Giorgio Morales

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Education

Montana State University	**Jan. 2022 – May 2025 (Expected)**
Ph.D., Computer Science (All But Dissertation). GPA: 3.97.	*Bozeman, MT, USA*
Montana State University	**Aug. 2019 – Dec. 2021**
M.Sc., Computer Science. GPA: 3.97.	*Bozeman, MT, USA*
National University of Engineering	**Aug. 2010 – Dec 2015**
B.S., Mechatronics Engineering. GPA: 3.5.	*Lima, Peru*

Experience

Université de Caen Normandie — **Jan. 2025 – Present**
Researcher — *Caen, NRM, France*
- Developing uncertainty quantification techniques for generative AI models to aid in neutrino physics simulations.

Montana State University — **Jan. 2021 – Dec. 2024**
Graduate Research Assistant — *Bozeman, MT, USA*
- Part of the Data-Intensive Farm Management (DIFM) project.
- Published 12 first-author journal and conference papers related to symbolic regression, prediction and optimization in Precision Agriculture, uncertainty quantification, and explainable machine learning.
- Developed a web application in Flask to demonstrate the functionality of the prediction and optimization tools.

Montana State University — **Aug. 2019 – Dec. 2020**
Graduate Teaching Assistant — *Bozeman, MT, USA*
- Courses: Machine Learning (Fall 2020), Advanced Algorithm Topics (Fall 2020), Data Structures and Algorithms (Spring 2020), and Basic Data Structures and Algorithms (Fall 2019 and Summer 2020).

National University of Engineering – INICTEL-UNI — **Nov. 2014 – July 2019**
Computer Vision Researcher — *Lima, Peru*
- Published 11 conference and journal papers, and 1 B.Sc. thesis related to computer vision and remote sensing.
- Led small teams and worked in multidisciplinary environments.
- Developed software to detect Mauritia Flexuosa palms in the Amazon using aerial images and drones. The project allowed the expansion of the monitored area by 200% and reduced the expedition costs by 500%.
- Developed software to segment clouds and shadows for the Space Agency of Peru (CONIDA) in high-resolution multispectral satellite images. The solution reduced the processing times by 1000%.

Selected Projects

Symbolic Regression Using Transformers and Genetic Algorithms — **January 2023 – Present**
- PhD thesis proposal. Goal: To develop a symbolic regression method that uses transformers and evolutionary algorithms to distill a black box model's computed function into analytical equations.
- Experimental results showed our method consistently learned expressions that matched the original mathematical structure.

Reduced-Cost Hyperspectral Image Classification — **August 2019 – December 2020**
- Published 2 journal papers, 1 conference paper, and an M.Sc. thesis.
- Designed low-cost convolutional neural networks for hyperspectral image classification.
- Proposed novel feature selection methods to determine salient wavelengths obtained from hyperspectral imaging systems to aid in the design and prototyping of compact, low-cost multispectral imagers for a range of applications, such as produce monitoring and identification of herbicide-resistance biotypes of different weeds.

Honors and Awards

- Seismic Monitoring and Analysis Challenge (2024): Awarded first prize in this competition hosted at ECML PKDD 2024.
- Cobleigh Endowment (2023, 2024): Scholarship for students of the Norm Asbjornson College of Engineering.
- Graduate Professional Advancement Grant (2023, 2024): Travel grant for MSU graduate students.
- IEEE CIS Travel Grant (2023): Travel grant for a student presenting at the IJCNN 2023, Gold Coast, Australia.
- Chunzi "Chris" Zhang (2023): Award for International Graduate Excellence in Research.
- William V. Benjamin (2021, 2022): Scholarship for students of the Norm Asbjornson College of Engineering.
- Southern Perú - ProUNI (2019): Graduate scholarship from the National University of Engineering.

