Eric J. Pabón Cancel

Curriculum Vitae

Contact Information

Mathematical Sciences Building, Office 609
Department of Mathematics, Purdue University
epabonca@purdue.edu
ejpaboncancel.github.io

Education & Academic Background

Doctor of Philosophy in Mathematics Expected June 2029
Purdue University, West Lafayette, Indiana

Master of Science in Mathematics Expected December 2025
Purdue University, West Lafayette, Indiana

Bachelor of Science in Pure Mathematics (*Magna Cum Laude*) June 2023
Curricular Sequence in Applied Mathematics for Science and Engineering
University of Puerto Rico, Mayagüez Campus (UPRM), Mayagüez, Puerto Rico

Skills and Other Information
Programming & Computation: Python, Julia, C++, SageMath, MATLAB | Formatting & Tools: HTML, LaTeX, Git
Math & AI/ML: NumPy, SciPy, PyTorch, Tensorflow, JAX, Flux, CUDA | Spoken Languages: English and Spanish

Research Experience

Research Intern in Dynamical Systems and Machine Learning May 2025–August 2025
URA-Sandia Graduate Student Summer Fellowship & Oak Ridge Institute of Science and Education
Computational & Information Sciences Foundation, Sandia National Laboratories, California Campus
Supervised by: Dr. Moe Khalil, Sandia National Laboratories
Data-Driven Closure Models

- Studied machine learning-based surrogate models, and learned and applied data assimilation for closure models.
- Conducted a parametric study of the optimization step for noisy samples of an SIQR epidemic model.
- Analyzed results with statistical techniques to understand the optimization value distribution of 100 samples of data.

Research Intern in Machine Learning May 2023–August 2023
MIT Lincoln Laboratory Summer Research Program (GEM Fellowship Employer Sponsor)
Group 39, Division 3, MIT Lincoln Laboratory, Massachusetts Institute of Technology
Supervised by: Dr. Sam Polk & Dr. Mabel Ramírez, MIT Lincoln Laboratory
Unsupervised Behavior Inference from Human Action Sequences (UNBIAS)

- Developed mathematical algorithms for autoencoders with LSTM architecture.
- Identified the autoencoder that minimized the loss function.
- Optimized silhouette score and utilized K-medoids, PCA and other clustering techniques for encoded space analysis.

Research Assistant in Number Theory August 2019–December 2022
Puerto Rico Louis Stokes Alliance for Minority Participation
Department of Mathematical Sciences, University of Puerto Rico, Mayagüez Campus
Supervised by: Prof. Reyes M. Ortiz Albino, University of Puerto Rico at Mayagüez
Properties of $\tau_{(n)}$-primes

- Research based on the theory of generalized factorizations in integral domains.
- Generalized the notion of complete residue systems for $\tau_{(2)}$-primes, $\tau_{(3)}$-primes and $\tau_{(6)}$-primes.
- Extended the Euler totient function to the notion of equivalence classes modulo a $\tau_{(n)}$-prime.

Research Assistant in Combinatorics June 2022–August 2022
Summer@ICERM 2022: Computational Combinatorics
Institute for Computational and Experimental Research in Mathematics, Brown University
Supervised by: Prof. Pamela E. Harris, University of Wisconsin-Milwaukee
Permutation Invariant Parking Assortments

- Combinatorics research focused on the study of generalizations of parking functions. Characterized car length sequence minimal invariance (case when the all-ones sequence is the only permutation invariant parking assortment).
- Characterized the form of the family of 2-tuple and 3-tuple parking assortments.

Research Assistant in Algebraic Coding Theory June 2021–August 2021
NSF REU in Combinatorics, Probability and Algebraic Coding Theory

East Tennessee State University & University of Puerto Rico at Ponce
Supervised by: Prof. Fernando Piñero González, University of Puerto Rico at Ponce
Improving the Dimension Bound of Hermitian-Lifted Codes

- Algebraic Geometry research focused on the study of Hermitian-Lifted Codes.
- Developed a formula that improved the counting of good recoverable functions.
- Improved the bound rate of the code from 0.007 to 0.1.

