# Vittorio **Erba**

vittorioerba.github.io
vittorio.erba@epfl.ch
vittorio.erba@posteo.net


**Current position: Postdoc at Statistical Physics of Computation Laboratory** 2021 - Present
École polytechnique fédérale de Lausanne Lausanne (CH)

- Supervisor: Lenka Zdeborová
- Research topics: Statistical physics of inference problems, machine learning and optimization

## Education

**Ph.D. in Theoretical Physics (full marks with honors)** 2018 - 2021
Università degli Studi di Milano Milano (IT)

- Supervisor: Sergio Caracciolo
- Thesis title: Aspects of data structure in machine learning
- Research topics: Euclidean random combinatorial optimization, Machine learning, Disordered systems
- Main collaborators: Sergio Caracciolo, Marco Gherardi, Pietro Rotondo, Andrea Sportiello

**M.Sc. in Physics (110 cum laude/110)** 2016 - 2018
Università degli Studi di Milano Milano (IT)

- Thesis supervisor: Sergio Caracciolo
- Thesis title: Random Euclidean bipartite matching with concave cost functions in 1d

**B.Sc. in Physics (110 cum laude/110)** 2013 - 2016
Università degli Studi di Milano Milano (IT)

- Thesis supervisor: Luca Molinari
- Thesis title: Slater decomposition of fractional quantum Hall states

## Publications

Asterisk * denotes first authors / equal contribution: I had a primary role in the research and writing related to these papers.

9. **Optimal denoising of rotationally invariant rectangular matrices.** Troiani, Erba*, Krzakala, Maillard, Zdeborová. Preprint Arxiv (2022)
8. **Self-induced quenched disorder in multimodal cavity quantum electrodynamics.** Erba*, Pastore, Rotondo. Physical Review Letters (2021).
7. **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)
5. **Statistical learning theory of structured data.** Pastore, Rotondo, Erba, Gherardi. Physical Review E (2020, Editor's suggestion)
4. **Random geometric graphs in high dimension.** Erba*, Ariosto, Gherardi, Rotondo. Physical Review E (2020)
3. **The Dyck bound in the concave 1-dimensional random assignment model.** Caracciolo, D'Achille, Erba*, Sportiello. Journal of Physics A (2020)
2. **Intrinsic dimension estimation for locally undersampled data.** Erba*, Gherardi, Rotondo. Scientific Reports (2019)

1. **Unified Fock space representation of fractional quantum Hall states.** Di Gioacchino, Molinari, Erba, Rotondo. Physical Review B (2017)

## Scientific service

- **Organized the AI&Physics Track** at the Applied Machine Learning Days 2022, one of the leading conferences in applied machine learning
- **Reviewer** for the following international journals: *Physica A: Statistical Mechanics and its Applications*

## Schools & Internships

**School — Glassy Systems and Inter-Disciplinary Applications** 07/2021
Institut d'Etudes Scientifiques Cargèse (FR)

- Lectures and research seminars on the physics of glassy systems, both from a theoretical and a phenomenological point of view, and on inter-disciplinary applications in biology, economics, material engineering and machine learning.

**School — Mathematical and Computational Aspects of Machine Learning** 10/2019
Ennio De Giorgi center Pisa (IT)

- Lectures on optimal transport, mean field Bayesian inference, numerical methods in machine learning and approximation theory

**School — Lectures on Statistical Field Theories** 02/2019
Galileo Galilei Institute Firenze (IT)

- Lectures on tensors networks, Floquet physics, Luttinger liquids and transport phenomena in 1d

**Internship — ESRF/ILL International Student Summer Programme** 09/2015
European Synchrotron Radiation Facility Grenoble (FR)

- Lectures on X-ray and neutron physics and on imaging techniques
- Experimental project with the ID26 - "X-ray absorption and emission spectroscopy" group (PI: Pieter Glatzel) on the measurement of Eu3+ fluorescence spectrum

