

Marian Temprana Alonso

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Education

- PhD** **Florida International University**, Computer Science Aug 2022 - Present
- Advisor: Farhad Shirani
 - Topic: Energy Efficient Compression and Communications With Low Resolution Analog to Digital Converters
- BSc** **Florida International University**, Applied Mathematics Aug 2019 - May 2022

Work & Research Experience

Sandia National Laboratories Albuquerque, NM/Miami, FL
Graduate Research Intern May 2023 - Present

• **Resilient Power Grid Analytics for Large Contingencies** [C4][T1][T2]

Collaboration with Los Alamos National Laboratory

- Applied data mining and advanced analytics to post-process high-contingency power grid simulations.
- Identified patterns in cascading events towards resilience planning.
- Developed a regression-based predictive framework to assess topology changes and mitigate the impact of High-Altitude Electromagnetic Pulses (HEMPs) on the grid.

Florida International University

Graduate Research Assistant

Miami, FL

Aug 2022 - Present

• **Temporal Knowledge Graphs for Accident Prediction in Autonomous Vehicles**

Collaboration with National Yang Ming Chiao Tung University, Indian Institute of Technology at Kanpur

- Developed a comprehensive pipeline combining YOLO-based object detection for labeling with MiDas depth perception, overlaying depth heatmaps on traffic scene frames captured from multiple camera angles.
- Leveraged a Large Language Model (LLM) to perform semantic analysis on processed images, generating propositional logic statements that describe traffic scenarios and encode them as a temporal knowledge graph.
- Integrated the temporal knowledge graph into a Graph Neural Network (GNN) framework, enabling accident probability prediction for autonomous vehicles.

• **Reinforcement Learning-Based Optimization for Quantization**

- Designed a Reinforcement Learning (RL) framework to approximate the optimal quantization configuration.
- Implemented and extended the CORTICAL algorithm for mutual information approximation and maximization in a discrete scenario with pre-determined quantization points.
- Performed extensive simulations to validate the framework in real-world applications, including wireless communications and task-based quantization.

• **Deep Learning-Driven Multi-Modal Sensor Fusion for CSI Compression** [C3][J2]

Collaboration with National Yang Ming Chiao Tung University, Indian Institute of Technology at Kanpur, Arizona State University

- Proposed a system model for Channel State Information (CSI) estimation incorporating multi-modal side information (MSI) at the base station.
- Conducted comprehensive evaluations of CSI estimation accuracy under varying MSI modalities and compression rates, leveraging state-of-the-art neural networks.

• **Task-Based Quantization with Nonlinear Analog Processing** [C2]

Collaboration with Weizmann Institute of Technology, University of Melbourne

- Investigated a task-based quantization paradigm where the objective task differs from the observed measurements.
- Explored the use of nonlinear analog processing to minimize distortion, achieving enhanced rate-distortion performance.

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- **Energy-Efficient Wireless Communication Using Low-Resolution ADCs** [J1]

Collaboration with University of California, Irwin

- Analyzed MIMO communication rates under low-resolution Analog-to-Digital Converters (ADCs) for energy-efficient wireless systems.
- Justified the incorporation of nonlinear operators through theoretical analysis and numerical evaluations, highlighting the gains in rate performance and energy efficiency under varying system configurations.

- **Consensus Based Sensor Fusion** [C1]

- Showed the existence of a tradeoff between the accuracy and consensus objectives in distributed estimation.
- Decomposed the fusion function into orthonormal basis components for the Hilbert space of functions of variables.
- Formulated an optimization problem for the optimal fusion algorithms.

Florida International University

Graduate Teaching Assistant

Miami, FL

Aug 2022 - Apr 2023

- Course: COT 3510: Applied Linear Structures for Computing
- Course: COT 3100: Discrete Structures

Skills

Languages: English (bilingual), Spanish (native)

Programming: Python (advanced), Matlab (proficient), Pytorch (advanced), Tensorflow (proficient)

Selected Honors & Awards

ISIT 2023 DeepVerse 6G Machine Learning Challenge Winning Team	2023
GAAN Fellowship	2023
Grace Hopper Celebration Scholar	2023
Student Academic Achievement & Service Award	2022

Publications & Pre-Prints

- [C1] **M. Temprana Alonso**, F. Shirani, S.S. Iyengar "Optimal Fault-Tolerant Data Fusion in Sensor Networks: Fundamental Limits and Efficient Algorithms." 2023 IEEE Information Theory Workshop (ITW), 2023.
- [J1] **M. Temprana Alonso**, X. Liu, H. Aghasi, and F. Shirani "Capacity Gains in MIMO Systems with Few-Bit ADCs Using Nonlinear Analog Circuits." 2025 under review for IEEE Transactions on Wireless Communications (TWC), 2025. <https://arxiv.org/abs/2212.05948>
- [C2] **M. Temprana Alonso**, F. Shirani, N. Irwin Bernardo, Y.C. Eldar "Non-Linear Analog Processing Gains in Task-Based Quantization." 2024 IEEE International Symposium on Information Theory (ISIT), 2024.
- [J2] S. Srivastava, **M. Temprana Alonso**, R. Chatterjee, N. Askar, U. Demirhan, F. Shirani, S. Rini, and A. Alkhateeb. "Deep Learning for Multi-Modal Sensor Fusion and CSI Compression in Vehicular Communications." under review for IEEE Transactions on Vehicular Technology (TVT), 2025.
- [C3] S. Srivastava, **M. Temprana Alonso**, N. Askar, U. Demirhan, F. Shirani, S. Rini, and A. Alkhateeb. "Deep Learning-Based Multi-Modal Sensor Fusion for CSI Compression in Wireless Networks." 2025 under review for IEEE International Conference on Machine Learning for Communication and Networking (ICMLCN), 2025.
- [C4] **M. Temprana Alonso**, R. Guttromson, and J.E. Tabarez. "Causal Inference for Grid Failures During a HEMP." 2025 under review for IEEE Power and Energy Society (PES) General Meeting (GM), 2025.
- [T1] R. Guttromson, R. Schiek, R. Driesen, **M. Temprana Alonso**, T. Overbye, J. Snodgrass, A. Birchfield, M. Stevens, M. Briones, E. Nelson, A. Barnes, J. Tabarez, and C. Colson, "HEMP Transmission consequence model (HTCM): User manual," Sandia National Laboratories, SAND2024-13709R, 2024.
- [T2] R. Guttromson, R. Schiek, R. Driesen, **M. Temprana Alonso**, T. Overbye, J. Snodgrass, A. Birchfield, M. Stevens, M. Briones, E. Nelson, A. Barnes, J. Tabarez, and C. Colson, "HEMP transmission consequence model (HTCM): Technical report," Sandia National Laboratories, SAND2024-13708R, 2024.