Improving the Minimum Distance Bound of Trace Goppa Codes

- Finite Fields research focused on the development of Goppa codes.
- Worked with Goppa matrices by using quadratic extensions and cubic extensions over finite fields.
- Improved the minimum distance bound of norm and trace Goppa polynomials.

Projects

Projects in Optimal Transport and Neural Networks January 2025–May 2025
Purdue University, West Lafayette
MA59500MM: Computational Optimal Transport and Deep Generative Models
Instructor: Prof. Rongjie Lai, Purdue University
Normalizing Flows Optimal Transport implementation on MNIST Dataset

- Developed a normalizing flow neural network that learned the optimal transport path of a Gaussian distributed MNIST image to the target MNIST number distribution.
- Generated recognizable digit images after training.

WGAN and Monge Map implementation on MNIST Dataset

- Constructed a Wasserstein Generative Adversarial Network with Gradient Penalty (WGAN-GP) and Monge Map Network and applied it to the MNIST dataset.
- Successfully generated realistic looking sample numbers at the end of training.
- Compared results between real images and generated images.

Project in Neural Networks and Dynamical Systems November 2024–December 2024
Purdue University, West Lafayette
MA59500MM: Introduction to Mathematical Modeling
Instructor: Prof. Alexandria Volkening. Purdue University
Physics-Informed Neural Networks (PINNs) for Hurricane Trajectory Prediction

- Exploration of PINNs research through data sets that model hurricane trajectories.
- Learned about the construction of loss functions with non-linear operators that model the physics behind the problem.

Project in Mathematical Optimization applied to Biotechnology June 2023–July 2023
MIT Lincoln Laboratory Summer Research Program
2023 MIT Lincoln Laboratory Intern Innovative Idea Challenge (I^3C)
Supervised by: Ryan Burrow and Ashok Kumar, MIT Lincoln Laboratory
SKINS: Skin-growth boosting and Intra-absorptive Solution bandages

- Ranked Top 3 out of a total of 28 submitted proposals in the competition.
- Proposed a hydrogel bandage with accelerated wound healing and anti-scarring properties.
- Estimated the materials cost, approximate bandage size, and compared performance of materials with standard antibiotics.

Awards and Merits

Fellowships, Scholarships and Prizes

2025 Universities Research Association-Sandia National Labs Graduate Summer Fellowship May 2025–August 2025
2023 National GEM Consortium PhD Science Fellowship August 2023–May 2024

- Purdue University Department of Mathematics Sponsorship August 2023–May 2024
- MIT Lincoln Laboratory Employer Sponsorship (Internship) May 2023–August 2023

2023 MIT Lincoln Laboratory I^3C 3^{rd} Place Research Proposal Prize July 2023
2022 Evertec Inc. STEM Scholarship October 2022
Puerto Rico-Louis Stokes Alliance for Minority Participation Research Scholarship August 2019–December 2022

Merits and Honors

2023 Ford Foundation Predoctoral Fellowship Honorable Mention March 2023
2022 Hispanic Scholarship Fund Scholar June 2022

National Math Alliance Predoctoral Scholar — November 2021
UPRM Faculty of Arts and Sciences Honor Roll — August 2018–May 2023
National Trig-Star Math Competition, 16th Overall Finalist — June 2017
Eagle Scout Rank, with 2 Silver Palms — May 2017

Papers and Articles

[1] S. Polk, E.J. Pabon-Cancel, R. Paleja, K. Chestnut-Chang, R. Jensen and M. Ramirez.
Unsupervised Behavior Inference from Human Action Sequences (UNBIAS). *2024 IEEE Conference on Games (CoG), Milan, Italy, 2024, pp. 1-8*.

