Francesco Camilli

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Publications and Preprints

Lezioni di Meccanica Elementare, e oltre 2023
Camilli, F., Contucci, P.
Textbook for a first course in Mathematical Physics.
Bologna University Press (BUP), *to appear*.

Matrix factorization with neural networks December 2022
Camilli, F., Mézard, M.
arXiv e-prints: arXiv:2212.02105v1 (2022)

Bayes-optimal limits in structured PCA, and how to reach them October 2022
Barbier, J, Camilli, F., Mondelli, M., Saenz., M.
arXiv e-prints: arXiv:2210.01237v1 (2022)

An inference problem in a mismatched setting: a spin-glass model with Mattis interaction April 2022
Camilli, F., Contucci, P., Mingione, E.
SciPost Physics **12**, 125 (2022)

A statistical physics approach to a multi-channel Wigner spiked model March 2022
Alberici, D., Camilli, F., Contucci, P., Mingione, E.
Europhysics Letters **136**, Article number: 4, (2022)

The Solution of the Deep Boltzmann Machine on the Nishimori Line July 2021
Alberici, D., Camilli, F., Contucci, P., Mingione, E.
Communications in Mathematical Physics **387**, 1191–1214, (2021)

The Multi-species Mean-Field Spin-Glass on the Nishimori Line January 2021
Alberici, D., Camilli, F., Contucci, P., Mingione, E.
Journal of Statistical Physics **182**, Article number: 2, (2021)

Conferences and Seminars

A spin-glass perspective on a mismatched inference problem 20-22 June 2022
Parma Italy
Short talk for the II Conference of the Italian Society of Statistical Physics - SIFS.

Bayesian inference in a mismatched setting: a spin-glass model with Mattis interaction 27-30 June 2022
Trieste Italy
Poster for Youth in High Dimensions 2022.

Glassy behaviour in mismatched rank-one matrix estimation 26 May 2022
University of Padova Padova, Italy
Short talk for the First UMI meeting of Ph.D. students during the 100UMI - 800UniPD conference.

Boltzmann Machines on the Nishimori line 28 April 2021
University of Bologna Bologna, Italy (Remote)
Invited speaker at the kick-off workshop AlmaHAI: Hard Sciences.

The deep Boltzmann machine on the Nishimori line 2 March 2021
ICTP - International Centre for Theoretical Physics Trieste, Italy (Remote)
Seminar for the Quantitative Life Sciences (QLS) group at ICTP.

Mathematical Methods and Models in Machine Learning 27-28 April 2020
University of Bologna Bologna, Italy
Member of the organizing committee and chairman of the April 28th's morning session.

Reviewing activity

Journal of Statistical Physics 2022
Springer Nature
SOURCE-WORK-ID: c652739e-7a3d-445c-86a8-bd496df404bf

Education

Predoctoral visiting scientist December 2022– January 2023
Institute of Science and Technology Austria (ISTA) Vienna, Austria

PhD in Mathematics November 2019– Current
University of Bologna Bologna, Italy
Research interests - Statistical Mechanics of Disordered Systems and applications:

- Multi-species disordered models;
- Boltzmann Machines;
- High dimensional statistical inference in optimal and mismatched settings;
- Disordered models on the Nishimori Line and their relation with statistical inference;
- Central limit theorems and scaling limits in statistical mechanics and inference;
- High dimensional inference with structured noise;

Supervisor: prof. Pierluigi Contucci.

Cotutelle: PhD in Physics May 2021– Current
École Normale Supérieure Paris, France
Research interests:

- Neural Networks
- High rank matrix factorization

Supervisor: prof. Marc Mézard.

Guest Scientist December 2021, 11-16 May 2022
ICTP - International Centre for Theoretical Physics Trieste, Italy
Invited by Dr. Jean Barbier, Quantitative Life Sciences (QLS) group.

M.Sc. in Physics | ***110/110 cum laude*** September 2017 – October 2019
University of Bologna Bologna, Italy

- Quantum Field Theory (advanced);
- Statistical Mechanics (advanced);
- General Relativity and basic notions of Quantum Field Theory in curved space-times.

Master Thesis: Statistical Mechanics Perspectives on Boltzmann Machines. Supervisor: prof. Pierluigi Contucci. Co-supervisor: dott. Emanuele Mingione.

Diploma of the Collegio Superiore September 2014 – October 2019
University of Bologna Bologna, Italy
Collegio Superiore is an institute of excellence of the University of Bologna. Admission and permanence are based exclusively on merits. It provides its students some benefits, among which:

- exemption from tuition fees;
- a 2650€/year scholarship;
- lodging.

B.Sc. in Physics | ***110/110 cum laude*** September 2014 – September 2017
University of Bologna Bologna, Italy
Thesis (ITA): Teoria classica dei campi: campo elettromagnetico e radiazione di cariche in moto. Supervisor: prof. Alexandre Kamenchtchik.

High School Diploma | ***100/100 cum laude*** September 2009 – September 2014
Liceo Scientifico G. Marconi Pesaro, Italy
Elected student representative in 2012/2013.

Teaching Experience

Lecturer at the Summer School Corso Estivo a Cesenatico 2 September 2022
University of Bologna Cesenatico, Italy
1-hour lecture on maximum likelihood estimation for the training of Boltzmann machines.

Teaching assistant for Statistical Mechanics of Complex Systems February 2020 – Current
University of Bologna Bologna, Italy
I assist the professor during the exams of the course. Total amount of hours: 36.

Teaching assistant for Mathematical Physics 1. February 2018 – Current
University of Bologna Bologna, Italy
I gave some lessons focusing on exercises for the course. I assisted the professor in correcting written tests and in oral exams. Total amount of hours: 246.

Skills

Languages: Italian (Native), English (C2), French (Basic interactions and understanding)
Programming: Python, C++ (Proficient user)
Document Creation: Microsoft Office Suite, LaTex (Proficient user)