Andres Ramirez-Jaime

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Professional Summary

Ph.D. Candidate in Electrical and Computer Engineering (University of Delaware; expected Jun 2026) developing **multimodal, physics-informed generative AI** for computational imaging and perception—with an emphasis on **diffusion models** and **transformers** for **compressive satellite LiDAR** using **SAR and imaging spectroscopy** side information, and extensions to hyperspectral/SAR remote sensing and gigapixel pathology. Co-authored **24 peer-reviewed publications** (**9 first-author**) and contributed to funded research with **NASA** and **NSF** partners, with a research trajectory focused on building reliable, high-impact AI systems that connect modern generative modeling with sensing and decision pipelines. Industry research experience includes **Apple** (LLM **tool-use/agentic** workflows: **RAG**, **LoRA** fine-tuning, large-scale evaluation and test-suite design) and **Vertex Pharmaceuticals** (semantic segmentation for whole-slide pathology), demonstrating the ability to translate AI advances into cross-domain impact. Extensive teaching experience as an instructor across **programming, robotics, control, machine learning, and statistics**, paired with mentoring and outreach.

Education

University of Delaware — Newark, DE, USA
Ph.D. in Electrical and Computer Engineering — *Jun 2026 (Expected)*

- GPA: 3.92.
- **Dissertation:** *Multimodal Generative AI for Compressive Satellite LiDAR with SAR and Imaging Spectroscopy Side Information.* **Advisor:** Gonzalo R. Arce. **Committee:** Javier Garcia-Frias (University of Delaware); Austin Brockmeier (University of Delaware); Mark Stephen (NASA); Guangning Yang (NASA).

University of Los Andes — Bogota, Colombia
M.S. in Computer and Electronic Engineering — *Mar 2016*

- Graduated *Cum Laude*.

University of Los Andes — Bogota, Colombia
B.S. in Electronic Engineering — *Oct 2013*

Research Experience

University of Delaware — Newark, DE, USA
Research and Teaching Assistant — *Feb 2022 – Present*

- Lead research on generative and multimodal ML for LiDAR and hyperspectral remote sensing (diffusion models, transformers, GANs) within the **NASA CASALS** project, contributing to advancements in AI and computer vision.
- Developed reconstruction and super-resolution methods for the **HyperHeight Data Cube (HHDC) 2 m dataset** (∼**100k** 3D tensors) using a novel forward imaging model; achieved <**1 m MAE** on CHM/DTM and multiple height percentiles under compressive sampling (∼**25%** sampling), demonstrating strong physics-informed ML capabilities.
- Built scalable end-to-end pipelines (data processing → training → evaluation) on ∼**60 GB** datasets; ran ∼**5-day** training cycles on a single **A100** and produced inference over ∼**600 m**^{2} areas in ∼**12 min**, showcasing efficient deep learning model deployment.
- Published and presented research: **24** peer-reviewed papers (**9 first-author**); presented at international venues in remote sensing and computational imaging, highlighting strong communication skills.
- Mentored 2 Ph.D. students, 1 master's student, and visiting researchers; fostering collaboration skills.

University of Delaware — Newark, DE, USA
Visiting Scholar — *Jul 2021 – Dec 2021*

- Designed the HyperHeight Data Cube (HHDC) representation for efficient storage and processing of compressed 3D satellite LiDAR data, enabling downstream learning and reconstruction workflows.
- Implemented a 3D convolutional autoencoder for HHDC reconstruction, improving reconstruction quality vs. classical image-processing baselines by **+6 dB** on CHM and **+18 dB** on DTM.

Robotics and Industrial Informatics Institute (UPC) Barcelona, Spain
Visiting Researcher *Sep 2015 – Mar 2016*

- Investigated real-time control techniques based on game theory for urban drainage systems; applied methods to Barcelona's sewer network, achieving results comparable to model predictive control approaches.

University of Los Andes Bogota, Colombia
CIFI Researcher *Feb 2015 – Feb 2016*

- Conducted research on urban drainage and climate change under the "Urban Drainage and Climate Change: Towards the Sewerage Systems of the Future - PAVCO Phase II" project; implemented real-time control techniques for flood mitigation in urban areas.

