Giorgio L. Morales Luna

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EDUCATION

Montana State University — **Bozeman, MT, USA**
Ph.D., Computer Science (Expected Graduation Date: 05/2025) — *January 2022 – Present*
- Member of the Numerical Intelligent Systems Laboratory (NISL).
- Advisor: John W. Sheppard.

Montana State University — **Bozeman, MT, USA**
M.Sc., Computer Science — *August 2019 – December 2021*
- Thesis: "Towards Reduced-Cost Hyperspectral and Multispectral Image Classification".
- Advisor: John W. Sheppard.
- GPA: 3.97.

National University of Engineering — **Lima, Peru**
B.S., Mechatronics Engineering — *August 2010 – December 2015*
- GPA: 3.5.

EXPERIENCE

Montana State University — **Bozeman, MT, USA**
Graduate Research Assistant. — *January 2021 – Present*
- Part of the Analysis Engine of the On-Field Precision Experiment (OFPE) Framework project.
- Published 8 journal and conference papers related to prediction and optimization in Precision Agriculture as well as uncertainty quantification and explainable machine learning.
- Developed a web application in Flask to demonstrate the functionality of the prediction and optimization tools.
- The developed techniques showed the potential to increase farmers' profits by up to $20,000 per field.

Graduate Teaching Assistant. — *August 2019 – December 2020*
- CSCI 447 - Machine Learning (Fall 2020).
- CSCI 432 - Advanced Algorithm Topics (Fall 2020).
- CSCI 232 - Data Structures and Algorithms (Spring 2020).
- CSCI 132 - Basic Data Structures and Algorithms (Fall 2019 and Summer 2020).

National Institute of Research and Training for Telecommunications (INICTEL-UNI) — **Lima, Peru**
Computer Vision Researcher. — *November 2014 – July 2019*
- Published 11 conference and journal papers, and 1 B.Sc. thesis related to computer vision and remote sensing.
- 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%.
- Led small teams and worked in multidisciplinary environments.

RELEVANT PROJECTS

Symbolic Regression Using Transformers and Genetic Algorithms — *January 2023 – Present*

PhD Thesis Proposal. Goal: Develop a symbolic regression method that leverages the advantages of deep learning techniques (e.g., LLMs) and genetic algorithms to distill experimental data into analytical equations that serve as causal explanations for the observable world. It offers an alternative to the use of black-box models and a promising avenue for the automated discovery of explanatory and causal models from observed data.

On-Field Precision Experiment framework - Analysis Engine. *January 2021 – Present*

Goal: To propose new computational methods based on the latest artificial intelligence and machine learning techniques to process the collected information from the fields efficiently and automatically to predict future values of variables of interest for the farmers, such as yield or protein content. This knowledge will be useful to propose a more efficient use of the available resources (e.g., water, nutrients, and pesticides), avoiding waste, minimizing environmental impact, and maximizing profit.

Reduced-Cost Hyperspectral Image Classification. *August 2019 – December 2020*

Designed low-cost convolutional neural networks for hyperspectral image classification and 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. Language: Python.

Cloud, Shadow and Road Detection for PERUSAT-1 imagery. *January 2018 – June 2019*

Developed a software for the Space Agency of Peru (CONIDA) to efficiently process PERUSAT-1 images (high-resolution multispectral satellite images) in order to generate cloud, shadow, and road masks with high accuracy using Deep Learning techniques. Language: Python.

Software for monitoring the density of Mauritia Flexuosa palms in the Peruvian Amazon. *January 2015 – December 2016*

Developed a software to semantically segment Mauritia Flexuosa palms (aguaje) in aerial high-resolution images acquired by UAVs using Convolutional Neural Networks. The project was funded by the Peruvian Ministry of Production. Language: C++(OpenCV), Python, Matlab.

TEACHING

Montana State University

Filled in for advisor to deliver lectures, engage with students, and ensure the smooth continuation of the course.

- CSCI 446 - Artificial Intelligence (Fall 2023, Fall 2024). One week/semester.
- CSCI 447 - Machine Learning (Fall 2022). Two weeks.

INICTEL–UNI

- Workshop: Deep Learning for Computer Vision. July 2019 (24 hours).
- 3th Program for Technological Entrepreneurs: Machine Learning. July 2018 (24 hours).

