

# GIORGIO MORALES

107 Paisley Court Apt. H, Bozeman, MT 59715

📞 (406) 589-3267 ✉ [giorgiomoralesluna@gmail.com](mailto:giorgiomoralesluna@gmail.com) [in linkedin.com/in/giorgio-morales/](https://www.linkedin.com/in/giorgio-morales/) [github.com/GiorgioMorales](https://github.com/GiorgioMorales)

## Education

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

## Experience

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<b>Montana State University</b> <i>Graduate Research Assistant</i>	<b>Jan. 2021 – Present</b> <i>Bozeman, MT</i>
<ul style="list-style-type: none"><li>• Published 8 journal and conference papers related to prediction and optimization in Precision Agriculture as well as uncertainty quantification and explainable machine learning.</li><li>• Developed a web application in Flask to demonstrate the functionality of the prediction and optimization tools.</li><li>• The developed techniques showed the potential to increase farmers' profits by up to \$20,000 per field.</li></ul>	
<b>Montana State University</b> <i>Graduate Teaching Assistant</i>	<b>Aug. 2019 – Dec. 2020</b> <i>Bozeman, MT</i>
<ul style="list-style-type: none"><li>• 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).</li></ul>	
<b>INICTEL-UNI</b> <i>Computer Vision Researcher</i>	<b>Nov. 2014 – July 2019</b> <i>Lima, Peru</i>
<ul style="list-style-type: none"><li>• Published 11 conference and journal papers, and 1 B.Sc. thesis related to computer vision and remote sensing.</li><li>• Led small teams and worked in multidisciplinary environments.</li><li>• 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%.</li><li>• 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%.</li></ul>	

## Selected Projects

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<b>Symbolic Regression Using Transformers and Genetic Algorithms</b>	<b>January 2023 – Present</b>
<ul style="list-style-type: none"><li>• PhD thesis proposal. Goal: To develop a symbolic regression method that uses deep learning techniques (e.g., LLMs) and genetic algorithms to distill experimental data into analytical equations.</li><li>• Preliminary results showed our method generated estimated univariate skeletons with a more similar mathematical structure as the underlying skeletons in comparison to one evolutionary-based and two deep learning-based SR methods.</li></ul>	
<b>Reduced-Cost Hyperspectral Image Classification</b>	<b>August 2019 – December 2020</b>
<ul style="list-style-type: none"><li>• Published 2 journal papers, 1 conference paper, and a M.Sc. thesis.</li><li>• Designed low-cost convolutional neural networks for hyperspectral image classification.</li><li>• 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.</li></ul>	

## Honors and Awards

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- 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

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### 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.
- P. Hegedus, B. Maxwell, J. Sheppard, S. Loewen, H. Duff, G. Morales, A. Peerlinck, “Towards a Low-Cost Comprehensive Process for On-Farm Precision Experimentation and Analysis,” *Agriculture*, 13(3), 524, Feb. 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.
- S. Huamán, A. Castro, G. Morales, and J. Telles, “Regression Models between Active Sensor-Measured NDVI and UAV-Acquired Multispectral Images with Positioning Uncertainty,” *IEEE Latin America Transactions*, 17(06), pp. 1055-1067, June 2019.
- 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, “Counterfactual Analysis of Neural Networks Used to Create Fertilizer Management Zones,” accepted to appear in *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 XXV Int. Conf. on Electronics, Electrical Engineering and Computing (INTERCON)*, Aug. 2018.
- W. Palomino, G. Morales, S. Huamán, and J. Telles, “PETEFA: Geographic Information System for Precision Agriculture,” *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.
- G. Morales, S. Huamán, and J. Telles, “Cloud Detection for PERUSAT-1 Imagery Using Spectral and Texture Descriptors, ANN, and Panchromatic Fusion,” *3rd Brazilian Technology Symposium (BTSym)*, 2017.

### Invited Papers

- G. Morales and J. Sheppard, “Two-dimensional Deep Regression for Early Yield Prediction of Winter Wheat,” *Proc. of 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,” *Proc. of the 15th Int. Conf. on Precision Agriculture*, June 2022.
- A. Peerlinck, G. Morales, J. Sheppard, P. Hegedus, and B. Maxwell, “Optimizing Nitrogen Application to Maximize Yield and Reduce Environmental Impact in Winter Wheat Production,” *Proc. of the 15th Int. Conf. on Precision Agriculture*, Minneapolis, Minnesota, United States, June 2022.
- B. Maxwell, P. Hegedus, S. Loewen, H. Duff, J. Sheppard, A. Peerlinck, G. Morales, A. Bekkerman, “Decision support from on-field precision experiments,” to appear in the *Proc. of the 15th Int. Conf. on Precision Agriculture*, Minneapolis, Minnesota, United States, 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.