Teaching Experience

University of Delaware Newark, DE, USA
Teaching Assistant *Feb 2022 – Present*

- Taught undergraduate including Imaging and Deep Learning, and Probability/Statistics, and graduate courses including Analytics I: Statistical Learning.

University of La Sabana Chia, Colombia
Mechanical Engineering Professor *Jan 2018 – Dec 2021*

- Taught undergraduate courses including Introduction to Programming, Digital Logic, Robotics I, Electrotechnics, Dynamic Systems and Control, Electronic Instrumentation, Electric Machines, and Introduction to Machine Learning.
- Supervised 12 undergraduate thesis projects; taught courses in prototypes and manufacturing.

National Learning Service (SENA) Soacha, Colombia
Robotics Facilitator *Feb 2017 – Dec 2017*

- Taught robotics and electronic hardware to apprentices from vulnerable populations at the TecnoAcademy Cazucá node; co-led the Material, Manufacturing Process, and Automation Research Group (MAPRA), mentoring students on applied robotics projects.

Industry Experience

Apple Inc. Cupertino, CA, USA
Large Language Models and Generative AI Engineering Intern *Jun 2024 – Aug 2024*

- Built a retrieval-augmented generation (RAG) system grounded in the iPhone user manual to generate higher-quality internal tool descriptions; improved descriptions for ∼**85%** of tools by strengthening retrieval and grounding.
- Fine-tuned Apple Intelligence LLMs for iPhone-focused tool usage via dataset curation and LoRA adapters on a distributed GPU cluster (up to **96 GPUs**); improved single-turn tool-selection accuracy from **61%** to **90.2%**.
- Created evaluation datasets and hand-crafted test suites (∼**2,500** human-created conversations spanning ∼**80** tools) to stress-test edge cases; used results to diagnose failure modes and prioritize fixes.
- Optimized the training/evaluation pipeline to increase iteration rate from **1** to >**4** cycles/day, accelerating experimentation and readiness for deployment.
- Reduced tool hallucinations (nonexistent tools) from ∼**3%** to **0%** on internal testing by analyzing error patterns and recommending mitigation changes.

Vertex Pharmaceuticals San Diego, CA, USA
Computer Vision and Machine Learning Engineer *Jun 2023 – Aug 2023*

- Partnered with biologists, physicians, and chemists on early drug discovery (IPF, ADPKD), translating scientific goals into ML deliverables and evaluation criteria, demonstrating strong collaboration skills and domain knowledge in healthcare.
- Built a U-Net semantic segmentation model for gigapixel pathology images achieving >90% accuracy; replaced outsourced processing (100 slides; up to 3-month turnaround) with in-house inference (∼**15 min** per processed slice/region), reducing vendor dependence and avoiding up to **$600k/year** external spend.
- Developed an automated pipeline to segment kidney organoids in whole-slide images and estimate morphology (size, wall thickness) with <3% error, improving measurement consistency for downstream analysis.

Publications

Journal Articles

• **Diffusion-Based Joint Recovery, Denoising, and Super-Resolution of Compressed-Sensing Satellite LiDAR Data**. **Ramirez-Jaime, A.**, Porras-Diaz, N., Stephen, M., Yang, G., Arce, G. R., *Submitted to the IEEE Transactions on Computational Imaging*, 2026.

• **Objective and Subjective Quality Assessment of Forest Landscapes Reconstructed Using Generative Diffusion Models From Compressed Satellite LiDAR Data**. Ieremeiev, O., Lukin, V., **Ramirez-Jaime, A.**, Arce, G. R., Kopytek, M., Lech, P., Okarma, K. P., *IEEE Access*, 2025.

• **Toward Submeter 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.

• **On the Lossless Compression of HyperHeight LiDAR Forested Landscape Data**. Makarichev, V., **Ramirez-Jaime, A.**, Porras-Diaz, N., Vasilyeva, I., Lukin, V., Arce, G., Okarma, K., *Remote Sensing*, 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., Ieremeiev, O., Rubel, A., Lukin, V., Kopytek, M., Lech, P., Fastowicz, J., Okarma, K., *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.