PUBLICATIONS

Journal Articles

- Giorgio Morales and John W. 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.
- Paul Hegedus, Bruce Maxwell, John W. Sheppard, Sasha Loewen, Hannah Duff, Giorgio Morales, Amy Peerlinck, "Towards a Low-Cost Comprehensive Process for On-Farm Precision Experimentation and Analysis," *Agriculture*, 13(3), 524, February 2023.
- Giorgio Morales, John W. Sheppard, Paul Hegedus, and Bruce 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.
- Giorgio Morales, John W. Sheppard, Riley Logan, and Joseph Shaw, "Hyperspectral Dimensionality Reduction Based on Inter-Band Redundancy Analysis and Greedy Spectral Selection," *Remote Sensing*, 13(18), 3649, September 2021.
- Giorgio Morales, John W. Sheppard, Bryan Scherrer, and Joseph Shaw, "Reduced-Cost Hyperspectral Convolutional Neural Networks," *Journal of Applied Remote Sensing*, 14(3), 036519 (2020), September 2020.

- Samuel Huamán, Antero Castro, Giorgio Morales, and Joel 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.
- Giorgio Morales, Guillermo Kemper, Grace Sevillano, Daniel Arteaga, Ivan Ortega, Joel 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, "Univariate Skeleton Prediction in Multivariate Systems Using Transformers," accepted to appear in *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, September 2024.
- Giorgio Morales and John Sheppard, "Counterfactual Analysis of Neural Networks Used to Create Fertilizer Management Zones," *Proceedings of the IEEE Int. Joint Conference on Neural Networks (IJCNN)*, June 2024.
- Giorgio Morales and John Sheppard, "Counterfactual Explanations of Neural Network-Generated Response Curves," *Proceedings of the IEEE Int. Joint Conference on Neural Networks (IJCNN)*, June 2023.
- Giorgio Morales, John Sheppard, Riley Logan, and Joseph Shaw, "Hyperspectral Band Selection for Multispectral Image Classification with Convolutional Networks," *Proceedings of the IEEE Int. Joint Conference on Neural Networks (IJCNN)*, July 2021.
- Marco Apolinario, Samuel Huamán Bustamante, Giorgio Morales, and Daniel Díaz, "Estimation of 2D Velocity Model using Acoustic Signals and Convolutional Neural Networks," *Proceedings of the IEEE XXVI Int. Conference on Electronics, Electrical Engineering and Computing (INTERCON)*, Lima, Peru, August 2019.
- Giorgio Morales, Alejandro Ramírez, and Joel Telles, "End-to-end Cloud Segmentation in High-Resolution Multispectral Satellite Imagery Using Deep Learning," *Proceedings of the IEEE XXVI Int. Conference on Electronics, Electrical Engineering and Computing (INTERCON)*, Lima, Peru, August 2019.
- Giorgio Morales, Samuel Huamán, and Joel Telles, "Shadow Removal in High-Resolution Satellite Images Using Conditional Generative Adversarial Networks," *Proceedings of the Int. Conference on Information Management and Big Data (SIMBig)*, Lima, Peru, February 2019.
- Giorgio Morales, Itamar Salazar, Joel Telles, and Daniel Díaz, "Detecting Violent Robberies in CCTV Videos Using Deep Learning," *Proceedings of the Artificial Intelligence Applications and Innovations (AIAI)*, Crete, Greece, May 2019.
- Giorgio Morales, Daniel Arteaga, Samuel Huamán, Joel Telles, and Walther Palomino, "Shadow Detection in High-Resolution Multispectral Satellite Imagery Using Generative Adversarial Networks," *Proceedings of the IEEE XXV Int. Conference on Electronics, Electrical Engineering and Computing (INTERCON)*, Lima, Peru, August 2018.
- Walther Palomino, Giorgio Morales, Samuel Huamán, and Joel Telles, "PETEFA: Geographic Information System for Precision Agriculture," *Proceedings of the IEEE XXV Int. Conference on Electronics, Electrical Engineering and Computing (INTERCON)*, Lima, Peru, August 2018.
- Giorgio Morales, Samuel Huamán, and Joel Telles, "Cloud Detection in High-Resolution Multispectral Satellite Imagery Using Deep Learning," *Proceedings of the Int. Artificial Neural Networks and Machine Learning (ICANN)*, Rhodes, Greece, October 2018.
- Giorgio Morales, Samuel Huamán, and Joel Telles, "Cloud Detection for PERUSAT-1 Imagery Using Spectral and Texture Descriptors, ANN, and Panchromatic Fusion," *Proceedings of the 3rd Brazilian Technology Symposium (BTSym)*, Campinas, Brazil 2017.
- Giorgio Morales, Daniel Arteaga, Marta Orduna, Guillermo Kemper, and Joel Telles, "An Algorithm for the Improvement of Aerial Images Acquired Via UAV for the Improvement of the Detection of Young Mauritia Flexuosa Palms in the Peruvian Amazon," *Proceedings of the 1st Brazilian Technology Symposium (BTSym)*, Campinas, Brazil 2015.

