MAYRA BORNACELLY CASTANEDA

PhD Researcher in AI Reliability and Fairness | University of Central Florida
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RESEARCH PROFILE

PhD researcher studying reliability and fairness in neural decision systems under distribution shift. Research focuses on gradient-based diagnostics, learned representations, and decision-boundary geometry to characterize model vulnerability and subgroup error patterns. Connects machine learning with Industrial Engineering and Human Factors through risk-aware human-AI decision support.

EDUCATION

Ph.D. in Industrial Engineering, University of Central Florida, USA
Expected 2029 | UCF cumulative GPA: **4.00/4.00**

M.Sc. in Data Science, University of Melbourne, Australia, 2024

Graduate Diploma in Economics, Pontificia Universidad Javeriana, Colombia, 2018

M.S. in Engineering Management (Research-Based), Universidad de La Sabana, Colombia, 2016

B.S. in Computer Science, Universidad San Martín, Colombia, 2010

SELECTED RESEARCH CONTRIBUTIONS

SciMargin: Developed class-conditioned boundary-exposure diagnostics evaluated on Adult, COMPAS, and German Credit. Under controlled COMPAS reweighting shifts, adding SciMargin to a mean signed-margin baseline increased mean explanatory R^2 for false-positive disparity from 0.678 to 0.834 across seeds.

Basal Stability (γ): Co-developed a supervised gradient-based diagnostic of post-convergence optimization pressure with model parameters held fixed. Observed elevated stress under controlled distribution shifts despite low predictive uncertainty.

FairTube: Developed a geometric and finite-sample framework to test whether a specified shared representation perturbation can jointly explain group-specific error patterns. Working manuscript; accepted for presentation at the 2026 INFORMS Workshop on Data Science.

Research tools: PyTorch; NVIDIA GPU experimentation; automatic differentiation; gradient and representation diagnostics; subgroup error analysis under distribution shift.

SELECTED HONORS, AWARDS, AND RECOGNITION

First Place, AI-ML Competition, IEOM North America Conference, Milwaukee, June 2026.

Second Place, Poster Competition, IEOM North America Conference, Orlando, June 2025.

COLFUTURO Scholarship-Loan Program, awarded for graduate study abroad.

Honors Degrees, Universidad San Martín and Pontificia Universidad Javeriana.

Future Faculty Laureates Program, selected participant, UCF, 2026 cohort.

Tau Beta Pi, member, Florida Delta Chapter, UCF.

Additional recognition: UCF graduate tuition waiver associated with a Graduate Teaching Assistantship; Cerrejón / Glencore Operational Excellence Awards (2021, 2022), Change Empower Award (2019), and Profitability Awards (2014, 2016).

SELECTED PUBLICATIONS AND CONFERENCE CONTRIBUTIONS

Published

Bornacelly, M. (2026). BayesIntuit: A Neural Framework for Intuition-Based Reasoning. In H. Florez, L. Rabelo, & C. Diaz (Eds.), Industrial Engineering and Operations Management, IEOM-CS 2025. Communications in Computer and Information Science, vol. 2557, pp. 117-132. Springer. doi.org/10.1007/978-3-031-98235-4_9

Bornacelly, M. (2026). Preserving Behavioral Coherence in Reliability-Aware Neural Decision Systems. Proceedings of the 11th North American International Conference on Industrial Engineering and Operations Management, Milwaukee, USA. IEOM Society International. doi.org/10.46254/NA11.20260043

Prada, A., Ortiz Castillo, D., Rabelo, L., Rincon-Guio, C., Zamora Aguas, J. P., Orozco Morales, N., **Bornacelly Castaneda, M.**, & Gutierrez, E. (2026). **Building Validated Causal Loops: A New Methodology Bridging Ishikawa Diagrams and Temporal Causality Analysis.** Proceedings of the 2026 International System Dynamics Conference, Delft, Netherlands. proceedings.systemdynamics.org/2026/index.html

Bornacelly, M., Gutiérrez, E., & Pastrana, J. (2017). **Predictive Analytics for Thermal Coal Prices Using Neural Networks and Regression Trees.** Advances in Research and Applications. Nova Science Publishers.

Bornacelly, M., Gutiérrez, E., & Pastrana, J. (2016). **Analysis Model of Thermal Coal Price Using Machine Learning and Delphi.** Proceedings of the Industrial and Systems Engineering Research Conference, Anaheim, USA.

