Tomàs Ortega

✉ tomaso@uci.edu
tomasortega.net
LinkedIn profile

PhD candidate at UC Irvine specializing in distributed optimization and machine learning, with experience in formal verification for theorem proving. Proficient in Lean formal verification language with active contributions to open source projects. Research intersects optimization theory, information theory, and AI systems.

Education

2021 – now **PhD in Electrical Engineering and Computer Science**, *UC Irvine*, Irvine.
Graduating Fall 2025 (expected)

2020 – 2021 **M.S. in Mathematics**, *UPC*, Barcelona.
Together with Simeon Ball, we showed the first practical (polynomial-time) construction of Generalized-Quadrangle-based LDPC codes, showcased at UPC's *Seminar on quantum and classical error-correcting codes (2021)*

2015 – 2020 **B.S. in Mathematics**, *CFIS, UPC*, Barcelona.

2015 – 2020 **B.Eng. in Telecommunications Engineering**, *CFIS, UPC*, Barcelona.

Professional and Research Experience

Summer 2025 **Research Intern at Nokia Bell Labs**, *Designing trustless decentralized data storage and management systems with formal verification guarantees*, Murray Hill.

Summer 2024 **Research Intern at the Vector Institute**, *Investigating Large Language Models optimization in Federated Learning scenarios*, Toronto.

Summer 2024 **Research Intern at the Vector Institute**, *Investigating and improving the optimization of Large Language Models in Federated Learning scenarios*, Toronto.

Summer 2022 **Graduate Fellow at NASA Jet Propulsion Laboratory**, *Designing and supervising the experimental tests for the channel sounding of Lunar South Pole communications. Developing novel algorithms for cooperative and compressed localization*, Pasadena.

Fall 2020 **Research Assistant at UPC (Signal Theory and Communications Department)**, *Design and optimization of 5G coverage estimators in urban scenarios, along with implementation and testing of the proposed solutions*, Barcelona.

February – July 2020 **JVSRP Internship at NASA Jet Propulsion Laboratory**, *Development and implementation of an adaptive-sweep algorithm for carrier acquisition and tracking in spacecraft radios*, Pasadena.

Winter 2019 **Research Project Collaborator at HP**, *Design of an ultrasound positioning system for mobile printers with a network of sensors, specializing in the position calculation and communications software*, Barcelona.

Summer 2018 **Summer Internship at BaseTIS**, *Enhancing task automation and parallelization for data analysis and reporting for Gas Natural Informatica*, Barcelona.

Skills

- **Formal Methods & Mathematical Foundations:** Lean theorem prover (active contributor to various open source projects, e.g. Compfiles, Maryna Viazovska and Sidharth Hariharan's Sphere-Packing-Lean, Google Deepmind's formal-conjectures), mathematical logic, formal verification, information-theoretic analysis
- **AI/ML Systems:** Federated learning (quantized, asynchronous, personalized), privacy-preserving aggregation, model-parallel training pipelines, performance benchmarking
- **Programming & Prototyping:** Python (TensorFlow, PyTorch), C++, Java, Git, Docker, CI/CD pipelines
- **Research and R&D Deliverables:** Publication pipeline (IEEE/ICML conferences & journals), patent drafting, experimental design, open-source library contributions
- **Tools & Platforms:** Linux, Kubernetes, AWS/GCP, LaTeX, Lean theorem prover, Jupyter, GitHub Actions
- **Communication & Collaboration:** Technical leadership, conference presentations, peer review (IEEE T-COM, DCC, IEEE SPS), cross-disciplinary collaboration
- **Languages:** Catalan (native), Spanish (native), English (proficient – Cambridge Proficiency certificate), French (conversational – DELF certificate)

Open-Source Software

- **Lean Formal Verification Projects**, contributed to David Renshaw's Compfiles, Maryna Viazovska and Sidharth Hariharan's Sphere-Packing-Lean, Google Deepmind's formal-conjectures, and Eric Paul's Ordered Semigroups, among others.
- **FLSim: Federated Learning Simulator** github.com/TomasOrtega/FLSim Reproduces experiments from "Quantized and Asynchronous Federated Learning" [4, 6]. Built in Python; supports custom compression and async aggregation.
- **DT-GO Decentralized Optimization** github.com/TomasOrtega/DT-GO Implements algorithms from "Decentralized Optimization in Time-Varying Networks with Arbitrary Delays" [3]. Python prototype with performance benchmarks for decentralized logistic regression and FL tasks.
- **Noisy Lattice Denoising** github.com/TomasOrtega/Noisy-lattice-problem MATLAB, Python and AMPL solver for a noisy lattice point recovery problem.
- **JavaSnake** github.com/TomasOrtega/JavaSnake Classic Snake game implemented in Java.

