Alessandro Pasqui

Curriculum Vitae

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Education

Sep 2021 – Oct 2025 (expected)

PhD at PSL Université de Paris 🇫🇷

Marie Skłodowska-Curie Actions (MSCA) Doctoral Fellowship

Collège de France, Centre Interdisciplinaire de Recherche en Biologie (CIRB) & École Normale Supérieure

Supervisor: Dr. Hervé Turlier

AI-based Methods for Inverse Problems in Biological Cell Systems

ZAugNet: Designed and implemented a self-supervised generative model for z-slice augmentation in 3D bio-imaging, built in PyTorch. The method combines adversarial learning and knowledge distillation to improve axial resolution in biomedical imaging. Manuscript: https://arxiv.org/abs/2503.04843, under revision at *Nature Communications*.

VertAX: Developed a differentiable vertex model for efficient forward and inverse modeling of confluent tissues, implemented in JAX. Leveraged automatic differentiation and bilevel optimization to infer optimal cellular parameters from experimental data or to reproduce target macroscopic behaviors. Manuscript in preparation for *Nature Computational Science*.

Defense date: 07–10–2025

Sep 2018 – Mar 2021

Master's Degree at Sapienza University of Rome 🇮🇹

Department of Physics & Italian Institute of Technology, Center for Life Nano Science (CLNS-IIT)

Supervisors: Prof. Giancarlo Ruocco, Dr. Giorgio Gosti, Dr. Mattia Miotto

High Performance Matching Algorithm Based on Orthogonal Polynomials

Developed a computational algorithm to detect complementary-shaped object portions, applied to 2D jigsaw puzzles and 3D archaeological artifacts. The method used local shape descriptors based on orthogonal polynomials. This work contributed to a broader CLNS-IIT project on spike protein–receptor interactions in viral infections (Milanetti et al. 2020).

Grade: 110 (with honors) / 110

Sep 2014 – Jan 2018

Bachelor's Degree at Sapienza University of Rome 🇮🇹

Department of Physics

Supervisor: Prof. Federico Ricci-Tersenghi

Percolation in Models with Long-Range Interactions

Studied, through theoretical analysis and numerical simulations, the critical point and critical exponents in percolation models involving long-range interactions.

Programming

JAX/Pytorch	excellent
Python	excellent
LaTex	excellent
C/C++	advanced
Shell Scripting	advanced

Languages

English	fluent
French	fluent
Italian	fluent
Spanish	advanced

Research Experiences

Sep 2023 – Dec 2023 **Italian Institute of Technology, Center for Life Nano Science (CLNS-IIT)**
Visiting Researcher in **Rome, Italy**
Supervisors: Prof. Giancarlo Ruocco, Dr. Giorgio Gosti, Dr. Mattia Miotto
Visiting period as part of a collaboration to test VertAX, a differentiable vertex-model that I had developed to solve inverse problems on real microscopic data for confluent tissues.

Apr 2021 – Aug 2021 **Collège de France, Centre Interdisciplinaire de Recherche en Biologie**
Research Engineer in **Paris, France**
Supervisor: Dr. Hervé Turlier
Developed image-to-image translation methods via convolutional neural networks for microscopy images in the context of developmental biology: from transmitted light microscopy to fluorescence microscopy (and back).

Jan 2020 – Feb 2020 **Sapienza University of Rome**
Intern in **Rome, Italy**
Supervisor: Dr. Francesca Colaiori
Studied the connection properties of the directed graph related to the election results for new Wikipedia administrators.

Mar 2019 – Jul 2019 **Italian Institute of Technology, Center for Life Nano Science (CLNS-IIT)**
Intern in **Rome, Italy**
Supervisors: Prof. Giancarlo Ruocco and Dr. Giorgio Gosti
Studied the pairwise correlation function for neural cells during neural rosettes development through automatic segmentation algorithms based on deep learning using convolutional neural networks.

Honors and Awards

Jun 2024 **II EELISA Student Scientific Competition**
Budapest, Hungary
Awarded *first prize* for outstanding research contribution in the Chemical and Bioengineering category. Featured in multiple interviews highlighting the scientific and societal impact of the project: *EELISA interview*, *PSL interview*.

Aug 2021 **Marie Skłodowska-Curie Actions (MSCA) - COFUND Fellowship**
AI4theSciences Doctoral Program 2021 at PSL Université Paris
Paris, France
Awarded a *Marie Skłodowska-Curie Actions (MSCA) COFUND Fellowship* as part of a highly competitive European PhD program, recognizing academic excellence and research potential.

List of Publications

2025 **Self-Supervised Z-Slice Augmentation for 3D Bio-Imaging via Knowledge Distillation**, *under revision at Nature Communications.*
Preprint available on arXiv: https://arxiv.org/abs/2503.04843

2025 (expected) **VertAX: Inverse Vertex-Based Modeling for Tissue Mechanics**, *in preparation for Nature Computational Science.*
Differentiable computational framework for efficient vertex-based forward and inverse modeling of confluent tissues via bilevel optimisation. Manuscript in preparation.

2025 (expected)   **AlphaMIC: Synthetic Microscopy Image Generation via CycleGANs**
In collaboration with the Turlier Lab. Development of a software tool to generate realistic artificial microscopy images using cyclic generative adversarial networks. Manuscript in preparation.

2025 (expected)   **3D Nuclear Roughness Estimation in Patient-Derived Organoids**
In collaboration with Dr. Kate Miroshnikova. Analysis of 3D nuclear morphology in patient-derived colonic organoids using spherical harmonics as local shape descriptors for pathological condition classification. Manuscript in preparation.

Conferences and Talks

Feb 2025   **GDR IASIS - Unrolling and un/self/supervised learning for inverse problems**
Inria Paris, France – Poster presentation.

Feb 2025   **Les Houches Physics School - From Soft Matter to Biophysics**
École de physique des Houches, France – Poster presentation.

Sep 2024   **Institute of Physics - AI for Biological Physics**
IoP London, United Kingdom – Talk 30 minutes.

Jul 2024   **World Congress on Computational Mechanics (WCCM/PANACM)**
Vancouver, Canada – Talk 20 minutes.

May 2024   **PSL Doctoral Conference - AI4theSciences**
Paris, France – Talk 20 minutes.

Peer Review

Apr 2023   **21st IEEE International Symposium on Biomedical Imaging (ISBI)**
Athens, Greece
Served as a peer reviewer for the "Light My Cells: Bright Field to Fluorescence Imaging Challenge", organized by the French National Research Infrastructure for Biological Imaging (FBI) as part of the ISBI 2024 conference.

Organizing Committees

Mar 2023 – Present   **CIRB Seminar Series at Collège de France**
Paris, France
Member of the organizing committee for the weekly seminar series of the Biology Department at Collège de France. Responsibilities include inviting speakers, chairing sessions, and coordinating post-seminar receptions.

Scientific Outreach

Oct 2024   **French Science Festival at Collège de France**
Paris, France
Organized and ran a public science outreach stand at the Collège de France as part of the French Science Festival, aimed at making scientific research accessible to a general audience.

Sep 2024 **European Heritage Days at Collège de France**
Paris, France
Contributed to the organization of events for the European Heritage Days at the Collège de France, helping welcome visitors and explain the historical and scientific significance of the institution.

Contacts for References

Dr. Hervé Turlier
Group Leader at Collège de France
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Paris, 12 September 2025