Carlos Enrique Nosa Guzman

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Summary

Mathematician and current Master's student in Applied Mathematics at the National University of Colombia, with a solid academic background and a strong interest in applying mathematical and computational methods to real-world problems. Experienced in mathematical modeling, statistical analysis, and scientific programming, developed through academic training, research projects, and teaching roles in undergraduate mathematics. Highly adaptable, committed to continuous learning and skilled at working in multidisciplinary teams, contributing analytical thinking, precision, and a rigorous approach to problem-solving.

Skills

Programming: Microsoft Office, Latex, Jupyter Notebooks, Python, Julia, R, Excel.

Languages: Spanish (Native), English (Intermediate), French (Beginner).

Soft skills: Time management, effective communication, teamwork and collaboration, adaptability, problem-solving, analytical thinking.

Education

MSc **National University of Colombia**, Master's in Applied Mathematics — Bogota, Colombia, Aug 2025 – Present

- Currently enrolled in the Master's program in Applied Mathematics with a research focus on probability and mathematical modeling using dynamical systems and statistics. Coursework includes topics in stochastic processes, advanced statistical inference and optimization, nonlinear dynamical systems, and advanced numerical analysis.

BS **National University of Colombia**, Mathematics — Bogota, Colombia, Mar 2020 – May 2025

- Grade: 4.7/5.0
- **Relevant coursework:**
  - **Mathematical Modelling I** (192 hours) – Introduction to mathematical modeling techniques for real-world systems, including the formulation, analysis, and simulation of models using probability, statistics, network and differential equations, with applications to population dynamics, epidemiology, and physical systems.
  - **Numerical Analysis II** (192 hours) – Theory and numerical methods for solving PDEs, including the heat equation, wave equation, and Laplace's equation, with an emphasis on analytical solutions and discretization techniques.
  - **Probability** (192 hours) – Theoretical foundations of probability theory, random variables, distributions, expectation, law of large numbers, central limit theorem, and introduction to stochastic processes.
- Conducted research on the Metropolis-Hastings algorithm for Bayesian inference in inverse problems, focusing on calibrating a model based on dynamical systems with simulated and real data.
- Participated in a research group focused on programming and numerical methods, working on optimization problems and the numerical approximation of partial differential equations using tools like Python and Julia.

Professional experience

Colombian geological service, Hydrocarbons department, Researcher — Bogota, Colombia, Nov 2025 – Now

- Creation, execution, and implementation of segmentation and classification models for microscopic images using classic machine learning and deep learning tools in Python geared toward computer vision.

National University of Colombia, LAB101, Researcher — Bogota, Colombia, Sep 2025 – Oct 2025

- Provided guidance on data analysis, database construction, and information management, ensuring the quality of statistical and computational data processing.
- Statistical models and data architectures are established to solve research problems and propose new approaches.

National University of Colombia, Research and Extension Institute, Advisor in typing and transcription of documents — Bogota, Colombia, Oct 2024 – Mar 2025

- Guided the formatting and structuring of academic and technical documents using LaTeX, ensuring professional quality and compliance with formal standards.

National University of Colombia, Faculty of Sciences, Specialist in Mathematical Modeling and Data Analysis — Bogota, Colombia, May 2024 – Oct 2024

- Developed AI models based on graphs to analyze climate change data in the Mojana region, using Python, cloud services, and data mining and data analysis techniques. Contributed to the design and implementation of a framework for integrating information from multiple models, supporting both conceptual and technical aspects. Assisted with literature review, data analysis, and preparation of technical documentation for the project.

National University of Colombia, Academic Direction, Mathematics tutor — Bogota, Colombia, Aug 2022 – Mar 2025

- Provided personalized tutoring in basic mathematics and received training in teaching strategies. Supported introductory math courses through classroom assistance, academic guidance, and collaborative work with instructors.

