Vittorio Erba

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Research positions

Main research interest: Statistical physics of inference, learning and optimization

01/2023 ↦ 12/2024 | **SNSF Postdoctoral Fellow**, École polytechnique fédérale de Lausanne
Independent researcher working with the group of Lenka Zdeborová

11/2021 ↦ 12/2022 | **Postdoctoral Researcher**, École polytechnique fédérale de Lausanne
Working in the group of Lenka Zdeborová

Education

10/2018 ↦ 10/2021 | **PhD in Theoretical Physics**, Università degli Studi di Milano
Thesis supervisor: Sergio Caracciolo | Full marks cum laude

10/2016 ↦ 10/2018 | **M. Sc. in Theoretical Physics**, Università degli Studi di Milano
Thesis supervisor: Sergio Caracciolo | 110 cum laude/110

10/2013 ↦ 07/2016 | **B. Sc. in Physics**, Università degli Studi di Milano
Thesis supervisor: Luca Molinari | 110 cum laude/110

Funding & Awards

- 2023 | SNSF Postdoctoral Fellowship (2 years) | 10% success rate, total budget ~221000 CHF
- 2018 | Ph.D. Scholarship (3 years) | Awarded by Unimi, Milan. Ranked 10th/out of 53 candidates
- 2015 | Excellence Scholarship (3 years) | Awarded by Unimi, Milan, to the best students
- 2012 | "Valerio Filippini" first prize and scholarship for young talents in Physics (Provincia di Varese)

Scientific service

Reviewer for AISTATS 2024, ICLR 2023, NeurIPS 2022 & 2023, Nature, Physical Review E, Physica A: Statistical Mechanics and its Applications

Organiser of:
- 08/2023 | "Statistical physics & machine learning back together again": 2-weeks workshop at the Cargese Institute of Scientific Studies
- 06/2022 | AI4Science Day: 1-day workshop for EPFL groups working on ML applied to natural sciences
- 03/2022 | AI&Physics Track, AMLD22: conference track on theoretical and applied machine learning
- 10/2016 | Particle and Astroparticle Physics Autumn Programme: visit to INFN and Gran Sasso labs

Volunteering for the Italian Association of Physics Students (2015 ↦ 2017)
- Secretary and IT contributor for the association
- Managed an outreach program for high-schools
- Rewrote the internal online website/database of associates (mostly in php)

Visits, Conferences & Schools

Poster	12/2023	EPFL CIS NeurIPS 2023 Regional Post-Event, EPFL Lausanne
Talk	08/2023	Statistical physics & machine learning back together again, Cargese Research Institute
Talk	06/2023	High Dimensional Statistics and Random Matrices, Porquerolles
Poster	05/2023	Youth in High-Dimensions, ICTP Trieste
Talk	04/2023	Visit to Riccardo Zecchina's group, Bocconi University, Milan
Poster	02/2023	Towards a theory of artificial and biological neural networks, Les Houches School
-	10/2022	The many facets of Statistical Field Theory, SISSA Trieste
Talk	08/2022	Mathematical and Scientific Machine Learning, Virtual

Poster	07/2022	Summer school on Statistical Physics & Machine learning, Les Houches School
Poster	06/2022	Youth in High-Dimensions, ICTP Trieste
-	03/2022	Applied Machine Learning Days 2022, EPFL Lausanne
-	02/2022	Loss Landscape of Neural Networks, EPFL Lausanne
-	12/2021	EPFL NeurIPS 2021 Mirror Event, EPFL Lausanne
-	09/2021	Rigorous Evidence for Information-Computation Trade-offs, Virtual
-	07/2021	Glassy Systems and Inter-Disciplinary Applications, Cargese Research Institute
-	02/2021	Symposium on Explanation in Neuroscience and Artificial Intelligence, Virtual
Talk	12/2020	Talk to Lenka Zdeborová's group, EPFL Lausanne
-	10/2020	Brain Criticality 2020, Virtual
Talk	10/2020	Visit to Michele Parrinello's group, Università della Svizzera Italiana, Lugano
Talk	10/2019	Complex Systems Meeting, Unimi Milan
-	10/2019	Mathematical and Computational Aspects of Machine Learning, SNS Pisa
Poster	06/2019	XXIV Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi, Parma
-	02/2019	Lectures on Statistical Field Theories, GGI Firenze
-	09/2018	Disordered serendipity: a glassy path to discovery, Sapienza University, Rome
-	08/2017	International Conference of physics students, Unito Torino
-	05/2017	Conferenza Italiana Studenti di Fisica, Uniba Bari
Talk	08/2016	International Conference of physics students, Malta
-	05/2016	Conferenza Italiana Studenti di Fisica, Unito Torino
-	05/2015	Conferenza Italiana Studenti di Fisica, Unito Torino