• **Transformer end-to-end optimization of compressive LiDARs using imaging spectroscopy side information**. Porras-Diaz, N., **Ramirez-Jaime, A.**, Arce, G. R., Pena-Pena, K., Harding, D., Stephen, M., MacKinnon, J., Vargas, R., *IEEE Transactions on Geoscience and Remote Sensing*, 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-Vega, F., Bastidas, A., **Ramirez-Jaime, A.**, Cardona, A. F., Vega, C. J. L., Serrano-Mayorca, C. C., Garay, D., Rincón, D. N., and others, *Heliyon*, 2024.

• **HyperHeight LiDAR Compressive Sampling and Machine Learning Reconstruction of Forested Landscapes**. **Ramirez-Jaime, A.**, Pena-Pena, K., Arce, G. R., Harding, D., Stephen, M., MacKinnon, J., *IEEE Transactions on Geoscience and Remote Sensing*, 2024.

• **Compressive spectral imaging via misalignment induced equivalent grayscale coded aperture**. Zhang, T., Zhao, S., Ma, X., **Ramirez-Jaime, A.**, Zhao, Q., Arce, G. R., *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., Echeverry-Mejia, J., Tembine, H., *Automatica*, 2022.

• **MatSWMM–an open-source toolbox for designing real-time control of urban drainage systems**. Riaño-Briceño, G., Barreiro-Gomez, J., **Ramirez-Jaime, A.**, Quijano, N., Ocampo-Martinez, C., *Environmental Modelling & Software*, 2016.

Book Chapters

• **Computational Lidar from Space: Toward the Next Generation of Satellite Lidars**. **Ramirez-Jaime, A.**, Arce, G. R., Porras-Diaz, N., Stephen, M., Yang, G. In *Handbook of Statistics, Vol. 54: Multidimensional Signal Processing* (A. S. R. Srinivasa Rao, K. V. Mishra, and G. R. Arce, Eds.). Elsevier, 2026 (In Press).

Conference Proceedings

• **Lossless Compression of Hyperheight LiDAR Forested Landscapes Data**. Makarichev, V., Lukin, V., Vasilyeva, I., Okarma, K., **Ramirez-Jaime, A.**, Arce, G. R., 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. IEEE Statistical Signal Processing Workshop (SSP)*, 2025.

• **Optimal illumination pattern for satellite compressive LiDAR using generative AI**. Newman-Sanders, C., **Ramirez-Jaime, A.**, Porras-Diaz, N., Arce, G. R., Stephen, M., in *Proc. Machine Learning from Challenging Data 2025*, 2025.

• **SpectralCam: High-Resolution Low-Cost Spectral Imaging Using DSLR Cameras**. Paruchuri, A., **Ramirez-Jaime, A.**, Arce, G., Alrushud, A., Ma, X., Radpour, R., in *Proc. IEEE ICASSP*, 2025.

• **Super-resolution of satellite lidars for forest studies via generative adversarial networks**. **Ramirez-Jaime, A.**, Porras-Diaz, N., Arce, G. R., Harding, D., Stephen, M., MacKinnon, J., in *Proc. IEEE IGARSS*, 2024.

• **Multi-modal transformer for compressive LiDARs using hyperspectral imaging side-information**. Porras-Diaz, N., **Ramirez-Jaime, A.**, Arce, G. R., Vargas, R., Harding, D., Stephen, M., MacKinnon, J., in *Proc. IEEE IGARSS*, 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. IEEE Conference on Computational Imaging Using Synthetic Apertures (CISA)*, 2024.

• **High altitude computational lidar emulation and machine learning reconstruction for Earth sciences**. Arce, G. R., **Ramirez-Jaime, A.**, Porras-Diaz, N., in *Proc. Big Data VI: Learning, Analytics, and Applications*, 2024.

• **Nonlinear model predictive control with constraint satisfactions for a quadcopter**. Wang, Y., **Ramirez-Jaime, A.**, Xu, F., Puig, V., in *Proc. Journal of Physics: Conference Series*, 2017.

• **A differential game approach to urban drainage systems control**. **Ramirez-Jaime, A.**, Quijano, N., Ocampo-Martinez, C., in *Proc. American Control Conference (ACC)*, 2016.

• **Co-simulation for the design of controllers in urban drainage systems**. Riaño-Briceño, G., **Ramirez-Jaime, A.**, Barreiro-Gomez, J., Quijano, N., Ocampo-Martinez, C., in *Proc. IEEE 2nd Colombian Conference on Automatic Control (CCAC)*, 2015.

