Manuel Pérez Carrasco

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Research Interests

My research applies machine learning to Earth observation for environmental monitoring and climate science applications. I specialize in computer vision, time series analysis, and natural language processing.

Education

MSc. Computer Science — Concepción, Chile
University of Concepción (GPA: 6.1/7.0) — *Mar. 2017 – Oct. 2019*

- Thesis: "Semi-supervised Adversarial Variational Domain Adaptation for Image Classification" (Grade: 7.0/7.0)
- Received Best Student Paper Award at Astroinformatics 2019 Conference, Caltech
- Research conducted at Harvard University's Institute for Applied Computational Sciences with Professors Guillermo Cabrera-Vives and Pavlos Protopapas

B.S. Industrial Engineering — Concepción, Chile
University of Concepción (GPA: 5.9/7.0) — *Mar. 2013 – Sep. 2018*

- Undergraduate honors thesis published in *Publications of the Astronomical Society of the Pacific*
- Focus on data science, machine learning, and optimization

Experience

Spark Postbaccalaureate Research Fellow — Cambridge, MA, USA
Center for Astrophysics (CfA), Harvard & Smithsonian — *Sept. 2025 – Present*
Working under Dr. Cecilia Garraffo (Director, AstroAI at CfA) and Dr. Xiong Liu (PI of TEMPO, SAO Lead of MethaneSAT).

- **MethaneSAT Mission – Atmospheric Remote Sensing**: Developed deep learning algorithms for cloud and shadow segmentation in spectroscopic imagery. Performing research on algorithms for methane plume detection using MethaneSAT satellite and MethaneAIR airborne data.
- **TEMPO Mission – Atmospheric Remote Sensing**: Designing geometry-based labeling system and machine learning models for cloud and shadow detection using spectroscopic data from NASA's Tropospheric Emissions: Monitoring of Pollution (TEMPO) satellite.

Chief Technology Officer — Concepción, Chile
Center for Data and Artificial Intelligence, University of Concepción — *Jul. 2019 – Aug. 2025*

- **Deep-Hub Geospatial Platform for Precision Silviculture**: Co-architected cloud-native ML infrastructure for automated tree detection using multi-sensor aerial imagery. Developed and deployed scalable deep learning models (detection, segmentation, land cover classification) processing 300,000+ acres of forest plantations. Led technical team of 5 engineers. Platform spun off as commercial venture from School of Engineering. Published research in *International Journal of Digital Earth*.
- **ALeRCE Anomaly Detector – Astronomical Time Series Analysis**: Designed and implemented deep learning-based anomaly detection algorithms identifying rare transient events in real-time telescope data. Research published in *The Astronomical Journal*. Funded by Millennium Institute of Astrophysics.
- **NLP for Social Science – Large-Scale Text Analysis**: Led development of transformer-based NLP platform for analyzing 500,000+ citizen feedback responses during Chilean social outbreak. Implemented sentiment analysis and topic modeling techniques, providing data-driven insights for policymakers. Platform's statistical outputs informed Chilean constitutional drafting process. Worked with Chilean Ministry of Social Development and Family.

Research Assistant — Cambridge, MA, USA
Institute for Applied Computational Sciences, Harvard University — *Dec. 2018 – May. 2021*

- Conducted research on semi-supervised domain adaptation for image classification under Prof. Pavlos Protopapas (IACS Scientific Program Director). Developed novel contrastive learning framework (Con^{2}DA) for domain adaptation, published at NeurIPS 2020 Workshop on Distribution Shifts.
- Master's thesis research on adversarial variational domain adaptation. Recipient of IACS financial support (stipend and travel funding) for research development.
- Applied deep learning methods to astronomical image classification problems, transferring network knowledge across different telescope surveys and observing conditions.