Invited Papers

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

Non-Refereed Conference Papers

- Daniele Rege Cambrin, Lorenzo Vaiani, Isaac Corley, Nils Lehmann, Giorgio Morales, Pascal Tribel, "Seismic Monitoring and Analysis Challenge (SMAC) Report," accepted to appear in *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD): Discovery Challenge*, September 2024.
- Giorgio Morales, John Sheppard, Amy Peerlinck, Paul Hegedus, and Bruce Maxwell, "Generation of Site-specific Nitrogen Response Curves for Winter Wheat using Deep Learning," *Proceedings of the 15th Int. Conference on Precision Agriculture*, Minneapolis, Minnesota, United States, June 2022.

- Amy Peerlinck, Giorgio Morales, John Sheppard, Paul Hegedus, and Bruce Maxwell, "Optimizing Nitrogen Application to Maximize Yield and Reduce Environmental Impact in Winter Wheat Production," *Proceedings of the 15th Int. Conference on Precision Agriculture*, Minneapolis, Minnesota, United States, June 2022.
- Bruce Maxwell, Paul Hegedus, Sasha Loewen, Hannah Duff, John Sheppard, Amy Peerlinck, Giorgio Morales, Anton Bekkerman, "Decision support from on-field precision experiments," to appear in the *Proceedings of the 15th Int. Conference on Precision Agriculture*, Minneapolis, Minnesota, United States, June 2022.

Theses

- Giorgio Morales, "Towards Reduced-Cost Hyperspectral and Multispectral Image Classification," MS thesis, Gianforte School of Computing, Montana State University, 2021.
- Giorgio 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.

SOFTWARE

- Jhordan Castillo, Walther Palomino, Giorgio Morales, Marco Apolinario (2020), "Software de Identificación de Nubes sobre Imágenes Multiespectrales SINIM-1". Registered at the National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI), Lima, Peru. Reg. Number: 00740-2021. Registration date: 17/06/2021.
- Giorgio Morales (2019), "Software de Segmentación de Aguajes MAUFLEX". Registered at the National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI), Lima, Peru. Reg. Number: 00572-2019. File number: 000735-2019. Registration date: 12/04/2019.
- Giorgio Morales, Luis Bendayán, Jorge Sanjurjo, Antero Castro, Guillermo Kemper, David Ponce, and Joel Telles (2017), "Software de Teledetección de Palmeras de Aguajales". Registered at the National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI), Lima, Peru. Reg. Number: 00989-2017. File number: 001120-2017. Registration date: 11/07/2017.
- Joel Telles, Walther Palomino, Urpi Brioso, Christian Vargas, Giorgio Morales, Ivan Ortega, Adison Pacheco, Samuel Huamán (2017), "Software de Identificación de Tres Patrones de Deforestación SI3PD". Registered at the National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI), Lima, Peru. Reg. Number: 01758-2017. File number: 003031-2017. Registration date: 13/11/2017.

PROFESSIONAL ACTIVITIES AND SERVICE

Professional Society Memberships

- Institute for Electrical and Electronics Engineers (IEEE), Member:
  - Computational Intelligence Society.
  - Young Professionals
- Int. Neural Network Society (INNS), Member

Journal Reviewer

- Journal of Photogrammetry and Remote Sensing (ISPRS).
- Journal of Applied Remote Sensing (SPIE).
- Journal of Electronic Imaging (SPIE).
- Drones (MDPI).
- Machine Learning and Knowledge Extraction (MDPI).

Program Committees

- 15th Int. Conference on Artificial Intelligence Applications and Innovations (AIAI 2019).
- 27th Int. Conference on Artificial Neural Networks (ICANN 18).

Conference Reviewer

- European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD): 2024 (PhD Forum).
- IEEE Int. Joint Conference on Neural Networks (IJCNN): 2022, 2023, 2024.
- IEEE Conference on Artificial Intelligence (ICAI): 2024.

