# Persia Jana Kamali

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## RESEARCH INTERESTS

Computational Neuroscience, Disordered Systems, Machine Learning, Statistical Physics

## EDUCATION

**Università Commerciale Luigi Bocconi**, Milano, Italy — September 2024 — Today
PhD in Computer Science and Computational Neuroscience

Supervisor: Prof. Nicolas Brunel
*I am currently pursuing a 4-year PhD in Computer Science at Università Bocconi, where I am completing the mandatory coursework while conducting research under the supervision of Prof. Nicolas Brunel. My research focuses on the intersection of statistical physics and neurobiology, leveraging statistical physics, machine learning, and information theory to address questions arising from experimental neuroscience.*

**Politecnico di Torino**, Trieste - Torino - Paris, Italy - France — December 2021 — October 2023
Master's degree in Physics of Complex Systems (International Track) — Final grade: 110/110 cum laude

Thesis Title: Dynamical Mean Field Theory for Confluent Tissues and Continuous Constraint Satisfaction Problems
Supervisors: Dr. Pierfrancesco Urbani, Prof. Alessandro Pelizzola
*Confluent tissues are a particular kind of biological tissues in which cells tessellate space. The simplest example is the epithelial tissue forming the skin. Many macroscopic properties of these tissues depend on whether they are found to be solid or liquid as a function of their control parameters. In the fields of medicine and biophysics they are the objects of countless studies as their characteristics determine the spread of cancerous cells in the skin. Therefore, a theoretical study of these tissues allows us to have a complete knowledge of their behavior and to guide and advance experimental and medical research. My thesis work was to study a theoretical model typical of disordered systems but also suitable for these tissues, to derive the fundamental equations for their dynamic description, using the Dynamical Mean Field Theory, and to create a Python algorithm for the numerical integration.*

**Université Paris-Saclay**, Paris, France — September 2022 — July 2023
Master M2 degree in Physics of Complex Systems — Final grade: Très Bien
Thesis Title: Dynamical Mean Field Theory for Confluent Tissues
Supervisor: Dr. Pierfrancesco Urbani

**Politecnico di Torino**, Torino, Italy — September 2018 — December 2021
Bachelor's degree in Physical Engineering — Final grade: 103/110

## ACADEMIC EXPERIENCE

**Università Commerciale Luigi Bocconi di Milano** — Milan, Italy
*Research Assistant* — February 2024 — July 2024

- Under the supervision of Prof. Nicolas Brunel, I worked on the subject of learning in recurrent neural networks, in particular on a generalization of the Hopfield model. To do this, I used numerical simulations and tools coming from statistical physics, such as Mean Field Theory.
- During this time, I also attended the course "Mathematical Modelling for Neuroscience" by Prof. Alessandro Sanzeni as an introductory course to computational neuroscience.
- I am continuing my research on memory and learning in the brain as part of my PhD in Computer Science at Università Bocconi.

**Institut de Physique Théorique (IPhT) - CEA Paris-Saclay** — Gif-sur-Yvette, France
*Intern* — February 2023 — July 2023

- I did my internship and Master's thesis under the supervision of researcher Dr. Pierfrancesco Urbani on the subject of confluent tissues and their dynamical properties.
- My role was to study the literature on Dynamical Mean Field Theory and apply it on the problem of confluent tissues, in order to derive its dynamical equation. In addition, I wrote an optimized and efficient code in Python that integrated the equations previously obtained analytically and launched the calculations on clusters.
- This work resulted in the publication of the articles cited below.

## TEACHING EXPERIENCE

**Private Tutoring** Como, Italy
December 2023 — September 2024

- In my spare time, I was a private tutor for both university and high-school students.
- My main subjects were Analysis I and II, Physics I and II, Chemistry.

**Politecnico di Torino** Torino, Italy
*Physics I Tutor* March 2022 — June 2022

- I worked for the Politecnico di Torino as a Physics' I tutor for students enrolled in a Bachelor's engineering degree program. I helped students by weekly solving exercises and supporting their preparation for the final exam.

