Nicolas Martin Guerra

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Education

PhD, Applied Mathematics Expected: May 2028
Cornell University | Ithaca, NY, USA
Advisor: Professor Yunan Yang

BS/MS, Applied Mathematics with concentration in Industrial Engineering June 2023
BM, Viola Performance
Northwestern University | Evanston, IL, USA
GPA: 3.93/4.00, *Cum Laude*

***Relevant Courses*:** Probability Theory, Mathematical Statistics, Functional Analysis, Linear Algebra, Partial Differential Equations, Statistical Learning for Data Analysis, Optimization Methods in Data Science, Machine Learning, Service Engineering and Management

Research Experience

Graduate Research Assistant December 2023 – Present
Yunan Yang Research Group | Ithaca, NY

- Developing theoretical foundations for Operator Learning, with applications in cancer detection and seismic imaging
- Designing training distributions to improve out-of-distribution model performance for SciML
- Building novel machine learning architectures in PyTorch for inverse problems like Calderón's problem

Research Assistant January 2020 – June 2023
Ulmer Research Group | Evanston, IL

- Employed image filtering and dimension reduction algorithms in Python to detect exoplanets 163 light-years away
- Developed MATLAB programs for quantitative analysis of telescopic mirror roughness
- Managed over 100 GB of space-imaging data ensuring efficient data-accessing measures and organization

Undergraduate Researcher January 2022 – June 2022
Petia M. Vlahovska Research Group | Evanston, IL

- Performed eigenvalue stability analysis on nonlinear ODE systems to characterize chaotic dynamics of Quincke rotors
- Modeled simulations of the above system's behavior using MATLAB to gain a deeper understanding of its dynamics

ISGC Summer Research Program June 2021 – September 2021

- Developed and automated Python programs to detect variable stellar sources and transient phenomena such as supernovae and gamma-ray bursts using image subtraction techniques
- Enhanced the speed and accuracy of original image processing procedures in the research lab by 40%
- Implemented efficient data handling pipelines for large-scale, remote Hubble datasets

ISGC Summer Research Program June 2020 – September 2020

- Theorized methods to model imperfect mirrors using Zernike polynomials
- Developed MATLAB programs to model rays of light hitting imperfect telescopic mirrors using vector calculus

Teaching Experience

Teaching Assistant August 2024 – December 2024

INFO 2950 Intro to Data Science, Cornell University | Ithaca, NY

- Led weekly discussion sessions and office hours to support learning in Python, SQL, and statistical modeling topics
- Designed and graded assessments for 250+ students, aligning evaluation with core data science concepts

Tutor Aide September 2022 – June 2023

America Reads @ McGaw YMCA | Evanston, IL

- Assisted elementary school children in reading, writing, and math to help them excel in school
- Facilitated students in completing and thoroughly understanding their homework assignments

Engineering Analysis IV Grader September 2022 – December 2022

Northwestern University | Evanston, IL

- Evaluated assignments and exams for a foundational differential equations course with over 100 students
- Provided constructive feedback on every assignment and addressed any uncertainties that students had

Instructor June 2019 – August 2019

iD Tech | Miami, FL

- Educated elementary and middle school students on programming fundamentals in Java and Lua
- Tailored my curriculum to align with each student's preferred learning style

Publications and Written Works

Guerra, N., Nelsen, N.H. and Yang, Y., 2025. Learning Where to Learn: Training Distribution Selection for Provable OOD Performance. *arXiv preprint arXiv:2505.21626*.

Ulmer, M.P., Dugard, J.H., Quispe, D., Buchholz, D.B., Stagon, S.P., Chung, Y.W., Cao, J., Kritikos, K., **Guerra, N.**, Stahl, M.T. and Shiri, R., 2022, August. A concept for a deployable normal incidence EUV mirror based on shape memory alloy sheets. In *Space Telescopes and Instrumentation 2022: Ultraviolet to Gamma Ray* (Vol. 12181, pp. 776-784). SPIE.

Ulmer, M.P., Jalilvand, M., Marks, N.A., Buchholz, D.B., Fujishima, B., **Guerra, N.**, Cao, J., Chung, Y.W., Baturalp, T.B., Coverstone, V.L. and Stagon, S.P., 2020, December. The prospects for applying magnetic smart materials combined with shape memory alloys to produce correctable and deployable space telescopes. In *Advances in Optical and Mechanical Technologies for Telescopes and Instrumentation IV* (Vol. 11451, pp. 393-404). SPIE.

Presentations

Oral Presentations

Guerra, N., Nelsen, N.H., Yang, Y. (2025, June) *Learning Where to Learn.* IMSI Statistical and Computational Challenges in Probabilistic Scientific Machine Learning. University of Chicago.
Presented theory for designing optimal training distribution to minimize out-of-distribution error and introduced two algorithms to construct such a distribution.

Guerra, N., Eberlin, S., Ulmer, M.P. (2021, August). *Search for Transient Phenomena.* Annual ISGC Summer Research Presentations. Zoom
Presented methods for detecting transient astronomical events such as supernovae and gamma-ray bursts using image subtraction techniques. Discussed approaches for analyzing light curves to identify candidate events

Guerra, N., Ulmer, M.P. (2020, August). *Power Spectral Density.* Annual ISGC Summer Research Presentations. Zoom.
Described a quantitative method for determining the surface roughness of telescopic mirrors via power spectral density analysis. Demonstrated how mirror roughness correlates with imaging performance and optical aberrations

Poster Presentations

Guerra, N., Nelsen, N.H., Yang, Y. (2025, June) *Learning Where to Learn.* IMSI Statistical and Computational Challenges in Probabilistic Scientific Machine Learning. University of Chicago.
Presented theory for designing optimal training distribution to minimize out-of-distribution error and introduced two algorithms to construct such a distribution.

Honors and Awards

NDSEG Fellowship September 2025 – August 2028
Prestigious three-year fellowship awarded by the U.S. Department of Defense to outstanding PhD students in STEM fields, based solely on academic merit and research potential

Cornell Fellowship August 2023 – May 2024
Awarded to a select incoming PhD students in recognition of exceptional academic performance and research promise during undergraduate studies

Cornell Graduate School Dean's Scholar August 2023
Scholars who have demonstrated a strong commitment to academic excellence and advancing aspects of diversity, access, equity, inclusion, and belonging in the academy and other communities

Co-Winner of Northwestern's Applied Mathematics Outstanding Graduate Award June 2022
Recognition for outstanding achievement given by the advisors of the applied mathematics department

Illinois Space Grant Consortium (ISGC) Scholarship September 2021 – June 2022
Consortium part of NASA's National Space Grant College and Fellowship Program

Summer Undergraduate Research Grant June 2021 – July 2021
Northwestern University

ISGC Scholarship September 2020 – June 2021
Consortium part of NASA's National Space Grant College and Fellowship Program

Skills

Professional

- Expertise in MATLAB, Python (PyTorch, Numpy, Pandas), R/RStudio, SQL
- Knowledgeable in Machine Learning, statistical analysis, high-performance computing, Github, AWS
- Familiarity with Java, C, and Docker

Languages

- Spanish: Native fluency
- Vietnamese: Conversational fluency