Publications

[1] S. Ball and **T. Ortega**. *Practical implementation of geometric quasi-cyclic LDPC codes*. 2024. arXiv: 2405.20524 [cs.IT].

[2] **T. Ortega** and H. Jafarkhani. "Decentralized Optimization in Networks with Arbitrary Delays". In: *ICC 2024 - IEEE International Conference on Communications*. 2024, pp. 794–799. DOI: 10.1109/ICC51166.2024.10622164.

[3] **T. Ortega** and H. Jafarkhani. *Decentralized Optimization in Time-Varying Networks with Arbitrary Delays*. 2024. arXiv: 2405.19513 [cs.LG].

[4] **T. Ortega** and H. Jafarkhani. "Quantized and Asynchronous Federated Learning". In: *IEEE Transactions on Communications* (2024), pp. 1–1. ISSN: 1558-0857. DOI: 10.1109/TCOMM.2024.3471996. URL: https://ieeexplore.ieee.org/document/10705319.

[5] **T. Ortega** et al. *Communication Compression for Distributed Learning without Control Variates*. 2024. arXiv: 2412.04538 [cs.LG].

[6] **T. Ortega** and H. Jafarkhani. "Asynchronous Federated Learning with Bidirectional Quantized Communications and Buffered Aggregation". In: *2023 International Conference on Machine Learning* Federated Learning and Analytics in Practice Workshop (July 2023). URL: https://openreview.net/pdf?id=DORg4vHAIV.

[7] **T. Ortega** and H. Jafarkhani. "Gossiped and Quantized Online Multi-Kernel Learning". In: *IEEE Signal Processing Letters* 30 (2023), pp. 468–472. DOI: 10.1109/LSP.2023.3268988.

[8] **T. Ortega**, A. Pascual-Iserte, and O. Muñoz. "LOS/NLOS Estimators for mmWave Cellular Systems With Blockages". In: *IEEE Wireless Communications Letters* 11.1 (2022), pp. 121–125. DOI: 10.1109/LWC.2021.3122090.

[9] **T. Ortega** et al. "Acquisition and tracking of high dynamics Doppler profiles for space applications". In: *2021 IEEE Aerospace Conference (50100)*. 2021, pp. 1–20. DOI: 10.1109/AERO50100.2021.9438418.

[10] **T. Ortega** et al. "Adaptive-Sweep Algorithm for Spacecraft Carrier Acquisition and Tracking: System Analysis and Implementation". In: *2021 IEEE Aerospace Conference (50100)*. 2021, pp. 1–9. DOI: 10.1109/AERO50100.2021.9438340.

Patents & Intellectual Property

2024 **SYSTEMS AND METHODS FOR QUANTIZED MACHINE LEARNING, FEDERATED LEARNING AND BIDIRECTIONAL NETWORK COMMUNICATION**, *USPA link*, pending.

2023 **QUASI-CYCLIC LDPC CODES BASED ON GENERALISED QUADRANGLES**, *WIPO link*, national phase pending.

Merits and Awards

2024 **Engineering Student Council at UCI**, *EECS Graduate Student of the Year*, awarded.

2023 **IEEE Signal Processing Society**, *Signal Processing Scholarship*, awarded.

2023 **ICML Federated Learning Workshop**, *Early Career invitation*, awarded.

2023 **Catalan Society of Mathematics**, *Évariste Galois prize for best MSc thesis in Catalonia*, honorable mention.

2022 **NASA's Jet Propulsion Laboratory**, *JPL Graduate Fellowship*, awarded.

2021 **UCI**, *Electrical Engineering and Computer Science department fellowship*, awarded.

2021 **Balsells program**, *Balsells graduate fellowship*, awarded.

2020 – 2018 **Google Hash Code**, *Respectively, 2nd, 1st and 1st team Spain*, 171st, 75th, and 53rd global.

2018 **Kernel Analytics Datathon**, *2nd place*, Accuracy when classifying Parkinson's Disease onset of symptomatology using sensor data.

2015 **CFIS**, *CFIS scholarship*, awarded.

Teaching

Winter 2024 **Probability for Engineers**, *EECS 55*, Irvine.

Winter 2025 **Probability for Engineers**, *EECS 55*, Irvine.

Leadership and Service

2023 – 2024 **Graduate Student Representative at the UCI Council on Planning and Budget**, *Representing the Graduate students at the UCI Council on Planning and Budget*, Irvine.

2023 – 2024 **Graduate Student Representative at the UCI Samueli School of Engineering Graduate Studies Committee**, *Representing the Graduate students at the Graduate Studies Committee*, Irvine.

2023 – 2024 **Council member for the School of Engineering at UCI's AGS**, *Representing the School of Engineering at the elected Associated Graduate Students council*, Irvine.