

# Andres Ramirez-Jaime

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## Summary

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Ph.D. candidate in Electrical and Computer Engineering specializing in machine learning, generative models, and large language models for remote sensing and computer vision, with a focus on diffusion models for imaging inverse problems (e.g., super-resolution, denoising, and reconstruction). Proven experience at Apple and Vertex delivering production-grade LLM and computer vision systems, including RAG pipelines, LoRA-based fine-tuning, and medical image segmentation. Track record of leading cross-functional research with NASA and industry partners, publishing in top IEEE venues, and mentoring junior researchers. Actively seeking Machine Learning / Applied Scientist / Research Scientist roles.

## Technical Skills

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- **Programming & Scripting:** Python, C, MATLAB, LabVIEW
- **ML & Deep Learning:** PyTorch, TensorFlow, Keras, GANs, Diffusion Models, Transformers, LLMs, multimodal neural networks
- **Domains:** Computer vision, large language models, remote sensing, LiDAR, hyperspectral imaging, biomedical signal processing, robotics
- **Tools & Platforms:** Linux, Git, GIS,  $\text{\LaTeX}$

## Experience

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### Apple Inc.

Cupertino, CA, USA

*Large Language Models and Generative AI Engineering Intern*

*Summer 2024*

- Developed and implemented a retrieval-augmented generation (RAG) system to enhance metadata for internal tools, improving in-context learning and performance of Apple Intelligence LLMs.
- Fine-tuned Apple Intelligence LLMs for iPhone-specific use cases by curating task-focused datasets and applying LoRA adapters for efficient parameter-efficient fine-tuning.
- Designed and maintained evaluation datasets and hand-crafted test suites targeting edge cases and complex queries to rigorously stress-test model behavior.
- Created and optimized the LLM testing pipeline, increasing the iteration rate from 1 to over 4 training/evaluation cycles per day, accelerating experimentation and deployment.
- Analyzed hallucination patterns in Apple Intelligence, contributing to mitigation strategies that improved reliability and user trust in model outputs.

### Vertex Pharmaceuticals

San Diego, CA, USA

*Computer Vision and Machine Learning Engineer*

*Summer 2023*

- Contributed to early drug discovery projects for pulmonary fibrosis (IPF) and polycystic kidney disease (ADPKD) in close collaboration with biologists, physicians, and chemists.
- Built a U-Net-based semantic segmentation model for medical gigapixel images achieving over 90% accuracy, helping histopathologists assess compound efficacy for pulmonary fibrosis.
- Developed an automatic computer vision pipeline to segment kidney organoids in whole slide images and estimate physiological properties (size, wall thickness) with errors below 3%.

### University of Delaware

Newark, DE, USA

*Research and Teaching Assistant*

*Feb 2022 – Present*

- Conduct research on machine learning for LiDAR and hyperspectral data using Transformers, Diffusion Models, GANs, and multimodal neural networks as part of the NASA CASALS project.
- Developed algorithms to enhance the accuracy and resolution of LiDAR and hyperspectral analysis, achieving satellite height estimation errors of less than 1 m.
- Co-authored multiple peer-reviewed papers and presented work at international conferences on remote sensing and computational imaging.
- Collaborated with interdisciplinary teams (ecology, physics, engineering) and implemented ML pipelines in Python and MATLAB for large-scale data processing.

- Mentored two Ph.D. students, one master's student, and several visiting researchers; served as TA for Statistical Learning, Imaging and Deep Learning, and Probability/Statistics courses.

## University of Delaware

*Visiting Scholar*

Newark, DE, USA

*Jul 2021 – Dec 2021*

- Designed the HyperHeight Data Cube (HHDC) representation for efficient storage and processing of compressed 3D satellite LiDAR data.
- Implemented a 3D convolutional autoencoder to reconstruct compressed HHDCs, significantly improving reconstruction accuracy and efficiency for remote sensing workflows.

## University of La Sabana

*Mechanical Engineering Professor*

Chia, Colombia

*Jan 2018 – Dec 2021*

- Taught in the Department of Prototypes and Manufacturing (Mechanical Engineering) and supervised 12 undergraduate thesis projects.
- Designed and programmed the embedded system for the UNISABANA Herons mechanical ventilator used in intensive care units for COVID-19 patients across Colombia.
- Automated respiratory control and data collection using C and LabVIEW, and built analysis tools that supported regulatory approval by the Colombian FDA.
- Led the university robotics group; developed embedded Linux applications and ML-based perception to recognize the soccer ball and referee whistle in real time for RoboCup competitions, achieving runner-up in category.

## Education

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### University of Delaware

*Ph.D. in Electrical and Computer Engineering*

Newark, DE, USA

*July 2026*

- GPA: 3.92; 2022 George W. Laird Fellow; 2024 ECE Signal Processing Award; 2024 Doctoral Fellowship for Excellence.

### University of Los Andes

*Master in Computer and Electronic Engineering*

Bogota, Colombia

*March 2016*

- Graduated *Cum Laude*.