Invited Talks

• "High-Altitude Earth Observation with Diffusion Models for Satellite LiDAR Reconstruction." Electronic Imaging 2025, Burlingame, CA, USA, February 2–6, 2025.

Awards and Honors

• 2024 Doctoral Fellowship for Excellence, University of Delaware.

• 2024 ECE Signal Processing Award, University of Delaware.

• 2022 George W. Laird Fellow, University of Delaware.

• Graduated *Cum Laude*, M.S., University of Los Andes, 2016.

Grants and Funding

• Co-authored successful proposal for NSF EAGER IMPRESS-U Grant #2404740: "Exploratory Research on Generative Compression for Compressive Lidar" (PI: Gonzalo R. Arce, University of Delaware; joint with ONRG and partners in Ukraine and Poland; $300,000; 2024–2026).

• Co-authored successful proposal for UNIDEL210-UD AI CTR-ARCE PILOT: "Computational Lidar Sensing for Earth Science" (PI: Gonzalo R. Arce, Co-PI: R. Vargas, University of Delaware; $15,000; 2/1/2023 – 1/30/2024).

• Co-authored successful proposal for NASA Grant #80NSSC22K1099: "Sampling and Deep Learning Reconstruction of LiDAR Waveforms" (PI: Gonzalo R. Arce, University of Delaware; $40,000; 6/1/2022 – 5/31/2023).

• Co-authored successful proposal for NASA EPSCoR RID Grant: "Planetary LiDAR Compressive Point-Cloud Sampling and Machine Learning High-Resolution Reconstruction" (PI: Gonzalo R. Arce, Co-PI: Amo Tong, University of Delaware; $28,000; 8/1/2021 – 6/30/2022).

Professional Service

• Reviewer, IEEE International Geoscience and Remote Sensing Symposium (IGARSS), 2024–2026.

• Peer Reviewer for The Journal of Supercomputing, IET Image Processing, and Journal of Spatial Science.

Leadership and Outreach

- Designed and programmed embedded control for the UNISABANA HERONS mechanical ventilator deployed in **400+** units during COVID-19; implemented respiratory control and data collection in C and LabVIEW, supporting regulatory approval by the Colombian FDA (University of La Sabana, 2018–2021).
- Led a robotics team for RoboCup 2019 (Sydney); reached the **Community Shield final** as runner-up, owning end-to-end technical execution (perception, control, systems integration) as team leader (University of La Sabana, 2018–2021).
- Active member, Hispanic/Latino Graduate Student Association (HLGSA), University of Delaware.
- Active member, Society for Advancement of Chicanos/Hispanics & Native Americans in Science (SACNAS).

Technical Skills

- **Programming**: Python, C, MATLAB, LabVIEW.
- **ML / Deep Learning**: PyTorch, TensorFlow, Keras; diffusion models, transformers, GANs; LLM fine-tuning (LoRA); retrieval-augmented generation (RAG); multimodal neural networks.
- **Computer Vision / Imaging**: semantic segmentation, super-resolution, denoising, reconstruction; computational imaging; medical and remote-sensing imagery.
- **Data / Systems**: large-scale training and evaluation (gigapixel images; 3D tensors; GPU training); dataset curation; experiment evaluation and test-suite design.
- **Tools**: Linux, Git, GIS, Latex.
- **Languages**: English (fluent), Spanish (native).

References

Gonzalo R. Arce — Charles Black Evans Professor, Department of Electrical & Computer Engineering, University of Delaware. arce@udel.edu

Javier Garcia-Frias — Professor and Associate Chair (Graduate Studies), Department of Electrical & Computer Engineering, University of Delaware. jgf@udel.edu

Volodymyr (Vladimir) Lukin — Head, Department of Information-Communication Technologies, National Aerospace University "Kharkiv Aviation Institute" (KhAI). v.lukin@khai.edu

Krzysztof Okarma — Professor, Department of Signal Processing and Multimedia Engineering, West Pomeranian University of Technology in Szczecin (ZUT). okarma@zut.edu.pl

Guangning Yang — Engineer, NASA Goddard Space Flight Center. Guangning.Yang-1@nasa.gov