Teaching & Supervision

University teaching

- EPFL, Fall 2023: Data analysis for Physics (resp. Lenka Zdeborová)
  Designed and taught 3 exercise sessions on numerical methods and data anlysis for physics.
- EPFL, Fall 2022: Scientific Machine Learning (resp. Lenka Zdeborová)
- UNIMI, Spring 2021: Mathematical methods in physics (resp. Luca Molinari)
  Taught 12 lectures where I solved exercises in complex and functional analysis at the blackboard.
- UNIMI, Fall 2020: Mini course of mathematics for freshman in physics (resp. Alberto Pullia)
  Designed and taught 5 lectures on functions, vectors, differentiation and integration.
- UNIMI, Fall 2020: Numerical treatment of experimental data (resp. Leonardo Carminati)
  Teaching assistant for a course on C++, object-oriented programming and numerical methods for physics.
- UNIMI, Spring 2020: Mathematical methods in physics (resp. Luca Molinari)
  Taught 12 lectures where I solved exercises in complex and functional analysis at the blackboard.
- UNIMI, Fall 2019: Mini course of mathematics for freshman in informatics (resp. Nicoletta Bressan)
  Designed and taught 5 lectures on equations (rational, irrational, trigonometric, logarithmic).
- UNIMI, Spring 2019: Mathematical methods in physics (resp. Luca Molinari)
  Taught 6 lectures where I solved exercises in complex and functional analysis at the blackboard.

Student supervision

- 2023, EPFL, Nathan Kupferschmid, Semester project (resp. Lenka Zdeborová)
- 2023, EPFL, Hamza Meel, Semester project (resp. Lenka Zdeborová)
- 2023, EPFL, Rodrigo Emilio Pérez Ortiz, M.Sc. thesis (resp. Lenka Zdeborová)
  A published article resulted from this supervision.
- 2022, EPFL, Odilon Duranthon, Semester project (resp. Lenka Zdeborová)
- 2022, EPFL, Matteo Vilucchio, Semester project (resp. Lenka Zdeborová)
  A published article resulted from this supervision.
- 2022, EPFL, Borja Mateos, Semester project (resp. Lenka Zdeborová)
- 2020, UNIMI, Sebastiano Ariosto, M.Sc. Thesis cosupervised with Marco Gherardi and Pietro Rotondo
  A published article resulted from this supervision.
- 2020, UNIMI, Mirko Rossini, M.Sc. Thesis cosupervised with Marco Gherardi and Pietro Rotondo

UNIMI: Università degli Studi di Milano
EPFL: École polytechnique fédérale de Lausanne.

Other

- Academic year 2016/17: Substitute physics teacher the "L. Einaudi" secondary public school, Varese
  Taught a full year of introductory physics to a secondary public school for adult students.
- 2013 $\mapsto$ 2018: Private lectures in math, physics, chemistry, latin

Publications

1. **Asymptotic Characterisation of Robust Empirical Risk Minimisation Performance in the Presence of Outliers.** Vilucchio, Troiani, Erba, Krazkala. Accepted at AISTATS (2024)
2. **Statistical mechanics of the maximum-average submatrix problem.** Erba†, Krzakala, Perez, Zdeborová. Journal of Statistical Mechanics (2023)
3. **Optimal denoising of rotationally invariant rectangular matrices.** Troiani, Erba†, Krzakala, Maillard, Zdeborová. Mathematical and Scientific Machine Learning (2022)
4. **Self-induced quenched disorder in multimodal cavity quantum electrodynamics.** Erba†, Pastore, Rotondo. Physical Review Letters (2021)
5. **The number of optimal matchings in the Euclidean assignment problem on the line.** Caracciolo, Erba†, Sportiello. Journal of Statistical Physics (2021)
6. **The p-Airy distribution.** Caracciolo, Erba†, Sportiello. Preprint Arxiv (2020)
7. **Statistical learning theory of structured data.** Pastore, Rotondo, Erba, Gherardi. Physical Review E (2020, Editor's suggestion)
8. **Random geometric graphs in high dimension.** Erba†, Ariosto, Gherardi, Rotondo. Physical Review E (2020)
9. **The Dyck bound in the concave 1-dimensional random assignment model.** Caracciolo, D'Achille, Erba†, Sportiello. Journal of Physics A (2020)
10. **Intrinsic dimension estimation for locally undersampled data.** Erba†, Gherardi, Rotondo. Scientific Reports (2019)
11. **Unified Fock space representation of fractional quantum Hall states.** Di Gioacchino, Molinari, Erba, Rotondo. Physical Review B (2017)

†: denotes first authorship: I had a primary role in the research and writing related to these papers.

Skills

- **Computer programming**: proficient in Julia, Python, Wolfram Mathematica, LaTeX. Have experience with C++, Bash
- **Web design**: knowledge of HTML and CSS for static websites. Basic experience with php and sql.
- **Graphics**: have experience with Inkscape

Languages

- **Italian**: mothertongue
- **English**: Fluent, CEFR C1. Certifications: Cambridge BULATS C1 (2019), Cambridge FCE B2 (2012)
- **French**: Intermediate