[2] A. Allen, E.J. Pabon-Cancel, F. Piñero-Gonzalez and L. Polanco.
Improving the Dimension Bound of Hermitian-Lifted Codes. arXiv: https://arxiv.org/abs/2302.01557

[3] D. Chen, P.E. Harris, J. Carlos Martinez Mori, E.J. Pabon-Cancel and G. Sargent.
Permutation Invariant Parking Assortments. *Enumerative Combinatorics and Applications*, **4:1**, 1-25 (2024). #S2R4.

[4] P.E. Harris, Z. Markman, L. Martinez, A. Mock, E.J. Pabón-Cancel, A. Verga, and S. Wang.
A Model for a One-Hour Workshop on Mentoring. *MAA Focus*, **43**(1), 18-21 (2023).

[5] I. Byrne, N. Dodson, R. Lynch, E.J. Pabon-Cancel and F. Piñero-Gonzalez.
Improving the minimum distance bound of Trace Goppa codes. *Designs, Codes and Cryptography*. **91**, 2649–2663 (2023).

Teaching and Grading Experience

- MA 26100 REC: Multivariate Calculus Recitation (Teaching) — August 2025–December 2025, January 2025–May 2025, August 2024–December 2024
- MA 13900: Mathematics for Elementary Teachers III (Grading) — June 2024–August 2024

Poster Sessions, Presentations and Conferences

- URA-Sandia Graduate Summer Fellowship Lightning Talk *(Virtual)* — 6 August 2025
  Presentation: Data-Driven Closure Models (DDCMs)
- Sandia National Laboratories CA SIP Intern Symposium — 5 August 2025
  Auditorium, Sandia National Laboratories-Livermore — Livermore, California
  Poster: Data-Driven Closure Models (DDCMs)
- Combinatorics and Coding Theory in the Tropics (UPR-Ponce) — 18 July 2025
  Invited REU Seminar: My Story & Permutation-Invariant Parking Assortments — Virtual Seminar
- Purdue University Student Commutative Algebra Seminar — 18 November 2024
  Helen B. Schleman Hall, Purdue University — West Lafayette, Indiana
  Presentation: Results in $\tau_{(n)}$-factorizations and $\tau_{(n)}$-primes.
- Purdue University Student Math History Seminar — 9 September 2024
  Lawson Computer Science Building, Purdue University — West Lafayette, Indiana
  Presentation: Testimonios: Stories of Latinos and Hispanics in Mathematics
- Underrepresented Students in Topology and Algebra Research Symposium 2024 — 20-21 April 2024
  University of Iowa — Iowa City, Iowa
- 2023 MIT Lincoln Lab Intern Innovative Idea Challenge — 14, 21 July 2023
  MIT Lincoln Laboratory Auditorium — Lexington, Massachusetts
  Poster: Skin-Absorptive and Skin-Growth Boosting Bandages
  Presentation: SKINS: Skin-growth boosting and Intra-absorptive Solution Bandages
- Combinatorics and Coding Theory in the Tropics (UPR-Ponce) — 7 July 2023
  Invited REU Seminar Talk: Graduate School: Application tips and advice — Virtual Seminar