Accepted and In Press

Bornacelly Castaneda, M. (in press). SciMargin: Diagnosing Fairness Degradation via Error-Aligned Boundary Exposure. Proceedings of the 9th International Conference on Applied Informatics (ICAI 2026). Springer Communications in Computer and Information Science.

Bornacelly Castaneda, M., & Guevara Rabanal, D. A. (in press). **Basal Stability in Learning Systems: A Gradient-Based Diagnostic for Reliability Under Distribution Shift.** Proceedings of ANNSIM 2026. Society for Modeling and Simulation International, in cooperation with IEEE and ACM.

Bornacelly Castaneda, M., & Guevara Rabanal, D. A. (in press). **Bayesian Reliability Under Domain Shift for Fairness-Sensitive Learning.** Proceedings of the IISE Annual Conference & Expo 2026. Institute of Industrial and Systems Engineers.

Conference Presentations and Extended Abstracts

Bornacelly Castaneda, M. (2026). FairTube: Error-Channel Fragility in Representation Space under Shift. 10th INFORMS Workshop on Data Science, San Francisco, USA, October 31, 2026. **Accepted for presentation.**

Bornacelly Castaneda, M. (2026). Toward Structural Reliability in Learning-Enabled Systems: A Geometric Perspective on Fairness Under Distribution Shift. ANNSIM 2026 PhD Colloquium, Society for Modeling and Simulation International. **Accepted extended abstract.**

ACADEMIC AND PROFESSIONAL EXPERIENCE

University of Central Florida - Instructor of Record / Graduate Teaching Associate, May 2026-Present. Teach STA 3032, Probability and Statistics for Engineers; develop assessments, instructional materials, and applied course projects.

University of Central Florida - Graduate Teaching Assistant, August 2025-May 2026.

Glencore / Cerrejón Coal - Applications and Data Analyst, February 2020-March 2022; IT Operations Analyst, March 2011-February 2020.

PEER REVIEW AND PROGRAM COMMITTEES

ACM FAccT 2027 - Reviewer; service ongoing.

NeurIPS 2026 - Ethics Reviewer.

SN Computer Science (Springer Nature) - Reviewer, 2026; two manuscript reviews; additional manuscript review, November 2026 (ongoing).

10th INFORMS Workshop on Data Science - Program Committee Member, 2026.

AIAS+ 2026, Chen Institute Symposium for AI Advancing Science & Society - Program Committee Member and Reviewer.

LogForum - Ad Hoc Reviewer, August 2026.

Modelling and Simulation in Engineering; Journal of Engineering - Reviewer, February and April 2026.

IEOM Conferences - Reviewer: 7th Latin American Conference, August 2026; 11th North American Conference, June 2026; 5th Indian Conference, October 2025.

INVITED TALKS AND PANELS

Invited Panelist, AI Panel, 3rd IEOM World Congress, Irvine, USA, October 2026. Theme: Advanced Manufacturing and Industrial AI Innovation.

Invited Panelist, AI-Powered Engineering: Redefining Problem Solving in the Digital Era, IEOM North America Conference, Milwaukee, USA, June 2026.

Invited Keynote Speaker, Unlocking Research Impact: From Idea to Publication, Southern Arkansas University, October 2025.

Guest Speaker, Data Science in Engineering, Universidad de La Sabana, Colombia, August 2022.

ACADEMIC AND COMMUNITY ENGAGEMENT

Mentor, INFORMS Mentor Match Program, November 2026-Present.
Mentoring focus: machine learning, undergraduate research, and preparation for summer opportunities.

Graduate Advisor, IEOM Student Chapter at UCF, August 2026-Present. Support chapter expansion through student recruitment, faculty coordination, and academic and professional activities.

Disciplinary Committee Member, University of Melbourne, 2022-2024. Formal adjudication panel member.

Featured Student Representative, Master of Data Science Program, University of Melbourne, 2025.

Science Mentor, In2science Program, University of Melbourne, March-April 2023.

RESEARCH METHODS AND PROFESSIONAL DEVELOPMENT

Research methods and tools: PyTorch; neural model experimentation; automatic differentiation and gradient-based diagnostics; representation and decision-boundary analysis; subgroup error analysis under distribution shift.

Professional development: Certified Peer Reviewer Course, Elsevier Researcher Academy, June 2026; Preparing Tomorrow's Faculty Program, UCF, 2026; Six Sigma Yellow Belt, Glencore / Cerrejón Coal.