

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	<ul style="list-style-type: none">• 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.	
EDUCATION	EPFL , Lausanne, Switzerland Ph.D., Physics and Machine Learning 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 (AWS) , 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 (15,000 CHF) on the statistical physics of deep learning 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] 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. [2] Hazimeh, A., Favero, A. and Frossard, P., 2024. Task Addition and Weight Disentanglement in Closed-Vocabulary Models. In Efficient Systems for Foundation Models Workshop, 41st International Conference on Machine Learning .	

- [3] 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.
- [4] 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.
- [5] 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%).
- [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.
To appear in the 2024 special issue on the Statistical Physics aspects of Machine Learning, Journal of Statistical Mechanics: Theory and Experiment, 2024.
- [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. and Wyart, M., 2024. A Phase Transition in Diffusion Models Reveals the Hierarchical Nature of Data. arXiv preprint arXiv:2402.16991.

CONFERENCE
ABSTRACTS

- [10] Favero, A., Cagnetta, F. and Wyart, M., 2023. Statistical Mechanics of Infinitely-Wide Convolutional Networks. [Bulletin of the American Physical Society](#).
- [11] 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.*

37th Conference on Neural Information Processing Systems, LLM Oral Session, New Orleans, 2023. *Task arithmetic in the tangent space: Improved editing of pre-trained models.*

Amazon AI Labs, 2023. *Task arithmetic in the tangent space of pre-trained models.*

MIT Center for Biological and Computational Learning, Boston, 2023. *Deep convolutional networks in kernel regimes: invariances, locality, and compositionality.*

NYU Center for Data Science, New York, 2023. *Generalization properties of deep convolutional networks in kernel regimes.*

American Physical Society March Meeting, Statistical Physics Meets Machine Learning focus session, Las Vegas, 2023. *Statistical mechanics of infinitely wide convolutional networks.*

EPFL Institute of Physics, Seminars in Physics of Bio/Complex Systems, Lausanne, 2023. *Symmetry, locality, and hierarchy in artificial neural networks.*

	Rice University , Workshop on the Theory of Overparameterized Machine Learning, 2022. <i>Locality defeats the curse of dimensionality in convolutional teacher-student settings.</i>
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 Large Language Models (RobustLLMs), 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 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"> T. H., 2023, M.S. Physics, EPFL. Thesis topic: <i>Maximum-entropy diffeomorphisms for adversarial training.</i> <p>Semester projects (Ph.D.)</p> <ul style="list-style-type: none"> A. A., 2024, Ph.D. Computer Science, EPFL. Topic: <i>Enhancing robustness via model editing.</i> A. H., 2023, Ph.D. Computer Science, EPFL. Topic: <i>Task addition in closed-vocabulary models.</i>
REFEREE	<ul style="list-style-type: none"> Advances in Neural Information Processing Systems (NeurIPS). 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.
AWARDS	<ul style="list-style-type: none"> Master’s valorization scholarship (15,000 CHF), EPFL, 2020. Merit-based scholarship for thesis abroad, Politecnico di Torino (2,500 EUR), 2020. Erasmus+ scholarship (3,000 EUR), Sorbonne Université, 2019. Fee reduction for high academic performance, Politecnico di Torino, 2019. Mobility grant for a semester at SISSA and ICTP (1,800 EUR), 2018. Top 200 engineering admission tests (among 8,000 applicants), Politecnico di Torino, 2014.