- 2023 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting — 29 April 2023
  University of Puerto Rico at Bayamón, Sponsored by PR-LSAMP — Bayamón, Puerto Rico
  Presentation: Properties of $\tau_{(n)}$-primes
- 38th Interuniversity Mathematical Sciences Research Seminar — 24-25 February 2023
  University of Puerto Rico, Mayagüez Campus — Mayagüez, Puerto Rico
  Presentation: Permutation Invariant Parking Assortments
- 2023 AAAS Emerging Researchers National Conference in STEM — 9-11 February 2023
  Omni Shoreham Hotel — Washington, District of Columbia
  Poster: Permutation Invariant Parking Functions with cars of assorted lengths
- Joint Mathematics Meetings 2023 — 4-7 January 2023
  John B. Hynes Veterans Memorial Convention Center — Boston, Massachusetts
  Poster: Permutation Invariant Parking Functions with cars of assorted lengths
  Presentation: Permutation Invariant Parking Functions with Cars of Arbitrary Lengths
- Field of Dreams Conference 2022 — 4-6 November 2022
  The Graduate Hotel, University of Minnesota-Twin Cities — Minneapolis, Minnesota
- 2022 SACNAS National Diversity in STEM Conference — 27-29 October 2022
  Pedro Roselló Convention Center — San Juan, Puerto Rico
  Poster: The Study of $\tau_{(n)}$-primes
- 2022 Gulf Coast Undergraduate Research Symposium — 8-9 October 2022
  William Marsh Rice University — Houston, Texas
  Presentation: Properties of $\tau_{(n)}$-primes
- Summer@ICERM 2022: Computational Combinatorics — 3 August 2023
  Institute for Computational and Experimental Research in Mathematics — Providence, Rhode Island
  Presentation: On Permutation-Invariant Parking Sequences
- 2022 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting — 9 April 2022
  University of Puerto Rico at Humacao, Sponsored by PR-LSAMP — Humacao, Puerto Rico
  Presentation: The Study of $\tau_{(n)}$-primes
- Joint Mathematics Meetings 2022 (*Virtual*) — 6-9 April 2022
  Poster: Improving Bounds of Hermitian-Lifted Codes
- 37th Interuniversity Mathematical Sciences Research Seminar (*Virtual*) — 25-26 February 2022
  Poster: The Study of $\tau_{(n)}$-primes
  Presentation: Improving Bounds of Hermitian-Lifted Codes
- 2021 Math REU Conference@Clemson University (*Virtual*) — 19 July 2021
  Presentation: Improved Hermitian-Lifted Codes
- 2021 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting (*Virtual*) — 23-24 April 2021
  Sponsored by PR-LSAMP
  Presentation: The Study of $\tau_{(n)}$-atoms
- 35th Interuniversity Mathematical Sciences Research Seminar — 6-7 March 2020
  University of Puerto Rico at Cayey — Cayey, Puerto Rico
  Poster: The Study of $\tau_{(n)}$-atoms

Graduate Coursework

Purdue University

MA 55400: Linear Algebra — August 2025–December 2025
MA 51900: Introduction to Probability — August 2025–December 2025
MA 57300: Numerical Solutions of Ordinary Differential Equations — August 2025–December 2025
MA 59500OT: Computational Optimal Transport and Deep Generative Models — January 2025–May 2025

MA 59800: Topics in Dynamical Systems: Bifurcation Theory — January 2025–May 2025
MA 54600: Introduction to Functional Analysis — January 2025–May 2025
MA 59500AFF: Analytic Theory of Function Fields — August 2024–December 2024
MA 59500MM: Introduction to Mathematical Modeling — August 2024–December 2024
MA 54300: Introduction to Ordinary Differential Equations and Dynamical Systems — January 2024–May 2024
MA 54400: Real Analysis and Measure Theory — January 2024–May 2024
MA 55300: Introduction to Abstract Algebra — August 2023–December 2023
MA 53000: Functions of a Complex Variable I — August 2023–December 2023

University of Puerto Rico, Mayagüez Campus
MATE 6101: Number Theory I — August 2022–December 2022
MATE 5150: Linear Algebra — January 2021–May 2021

Student Associations

PythagoRUM — **Mayagüez, PR**
Co-founder & Vice-President — August 2022–December 2022

- Served as co-founder and Vice-President for the mathematics and computer science student association. This association has the purpose to promote research in mathematics, as well as related fields of STEM, through professional development workshops and research colloquia.
- Coordinated professional development workshops and semester activities.

Society of Physics Students, UPRM Chapter — **Mayagüez, PR**
Committee Assistant — August 2018–December 2022

- Served as a Demonstration Committee assistant in 2 physics phenomena presentations. The presentations were for an audience of 20+ elementary school students to motivate them to study science. Served as a Sales Committee assistant in chapter food sales events.