Publications

Spherical latent space models for social network analysis — Preprint — Bogota, Colombia, Aug 2025

- Authors: Phd Juan Camilo Sosa, BS. *Carlos Nosa*.
- This article introduces a spherical latent space model for social network analysis, embedding actors on a hypersphere rather than in Euclidean space as in standard latent space models. The spherical geometry facilitates the representation of transitive relationships and community structure, naturally captures cyclical patterns, and ensures bounded distances, thereby mitigating degeneracy issues common in traditional approaches. Bayesian inference is performed via Markov chain Monte Carlo methods to estimate both latent positions and other model parameters. The approach is demonstrated using two benchmark social network datasets, yielding improved model fit and interpretability relative to conventional latent space models.

Academic projects

Scientific calculus seminar — Active participant — Bogota, Colombia, Feb 2024 – Present

- Participated in a research group focused on optimization and numerical methods for PDEs, particularly elliptic equations, with applications in physics and engineering. Developed projects on topology optimization using continuum physics, image processing, and computer vision, as well as the study of leaf venation patterns through ordinary differential equation models on networks representing the ve-

nation structure. Engaged in topics including mathematical modeling, numerical analysis, and programming in Python and Julia.

- Led by Phd Juan Galvis.

The Metropolis-Hastings algorithm — Author

Bogota, Colombia
Oct 2024 – Mar 2025

- Undergraduate thesis — Final grade: 5.0/5.0. Presented at MAPI III 2024. Research on the Metropolis-Hastings MCMC method for Bayesian inference in inverse problems, applied to calibration of the TOMGRO model with simulated and real data. Covered prior selection, convergence diagnostics, and computational implementation in Python and Julia.
- GitHub repository
- Advisor Phd Juan Galvis

TOMGRO model — Collaborator in model understanding and application

Bogota, Colombia
Jan 2024 – Dec 2024

- Implemented and adapted the TOMGRO model to describe phenological development and dry weight accumulation in tomato plants under local environmental conditions.
- Collected data in UNAL greenhouses, processed with Python, and implemented the model in Julia.

Bidiagonal Golub-Kahan algorithm applied to eigenfaces — Author

Bogota, Colombia
Jul 2023 – Dec 2023

- Team-based project studying the Golub-Kahan bidiagonal algorithm for singular value decomposition and its application to eigenfaces in facial recognition.
- Explored theoretical and algorithmic foundations, implemented in Python, and applied PCA for compact facial feature representation.
- Presented at MAPI III 2024, the National Conference on Applied Mathematics.

Additional experience

Deep Learning Spring School 2025 — Active participant

Buenos Aires, Argentina
Oct 2025 - Nov 2025

- Participation in a two-week intensive program at the University of Buenos Aires, focusing on concepts, methods, and new technologies for deep learning applied to large-scale problems.

2024 Gene Golub SIAM Summer School: Iterative and Randomized Methods for Large-Scale Inverse Problems — Active participant

Quito, Ecuador
Jul 2024 – Aug 2024

- Participated in a two-week intensive program in English focused on advanced mathematical and statistical methods for solving large-scale inverse problems.
- Gained hands-on experience in Randomized Numerical Linear Algebra, data assimilation, and iterative algorithms.
- Collaborated with international peers on practical computational exercises, enhancing skills in Python and MATLAB for large-scale data analysis.

CARES Foundation — Volunteer Mathematics Tutor (6 hours/week)

Bogota, Colombia
Mar 2024 – Jul 2024

- Provided weekly tutoring sessions in mathematics for underserved students, covering topics from basic arithmetic to introductory algebra.
- Developed customized learning materials and exercises to strengthen problem-solving skills and conceptual understanding.

Distinctions

Graduate Honor scholarship for academic excellence — National University of Colombia

Bogota, Colombia
May 2025

- Awarded a full scholarship for the Master's program in Applied Mathematics, granted to top-performing students based on outstanding undergraduate academic performance (GPA: 4.7/5.0).