

ALBERT ALONSO

Postdoctoral Researcher – Ph.D. in Biophysics

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🌐 albertalonso.com

I design and implement machine learning systems for real-world data, bridging research and production. My work includes PyTorch pipelines for medical and multimodal imaging, and high-performance libraries for differentiable computation. I focus on scalable, maintainable AI tools that combine speed, clarity, and scientific accuracy.

PROFESSIONAL EXPERIENCE

Postdoctoral Researcher, Medical AI 2024 – Present
IMAGE Section, DIKU, University of Copenhagen

- Built deep learning models (PyTorch) for medical imaging and multimodal data analysis.
- Designed data pipelines linking SQL databases, tabular patient records, and imaging datasets.
- Collaborated with clinicians to create AI tools for dental treatment outcome prediction.
- Contributed to a microscopy image refinement model using differentiable rendering (2025).
- Developed approaches for explainable AI in image classification tasks (2025).

PhD Researcher, Biophysics 2021 – 2024
Biocomplexity, Niels Bohr Institute, University of Copenhagen

- Used differentiable programming (JAX) to model optimal sensing and control in living systems.
- Applied reinforcement learning to simulate adaptive cellular decision-making.
- Combined analytical modeling and numerical simulation to study efficient biological strategies.
- Published in scientific journals such as *Nature Comms. Bio.*, *PNAS*, and *Physical Review Letters*.
- Awarded Diploma of Excellence in SCIENCE for Ph.D. Dissertation.

Teaching Assistant 2020 – 2023
University of Copenhagen

- Courses: Machine Learning, High-Performance Programming, and Numerical Methods.
- Supported student projects on scientific computing, optimization, and parallel programming.

Software Developer 2018 – 2019
Nucleids Applied Science, Barcelona

- Built C# applications for data analysis and visualization in research and nuclear facilities.
- Created real-time monitoring systems for detector networks and laboratory sensors.

EDUCATION

Niels Bohr Institute, University of Copenhagen, Denmark 12/2021 – 12/2024
PhD in Biophysics
Topic: *Differentiable Programming Approaches to Biophysical Questions*

Niels Bohr Institute, University of Copenhagen, Denmark 09/2019 – 06/2021
MSc in Computational Physics
Thesis: *Use of Tensor Processing Units (TPUs) in Physics Simulations*

University of Barcelona, Spain 09/2014 – 01/2019
BSc in Physics (Minor in Theoretical Physics)

TECHNICAL CONTRIBUTIONS

Core research libraries

- *De(ep)tangle*: High-density tracking of overlapping slender bodies (state-of-the-art in worm imaging).
- *Bayex*: Bayesian optimization toolkit in JAX for GPU-accelerated parameter tuning.
- *ChemoXRL*: Reinforcement learning framework for stochastic cell-navigation models.

Supporting tools and utilities

- *PCAx*: Differentiable PCA for modern ML pipelines.
- *t-SNEx*: Fast t-SNE implementation for high-dimensional data.
- *BoundVor*: Voronoi tessellation algorithm constrained to bounded domains.
- *Notata*: Minimal filesystem-based experiment logger for research workflows.

TECHNICAL SKILLS

Programming	Python, C++, Fortran, Bash/Shell
Frameworks	JAX, Pytorch, Git, Docker
Computing	HPC clusters, GPU/TPU acceleration, distributed training
Core strengths	Scientific computing, numerical modeling, optimization, ML pipelines
Languages	English (Fluent); Spanish, Catalan (Native); Danish (Beginner)

PUBLICATIONS

Peer-reviewed papers in physics, biology and machine learning

- Alonso & Kirkegaard — *Fast detection of slender bodies*, *Nat. Commun. Biol.*, 2023.
- Alonso & Kirkegaard — *Optimal integration of information in chemotaxis*, *PNAS Nexus*, 2024.
- Alonso et al. — *Local clustering but global spreading for optimal sensing*, *Phys. Rev. Lett.*, 2025.
- Alonso et al. — *Pseudopod splitting is an effective chemotaxis strategy*, *PNAS*, 2025.
- Alonso et al. — *Adaptive node positioning in transport networks*, *Phys. Rev. Lett.*, 2025.
- Pham, Alonso & Proesmans — *Irreversibility in non-reciprocal chaotic systems*, *New J. Phys.*, 2025.
- Zdyb, Alonso & Kirkegaard — *Spline refinement with differentiable rendering*, *MICCAI*, 2025.

Theses

- *Mind the Gradient*, Ph.D. Biophysics, Univ. of Copenhagen, 2024
- *Evaluation of Google TPUs for Physics Calculations*, M.Sc. Comp. Physics, Univ. of Copenhagen, 2021
- *Simulations of Strongly Coupled Ions*, B.Sc. Physics, Univ. of Barcelona, 2019