Advanced Mathematics (INdAM – Istituto Nazionale di Alta Matematica), Cortona, 2024 (<i>invited</i>). • Analytical connectionism summer school, Flatiron Center for Computational Neuroscience, New York, 2024. • Machine learning theory summer school, Princeton University, Princeton, 2022. • Statistical physics and machine learning summer school, Les Houches School of Physics, Les Houches, 2022.
TEACHING EXPERIENCE	<p>EPFL, Lausanne, Switzerland</p> <p>Teaching assistant (<i>2024 Dean’s award for teaching excellence</i>) Fall 2021 to present</p> <ul style="list-style-type: none"> • PHYS-316 Statistical Physics II: Phase Transitions and Critical Phenomena (Spring 2023, Spring 2024). • PHYS-467 Machine Learning for Physicists (Fall 2021, Fall 2022, Fall 2023). • PHYS-421 Physics Projects I: Statistical Mechanics of Deep Learning (Fall 2021). <p>Guest lecturer at CS-625 Transfer Learning and Meta-Learning (Spring 2024).</p>
ADVISING AND MENTORING	<p>Master’s theses</p> <ul style="list-style-type: none"> • C. A. B., 2024, M.S. Cyber Security, EPFL–ETH Zurich. • T. H., 2023, M.S. Physics, EPFL. <p>Semester projects (Ph.D.)</p> <ul style="list-style-type: none"> • A. A., 2024, Ph.D. Computer Science, EPFL. • A. H., 2023, Ph.D. Computer Science, EPFL.

REFeree

- Advances in Neural Information Processing Systems (NeurIPS). *Top reviewer 2024*.
- Transactions on Machine Learning Research (TMLR).
- International Conference on Machine Learning (ICML).
- International Conference on Learning Representations (ICLR).
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR).
- Physical Review Journals.

Academic Service

- ELLIS (European Lab for Learning & Intelligent Systems) PhD Recruiting Committee, Evaluator (a.y. 2024-25)

Awards

- **Dean's award for teaching excellence** (1,100 USD), EPFL, 2024.
- **Top reviewer** award, NeurIPS, 2024.
- Master's valorization research scholarship (18,000 USD), EPFL, 2020.
- Merit-based scholarship for thesis abroad, Politecnico di Torino (2,800 USD), 2020.
- Erasmus+ scholarship (3,400 USD), Sorbonne Université, 2019.
- Fee reduction for high academic performance, Politecnico di Torino, 2019.
- Mobility grant for a semester at SISSA and ICTP (2,000 USD), 2018.
- Top 200 engineering admission tests (among 8,000 applicants), Politecnico di Torino, 2014.