### University of Los Andes

*Bachelor in Electronic Engineering*

Bogota, Colombia

*October 2013*

## Publications

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- **On the Lossless Compression of HyperHeight LiDAR Forested Landscape Data.** Makarichev, V., Ramirez-Jaime, A. et al., *Remote Sensing*, 2025.
- **Lossless Compression of Hyperheight LiDAR Forested Landscapes Data.** Makarichev, V., Ramirez-Jaime, A. et al., in *Proc. 29th International Conference on Methods and Models in Automation and Robotics (MMAR)*, 2025.
- **Denoising and Super-Resolution of Satellite Lidars Using Diffusion Generative Models.** Ramirez-Jaime, A., Porras-Diaz, N., Arce, G. R., Stephen, M., in *Proc. 2025 IEEE Statistical Signal Processing Workshop (SSP)*, 2025.
- **Optimal Illumination Pattern for Satellite Compressive LiDAR Using Generative AI.** Newman-Sanders, C., Ramirez-Jaime, A. et al., in *Proc. SPIE Machine Learning from Challenging Data*, 2025.
- **SpectralCam: High-Resolution Low-Cost Spectral Imaging Using DSLR Cameras.** Paruchuri, A., Ramirez-Jaime, A. et al., in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2025.
- **Generative Diffusion Models for Compressed Sensing of Satellite LiDAR Data: Evaluating Image Quality Metrics in Forest Landscape Reconstruction.** Ramirez-Jaime, A., Arce, G. R., Porras-Diaz, N. et al., *Remote Sensing*, 2025.
- **Super-Resolved 3D Satellite LiDAR Imaging of Earth Via Generative Diffusion Models.** Ramirez-Jaime, A., Porras-Diaz, N., Arce, G. R., Stephen, M., *IEEE Transactions on Geoscience and Remote Sensing*, 2025.
- **Toward Sub-Meter Satellite Surface Topography and Vegetation Mapping Using LiDAR/RGB Constrained Generative Diffusion.** Porras-Diaz, N., Ramirez-Jaime, A., Arce, G. R., Stephen, M., *IEEE Transactions on Geoscience and Remote Sensing*, 2025.
- **Multi-Modal Transformer for Compressive LiDARs Using Hyperspectral Imaging Side-Information.** Porras-Diaz, N., Ramirez-Jaime, A. et al., in *Proc. IGARSS 2024 – IEEE International Geoscience and Remote Sensing Symposium*, 2024.

- **Super-Resolution of Satellite Lidars for Forest Studies Via Generative Adversarial Networks.** Ramirez-Jaime, A., Porras-Diaz, N., Arce, G. R. et al., in *Proc. IGARSS 2024 – IEEE International Geoscience and Remote Sensing Symposium*, 2024.
- **High Altitude Computational LiDAR Emulation and Machine Learning Reconstruction for Earth Sciences.** Arce, G. R., Ramirez-Jaime, A., Porras-Diaz, N., in *Proc. SPIE Big Data VI: Learning, Analytics, and Applications*, 2024.
- **Super-Resolution of Satellite Lidars for Forest Studies Using Diffusion Generative Models.** Ramirez-Jaime, A., Arce, G. R., Stephen, M., MacKinnon, J., in *Proc. 2024 IEEE Conference on Computational Imaging Using Synthetic Apertures (CISA)*, 2024.
- **The Development and Implementation of a Low-Cost Mechanical Ventilator in a Low-Middle-Income Country During the COVID-19 Pandemic: The Unisabana-HERONS.** Giraldo-Cadavid, L. F., Echeverry, J., Varón, F., Ramirez-Jaime, A. et al., *Heliyon*, 2024.
- **HyperHeight LiDAR Compressive Sampling and Machine Learning Reconstruction of Forested Landscapes.** Ramirez-Jaime, A., Peña-Peña, K., Arce, G. R. et al., *IEEE Transactions on Geoscience and Remote Sensing*, 2024.
- **Transformer End-to-End Optimization of Compressive LiDARs Using Imaging Spectroscopy Side Information.** Porras-Diaz, N., Ramirez-Jaime, A., Arce, G. R. et al., *IEEE Transactions on Geoscience and Remote Sensing*, 2024.
- **HyperHeight LiDAR Compressive Sampling and Machine Learning Reconstruction of Forested Landscapes.** Ramirez-Jaime, A., Peña-Peña, K., Arce, G. R. et al., in *Proc. IGARSS 2023 – IEEE International Geoscience and Remote Sensing Symposium*, 2023.
- **Compressive Spectral Imaging Via Misalignment Induced Equivalent Grayscale Coded Aperture.** Zhang, T., Zhao, S., Ma, X., Ramirez-Jaime, A., Zhao, Q., *IEEE Geoscience and Remote Sensing Letters*, 2023.
- **Positive-Pressure Ventilation: Modeling, Validation, and Stochastic Control of Mean-Field Type.** Ramirez-Jaime, A., Barreiro-Gomez, J., Longas, L. et al., *Automatica*, 2022.
- **Nonlinear Model Predictive Control with Constraint Satisfaction for a Quadcopter.** Wang, Y., Ramirez-Jaime, A., Xu, F., Puig, V., *Journal of Physics: Conference Series*, vol. 783, 2017.
- **MatSWMM – An Open-Source Toolbox for Designing Real-Time Control of Urban Drainage Systems.** Riaño-Briceño, G. A., Barreiro-Gomez, J., Ramirez-Jaime, A., Quijano, N., Ocampo-Martínez, C., *Environmental Modelling & Software*, 2016.
- **A Differential Game Approach to Urban Drainage Systems Control.** Ramirez-Jaime, A., Quijano, N., Ocampo-Martínez, C., in *Proc. 2016 American Control Conference (ACC)*, 2016.
- **Co-Simulation for the Design of Controllers in Urban Drainage Systems.** Riaño-Briceño, G. A., Ramirez-Jaime, A., Barreiro-Gomez, J., Quijano, N., Ocampo-Martínez, C., in *Proc. 2015 IEEE 2nd Colombian Conference on Automatic Control (CCAC)*, 2015.

## Leadership & Service

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- Board Member, Hispanic/Latino Graduate Student Association (2021–2023).
- Board Member, SACNAS – Society for Advancement of Chicanos/Hispanics and Native Americans in Science (2023–2024).
- First Point of Contact, University of Delaware Summer Research Program (2021–2023).
- International Volunteer, World Youth Day (2019); Volunteer Staff, Opus Dei (2018–2021).