Publications

Pérez-Carrasco, M., Nasr, M., Roche, S., Chan Miller, C., Zhang, Z., Park, C. F., Walker, E., Garraffo, C., Finkbeiner, D., Gautam, R., & Wofsy, S. (2025). Deep learning for clouds and cloud shadow segmentation in methane satellite and airborne imaging spectroscopy. *Under review.*

Pérez-Carrasco, M., Karelovic, B., Molina, R., Saavedra-Passache, R., Cerulo, P., & Cabrera-Vives, G. (2022). Precision silviculture: Use of UAVs and comparison of deep learning models for the identification and segmentation of tree crowns in pine crops. *International Journal of Digital Earth*, 15(1), 2223-2238.

Pérez-Carrasco, M., Cabrera-Vives, G., Hernandez-García, L., Förster, F., Sanchez-Saez, P., Muñoz Arancibia, A. M., et al. (2023). Alert classification for the ALeRCE broker system: The anomaly detector. *The Astronomical Journal*, 166(4), 151.

Sanchez-Saez, P., et al. (2021). Searching for changing-state AGNs in massive data sets. I. Applying deep learning and anomaly-detection techniques. *The Astronomical Journal*, 162(5), 206.

Förster, F., et al. (2021). The automatic learning for the rapid classification of events (ALeRCE) alert broker. *The Astronomical Journal*, 161(5), 242.

Pérez-Carrasco, M., Cabrera-Vives, G., Martinez-Marín, M., Cerulo, P., Demarco, R., Protopapas, P., Godoy, J., & Huertas-Company, M. (2019). Multiband galaxy morphologies for CLASH: A convolutional neural network transferred from CANDELS. *Publications of the Astronomical Society of the Pacific*, 131(1004), 108002.

Conference Presentations & Service

NeurIPS 2025: Climate Change ML Workshop – Poster Presenter
NeurIPS 2024: LatinX in AI Workshop – Finance/Sponsorship Co-Chair
NeurIPS 2023: Climate Change ML Workshop – Poster Presenter
ICML 2023: Machine Learning for Astrophysics Workshop – (3) Poster Presentations
NeurIPS 2021: Workshop on Distribution Shifts – Poster Presenter
Astroinformatics 2019: Oral. Best Student Paper Award, Caltech

Teaching Experience

Lecturer Concepción, Chile
School of Engineering, University of Concepción *Jul. 2019 – Present*

- Taught graduate and undergraduate courses including Deep Learning (2022-2024), Introduction to Data Science (2021-2022), Machine Learning (2019-2020), and Data Analysis (2024). Co-designed curriculum, lectures, and assessments for classes of ∼30 students. Worked with professor Guillermo Cabrera-Vives.
- Topics covered: supervised/unsupervised learning, cross-validation, convolutional neural networks, recurrent architectures, transformers, computer vision, NLP and time series analysis.

Teaching Fellow Cambridge, MA, USA
Institute for Applied Computational Sciences, Harvard University *Feb. 2019 – May 2019*

- Teaching fellow for CS109b: Advanced Topics in Data Science, a required course for the Data Science Master's program. Conducted office hours, graded assessments, and mentored students on applied ML projects under Prof. Pavlos Protopapas.

Honors & Awards

- SPARK Postbaccalaureate Fellowship, Center for Astrophysics, Harvard & Smithsonian (2025)
- AstroAI/EarthAI affiliate, Center for Astrophysics, Harvard & Smithsonian (2023-2025)
- Best Student Paper Award, Astroinformatics 2019 Conference, Caltech
- Harvard-Chile Research Internship, Institute for Applied Computational Sciences at Harvard University (2018-2019)
- UdeC Scholarship for Master studies (2017-2019)

Technical Skills

Programming: Python (Expert: PyTorch, TensorFlow/Keras, scikit-learn, NumPy, pandas), SQL, Bash.
Machine Learning: Deep learning, computer vision, time series analysis, NLP, anomaly detection, domain adaptation.
Cloud & Engineering: AWS, GCP, Docker, Git.
Data Visualization: Matplotlib, Seaborn, Plotly, scientific visualization
Languages: Spanish (Native), English (Fluent)