Selected Publications

Journal Articles

- G. Morales and J. Sheppard, "Dual Accuracy-Quality-Driven Neural Network for Prediction Interval Generation," accepted for publication at *IEEE Transactions on Neural Networks and Learning Systems*, December 2023.
- G. Morales, J. Sheppard, P. Hegedus, and B. Maxwell, "Improved Yield Prediction of Winter Wheat Using a Novel Two-Dimensional Deep Regression Neural Network Trained via Remote Sensing," *Sensors*, 23(1), 489, January 2023.
- G. Morales, J. Sheppard, R. Logan, and J. Shaw, "Hyperspectral Dimensionality Reduction Based on Inter-Band Redundancy Analysis and Greedy Spectral Selection," *Remote Sensing*, 13(18), 3649, September 2021.
- G. Morales, J. Sheppard, B. Scherrer, and J. Shaw, "Reduced-Cost Hyperspectral Convolutional Neural Networks," *Journal of Applied Remote Sensing*, 14(3), 036519 (2020), September 2020.
- G. Morales, G. Kemper, G. Sevillano, D. Arteaga, I. Ortega, J. Telles, "Automatic Segmentation of Mauritia flexuosa in Unmanned Aerial Vehicle (UAV) Imagery Using Deep Learning," *Forests*, 2018(9), 736, November 2018.

Refereed Conference Papers

- G. Morales and J. Sheppard, "Adaptive Sampling for Epistemic Uncertainty Reduction Using Prediction-Interval Generation Neural Networks," accepted to appear in *AAAI Conference on Artificial Intelligence*, February 2025.
- G. Morales and J. Sheppard, "Univariate Skeleton Prediction in Multivariate Systems Using Transformers," *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, September 2024.
- G. Morales and J. Sheppard, "Counterfactual Analysis of Neural Networks Used to Create Fertilizer Management Zones," *IEEE International Joint Conf. on Neural Networks (IJCNN)*, June 2024.
- G. Morales and J. Sheppard, "Counterfactual Explanations of Neural Network-Generated Response Curves," *IEEE International Joint Conf. on Neural Networks (IJCNN)*, June 2023.
- G. Morales, J. Sheppard, R. Logan, and J. Shaw, "Hyperspectral Band Selection for Multispectral Image Classification with Convolutional Networks," *IEEE Int. Joint Conf. on Neural Networks (IJCNN)*, July 2021.
- G. Morales, A. Ramírez, and J. Telles, "End-to-end Cloud Segmentation in High-Resolution Multispectral Satellite Imagery Using Deep Learning," *IEEE Int. Conf. on Electronics, Electrical Engineering and Computing (INTERCON)*, Aug. 2019.
- G. Morales, S. Huamán, and J. Telles, "Shadow Removal in High-Resolution Satellite Images Using Conditional Generative Adversarial Networks," *Int. Conf. on Information Management and Big Data (SIMBig)*, Feb. 2019.
- G. Morales, I. Salazar, J. Telles, and D. Díaz, "Detecting Violent Robberies in CCTV Videos Using Deep Learning," *Artificial Intelligence Applications and Innovations (AIAI)*, May 2019.
- G. Morales, D. Arteaga, S. Huamán, J. Telles, and W. Palomino, "Shadow Detection in High-Resolution Multispectral Satellite Imagery Using Generative Adversarial Networks," *IEEE Int. Conf. on Electronics, Electrical Engineering and Computing (INTERCON)*, Aug. 2018.
- G. Morales, S. Huamán, and J. Telles, "Cloud Detection in High-Resolution Multispectral Satellite Imagery Using Deep Learning," *Int. Artificial Neural Networks and Machine Learning (ICANN)*, October 2018.

Invited Papers

- G. Morales and J. Sheppard, "Two-dimensional Deep Regression for Early Yield Prediction of Winter Wheat," *SPIE Future Sensing Technologies*, November 2021.

Non-Refereed Conference Papers

- G. Morales, J. Sheppard, A. Peerlinck, P. Hegedus, and B. Maxwell, "Generation of Site-specific Nitrogen Response Curves for Winter Wheat using Deep Learning," *Int. Conf. on Precision Agriculture*, June 2022.

Theses

- G. Morales, "Towards Reduced-Cost Hyperspectral and Multispectral Image Classification," MS thesis, Gianforte School of Computing, Montana State University, 2021.
- G. Morales, "Development of a Remote Sensing Software Oriented to the Identification and Automatic Measurement of Mauritia Flexuosa plantations in the Peruvian Amazon using Aerial Images Acquired Via UAV and Digital Image Processing Algorithms," BS thesis, Department of Mechatronic Engineering, Universidad Nacional de Ingeniería, 2017.

Language and Skills

- Spanish (native), English (full professional proficiency), Italian (C1), French (B1).
- Python, Java, C/C++, Pytorch, Tensorflow/Keras, Matlab, LaTeX.