## Talks and Posters

**Invited seminar | Data structure in machine learning: estimators and models** 15/12/2020
Lenka Zdeborová's group, École polytechnique fédérale de Lausanne Virtual

**Invited seminar | Intrinsic dimension estimation for locally undersampled data** 12/11/2019
Michele Parrinello's group, Università della Svizzera Italiana Lugano (CH)

**Contributed talk | Intrinsic dimension estimation for locally undersampled data** 31/10/2019
Complex System Meeting, Università degli Studi di Milano Milano (IT)

**Poster | Intrinsic dimension estimation for locally undersampled data** 24/06/2019
XXIV Statistical Physics Meeting, Università degli Studi di Parma Parma (IT)

## Honors & Awards

**Ph.D Scholarship** 2019 - 2021
Awarded by Università degli Studi di Milano

**Excellence Scholarship** 2015 - 2017
Awarded by Università degli Studi di Milano to students complying with annual courses requirements

## Skills

- **Programming:** Julia, C++, Mathematica, Python
- **M. Learning/Optimization::** PyTorch, Flux, JuMP, CPLEX
- **Tools/Techs:** Bash, LaTeX, Inkscape
- **Web:** HTML, CSS

## Languages

- **Italian:** Mothertongue
- **English:** Fluent, CEFR C1 (Certifications: Cambridge BULATS C1 (2019), Cambridge FCE B2 (2012))
- **French:** Basic knowledge

## Teaching & Supervision

**Tutoring for university courses** Spring 2019 - Present
University of Milan Milano (IT)

- Spring 2021: Mathematical methods in physics (complex and functional analysis)
- Fall 2020: Numerical treatment of experimental data (C++, OOP and numerical methods)
- Fall 2020: Precourse of mathematics for freshmen in physics (basic maths)
- Spring 2020: Mathematical methods in physics (complex and functional analysis)
- Fall 2019: Recovery course of mathematics for freshman in natural sciences (basic maths)
- Spring 2019: Mathematical methods in physics (complex and functional analysis)

**Thesis supervision** Fall 2019
University of Milan Milano (IT)

- Fall 2019, Sebastiano Ariosto, "Random geometric graphs in high dimension"
- Fall 2019, Mirko Rossini, "Geometry of structured datasets via multi-scale persistency analysis"

**Substitute physics teacher for a secondary public school** 10/2016 - 06/2017
Istituto Professionale "L. Einaudi" Varese (IT)

## Participation to conferences and workshops

**Applied Machine Learning Days 2022** 03/2022
École polytechnique fédérale de Lausanne Lausanne (CH)

**Loss Landscape of Neural Networks** 02/2022
Virtual, École polytechnique fédérale de Lausanne Lausanne (CH)

**EPFL CIS NeurIPS 2021 Mirror Event** 12/2021
École polytechnique fédérale de Lausanne Lausanne (CH)

**Symposium on Explanation in Neuroscience and Artificial Intelligence** 02/2021
Virtual venue

**Brain Criticality Meeting** 10/2020
Virtual venue

**Complex Systems Meeting** 10/2019
University of Milan Milano (IT)

**XXIV Statistical Physics Meeting** 06/2019
University of Parma Parma (IT)

**International Conference of Physics Students** 2016 & 2017
Organized by IAPS (International Association of Physics Students)

**Italian Conference of Physics Students** 2015, 2016 & 2017
Organized by AISF (Italian Association of Physics Students)

## Other experiences

**Student job at the office for didactics** 11/2017 - 03/2018
Università degli Studi di Milano, Maths dept. Milano (IT)

- Responsible for exams' scheduling
- Responsible for the update of the informations on courses, professors and exams on the department websites

**Secretary and IT contributor** 09/2014 - 12/2017
Italian Association of Physics Students

- Responsible for the bureaucracy of the non-profit association
- Contributor to the development of the public website and the private online database of the association
- Organizer of the PAPAP16 event, a visit to the Gran Sasso national laboratories with 40 participants from all around Europe
- Organizer of outreach events in high schools
- Volunteer for the XXXII International Conference of Physics Students