- World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI): 2022.
- IEEE Int. Conference on Electronics, Electrical Engineering, and Computing (INTERCON): 2020.

Conference Session Chair

- IEEE Int. Joint Conference on Neural Networks (IJCNN): 2021, 2023.
- IEEE Int. Conference on Electronics, Electrical Engineering, and Computing (INTERCON): 2019.

Other Committees

- Faculty Search Committee (Student Representative), Gianforte School of Computing, Montana State University, 2021.

INVITED TALKS

- Giorgio Morales, "AI for Precision Agriculture", AI in Research and Education Symposium, Montana INBRE Data Science Core and Montana Technological University, October 2024.
- Giorgio Morales, "Counterfactual Explanations of Nitrogen Response Curves", International Conference for On-Farm Experimentation (ICOFPE), Research Reports: ML and AI, Texas, January 2024.
- Giorgio Morales, "Prediction Software using OFPE and Machine Learning", International Conference for On-Farm Experimentation (ICOFPE), Data Intensive Farm Management Cyber-Infrastructure, Texas, January 2024.
- Giorgio Morales, "First Paper Essentials: How to Write Your First Paper", Invited Seminar, Student Chapter IEEE Signal Processing Society, National University of Engineering, Lima, Peru, July 2022.
- Giorgio Morales, "Participation in Research Projects and General Admission Process to US Universities", Invited Seminar, Student Chapter IEEE Signal Processing Society, National University of Engineering, Lima, Peru, July 2021.
- Giorgio Morales, "Hyperspectral Image Classification with Low Cost 3D-2D Convolutional Neural Networks", Seminar for Gianforte School of Computing, Montana State University, Bozeman, Montana, February 2020.
- Giorgio Morales, "Use of Drones for Research", *"Eduardo Hábich" Conference Cycle*, National University of Engineering, Lima, Peru, June 2018.
- Giorgio Morales, Alejandro Ramírez, Daniel Arteaga, Itamar Salazar, and Pavel Mendoza, "Smart Cities: Tourist Challenge", *World Day of Telecommunications and Information Society*, INICTEL-UNI, Lima, Peru, May 2016.
- Giorgio Morales, "Drones and their Application in Agriculture", *First Meeting of Innovation and Technological Entrepreneurship in Engineering and Architecture*, Peruvian University "Unión", Lima, Peru, October 2015.

Awards and Recognitions

Seismic Monitoring and Analysis Challenge (SMAC) (2024)	Awarded the first prize in this discovery challenge 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 to conduct oral presentations at professional conferences.
IEEE CIS Travel Grant (2023)	Travel grant for a student presenting at the IJCNN 2023.
Chunzi "Chris" Zhang (2023)	Award for Int. 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.

CERTIFICATIONS

Machine Learning Engineering for Production (MLOps) Specialization — *January 2023*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/specialization/6ZRMRMYJALBB.

Deploying Machine Learning Models in Production — *January 2023*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/S3PQ5G7K436L.

Machine Learning Modeling Pipelines in Production — *January 2023*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/92HQPG98T9D5.

Machine Learning Data Lifecycle in Production *January 2023*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/8KWAFHQSD8SZ.

Machine Learning in Production *January 2023*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/7V34NWM239TG.

"RENACYT" Researcher - Group "María Rostworowski", Level III *September 2020*
- Organization: Concytec Perú.
- Credential ID: P0048308.

IRB Data or Specimens Acquired from Human Subjects *July 2020*
- Organization: CITI: Collaborative Institutional Training Initiative.
- Credential ID: 37511482.

Deep Learning Specialization *December 2018*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/specialization/JGTWUVQVTBJM.

Sequence Models *December 2018*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/J3WDNYEKEUW7.

Convolutional Neural Networks *December 2017*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/JW66CK3KXBMQ.

Structuring Machine Learning Projects *October 2017*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/8QGT9ZNBRQY2.

Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization *September 2017*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/2894FSX8SQAW.

Neural Networks and Deep Learning *September 2017*
- Organization: DeepLearning.AI.
- Credential ID: coursera.org/verify/VHQ4RSZVLC4E.

Object Detection *November 2016*
- Organization: Universitat Autònoma de Barcelona.
- Credential ID: coursera.org/verify/BC2UP2WAFTAB.

Machine Learning *July 2016*
- Organization: Standford University.
- Credential ID: coursera.org/verify/DBS7CC7AWA7Z.

LANGUAGE AND SKILLS

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

REFERENCES

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