## PUBLICATIONS

- Kamali, P. J., and Urbani, P. 2023. Stochastic Gradient Descent outperforms Gradient Descent in recovering a high-dimensional signal in a glassy energy landscape. arXiv:2309.04788v2. *Submitted*
- Kamali, P. J., and Urbani, P. 2023. Dynamical mean field theory for models of confluent tissues and beyond. SciPost Physics, 15(5). DOI: 10.21468/SciPostPhys.15.5.219. *Published*

## SELECTED COURSES

**Master's Courses**

- Probability and Information Theory - Prof. M. Marsili
- Introduction to Systems and Computational Neuroscience - Prof. A. Treves, Prof. D. Zoccolan, Prof. M. Diamond, Prof. D. Crepaldi
- Statistical Physics - Prof. A. Pelizzola
- Algorithms for optimization, inference and learning - Prof. A. Braunstein
- Stochastic processes - Prof. E. Trizac
- Computational Science - Prof. M. Weigt
- Statistical Field Theory - Prof. D. Mouhanna
- Advanced statistical mechanics - Prof. L. Cugliandolo

**Additional Courses**

- Four lectures on *Mathematical Problems in Machine Learning* by Prof. A. Montanari
- *Mathematical Modelling for Neuroscience* by Prof. A. Sanzeni

**Bachelor's Courses**

- Analisi matematica I
- Analisi matematica II
- Fisica I
- Fisica II
- Metodi matematici per l'ingegneria
- Fisica dei sistemi complessi

## AWARDS

**IDEX Scholarship** Paris, France
July 2022

- As a support for my Master's studies in Paris and on the basis of my previous academic achievements, I was awarded the IDEX scholarship by Université Paris-Saclay, which corresponds to a sum of 10.000 euros per year.

## OTHER EXPERIENCES

**Summer School on Complex and Glassy Systems** Cargèse, France
Institut d'Études Scientifiques de Cargèse July 2024

- During the two-week summer school, I attended lectures on tools and techniques for studying disordered systems. Additionally, I attended a seminar by Prof. S. Ganguli on his recent research on grid cells in mice navigating virtual environments..

**Summer School on Statistical Physics of Deep Learning II** Como, Italy
Lake Como School of Advanced Studies June 2024

- The Summer School on Statistical Physics of Deep Learning II is a 5-day long program dedicated to the research of statistical physics in both artificial and biological intelligence.
- I attended lectures by Dr. F. Mastrogiuseppe on the use of recurrent neural networks (RNNs) as models for neural dynamics. I also engaged with many students working on the interface between neuroscience and physics.

**Spring College on the Physics of Complex Systems** Trieste, Italy
ICTP, SISSA February 2023 — March 2023

- The Spring College on the Physics of Complex Systems is a 4-week program addressed to students from all around the world, as an opportunity to delve into the current subjects of scientific research on complex systems.
- The 2023 edition had biophysics as the main subject of discussion and the speakers were: Prof J. Kurchan, Prof. K. Kaneko, Prof. M. Bandi, Dr. F. Pinheiro and Dr. J. Davila-Velderrain.

**Semester at ICTP and SISSA** Trieste, Italy
ICTP, SISSA October 2021 — February 2022

- I attended the courses of the first semester of my Master's degree at SISSA (International School for Advanced Studies) and at ICTP (Abdus Salam International Centre for Theoretical Physics).

## LANGUAGES

**IELTS (Academic): 8.0** (overall score)
Listening: 8.5 — Reading: 9.0
Speaking: 8.5 — Writing: 6.0
Test date: 31st May 2019

**Mother tongues:** English, Italian

**Other languages:** Czech, French

## SKILLS

- **Programming:** C, Julia, Python
- **Software:** MATLAB, Microsoft Excel, Quantum ESPRESSO
- **Soft Skills:** Adaptability, Critical thinking, Organization, Problem Solving, Time management