

# Tomàs Ortega

## Curriculum Vitae

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PhD candidate at UC Irvine studying distributed optimization with communication compression, focusing on Privacy-Preserving Machine Learning. This includes algorithms for Federated Learning and Decentralized Control for wireless communication scenarios.

More broadly, I am interested in optimization, information theory, and AI. I also organized a group for people in the greater LA area to learn how to write mathematical proofs in the Lean formal verification language.

### Education

- 2021 – now **PhD in Electrical Engineering and Computer Science**, *UC Irvine*, Irvine.  
Graduating June 2026 (expected)
- 2020 – 2021 **M.S. in Mathematics**, *UPC*, Barcelona.
- 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*, Murray Hill.
- 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

- **Distributed Systems & Software Engineering:** Decentralized optimization, consensus protocols, trustless/decentralized data-ledgers, cryptographic primitives
- **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)

## Publications

- [1] **T. Ortega** and H. Jafarkhani. “Decentralized Parameter-Free Online Learning”. In: *arXiv preprint arXiv:2510.15644* (2025).
- [2] **T. Ortega** et al. *Communication Compression for Distributed Learning with Aggregate and Server-Guided Feedback*. 2025. arXiv: [2512.22623 \[cs.LG\]](#).
- [3] S. Ball and **T. Ortega**. *Practical implementation of geometric quasi-cyclic LDPC codes*. 2024. arXiv: [2405.20524 \[cs.IT\]](#).
- [4] **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](#).
- [5] **T. Ortega** and H. Jafarkhani. *Decentralized Optimization in Time-Varying Networks with Arbitrary Delays*. 2024. arXiv: [2405.19513 \[cs.LG\]](#).
- [6] **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>.
- [7] **T. Ortega** et al. *Communication Compression for Distributed Learning without Control Variates*. 2024. arXiv: [2412.04538 \[cs.LG\]](#).
- [8] **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>.
- [9] **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](#).
- [10] **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](#).

- [11] **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](https://doi.org/10.1109/AERO50100.2021.9438418).
- [12] **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](https://doi.org/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.

## Open-Source Software

- **FLSim: Federated Learning Simulator** [github.com/TomasOrtega/FLSim](https://github.com/TomasOrtega/FLSim) Reproduces experiments from "Quantized and Asynchronous Federated Learning" [6, 8]. Built in Python; supports custom compression and async aggregation.
- **DT-GO Decentralized Optimization** [github.com/TomasOrtega/DT-GO](https://github.com/TomasOrtega/DT-GO) Implements algorithms from "Decentralized Optimization in Time-Varying Networks with Arbitrary Delays" [5]. Python prototype with performance benchmarks for decentralized logistic regression and FL tasks.
- **Noisy Lattice Denoising** [github.com/TomasOrtega/Noisy-lattice-problem](https://github.com/TomasOrtega/Noisy-lattice-problem) MATLAB, Python and AMPL solver for a noisy lattice point recovery problem.
- **JavaSnake** [github.com/TomasOrtega/JavaSnake](https://github.com/TomasOrtega/JavaSnake) Classic Snake game implemented in Java.

## 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.

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## Teaching

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

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

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## 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.