Nicolás J. Hernández Banadik

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RESEARCH INTERESTS

Statistical inference and Statistical Machine Learning for high-dimensional and functional data; Variable and Domain selection; Causal Inference with Functional data; Functional Time Series forecasting, uncertainty quantification.
Areas of application: energy, economics, the environment, demography, chemometrics, health and genetics

ACADEMIC BACKGROUND

Ph.D. in Statistics 2019
University Carlos III of Madrid, Spain

- Dissertation title: *"Statistical learning methods for functional data with applications to prediction, classification and outlier detection"* - Cum Laude Honours.
- Advisor: Dr. Alberto Muñoz García.

M.Sc. in Business and Quantitative Methods 2015
University Carlos III of Madrid, Spain.

- Dissertation Topic: "Deep Bootstrap Predictions for Univariate, Multivariate and Functional Time Series".
- Advisor: Prof. Juan Romo Urroz.

B.Sc. in Economics 2011
University ORT

- GPA: 8.8/Top 5%

EMPLOYMENT HISTORY

Lecturer in Statistics 2024 - Present
School of Mathematical Sciences, Queen Mary University of London, London, UK

Senior Research Fellow 2021 - 2024
Department of Statistical Science, UCL, London, UK

- Research project: "Statistical Inference for High-Dimensional and Functional Data", Institute of Mathematical and Statistical Science (IMSS).
- Group Leader: "High-Dimensional and Functional Data" group

Research Associate 2019 - 2021
MRC-BSU, University of Cambridge

- Research associate on Statistical–OMICS
- Post-doc supervisor: Dr. Jennifer Asimit

Teaching & Research Assistant 2013 - 2019
University Carlos III of Madrid, Spain

Senior Research Analyst 2010 - 2013
CPA FERRERE - Economic and financial services consultancy firm.
Projects:

- Risk Mapping Models for different Government Offices: Customs, Social Security, and Tax authorities.

- Fraud detection models for the National Customs Agency of Uruguay
- Social security risk map: estimating the likelihood of under-reported income in the manufacturing sector.
- Tax Risk map: detection of fraudulent companies for the Government Taxation Office.
- Sample design of the net energy consumption survey in the industrial sector for the Ministry of Industry and Energy.
- Impact analysis on financial inclusion of banking policies
- Analysis of the Credit Card Market: regulatory, efficiency and equity aspects.
- Socio–economic impact assessment of a great economic significance iron mining project in Uruguay.
- Estimation of housing demand for low income households for the Housing Program of the National Institute of Social Security.

Research Assistant 2009
CIU (Uruguayan Chamber of Industry).
- RA in the Business Development Department.
- Processing and analysis of surveys and monitoring of companies.

Research Assistant 2008 - 2009
ANII (National Research and Innovation Agency, Uruguay)
- RA in the oversight and evaluation office.
- Evaluation of research and innovation programmes designed and executed by ANII.

LANGUAGES

English – Professionally fluent.

Spanish – Native speaker.

PUBLICATIONS

1. **Hernández, N.**, & Nagy, S. (2025). The Common Support Function with Applications. To appear in the IWFOS 2025 Book of Proceedings. Springer International Publishing.
2. **Hernández, N.**, & Martos, G. (2024). Domain Selection for Gaussian Process Data: An application to electrocardiogram signals. Biometrical Journal, 66(8).
3. **Hernández, N.**, Cugliari, J., & Jacques, J. (2024). Simultaneous predictive bands for functional time series using minimum entropy sets. Communications in Statistics - Simulation and Computation, 1–25.
4. **Hernández, N.**, Muñoz, A. & Martos, G. Density kernel depth for outlier detection in functional data. Int J Data Sci Anal 16, 481–488 (2023).
5. **Hernández, N.**, et al. The flashfm approach for fine-mapping multiple quantitative traits. Nature Communications 12.1 (2021): 1-14.
6. Martos, G., **Hernández, N.**, Muñoz, A. & Moguerza, J. M. (2018). Entropy Measures for Stochastic Processes with Applications in Functional Anomaly Detection. Entropy, 20(1), 33.
7. Muñoz, A., **Hernández, N.**, Moguerza, J. M. & Martos, G. (2018). Combining entropy measures for anomaly detection. Entropy, 20(9), 698.

8. **N. Hernández**, A. Muñoz. (2016). Kernel Depth Measures for Functional Data with Application to Outlier Detection. Lecture Notes in Computer Science, vol 9887, pp 235-242.

RESEARCH PROJECTS

Institute of Mathematical and Statistical Science - *Fellowship* 2021-2024

- "Statistical Inference for High-Dimensional and Functional Data".
- Role: PI

SPECIAL ACHIEVEMENTS

Awards

- *Travel Award to attend the 2024 COMPSTAT* – IASC-ISI, (€700).
- *Early Career Development Travel Grant.* Faculty of Mathematical & Physical Science, UCL, 2022-2023.
- *Doctoral research stay grant (PPI).* Universidad Carlos III de Madrid, 2018. (€4,000)
- *Scholarship for the CRoNoS Summer Course on Functional Data Analysis (Iasi , 2018).* CRoNoS, IASC-ISI, (€500)
- *Scholarship for the CRoNoS Summer Course on Multivariate Data Analysis (Cyprus, 2018).* CRoNoS, IASC-ISI, (€500)
- *Scholarship for Doctoral studies (PIF).* Universidad Carlos III de Madrid, 2015 - 2019. (€24,000 per year).
- *Scholarship for postgraduate studies.* Universidad Carlos III de Madrid, 2013 - 2015. (€18,000 per year).

Invited Talks (selection)

- "A Functional Extreme Value Regression Model". Dept. of Mathematics, University of Manchester, UK. March 2025
- "Simultaneous predictive bands for functional time series using minimum entropy sets". Queen Mary University of London, School of Mathematical Sciences, London, UK. 04/2024.
- "Domain selection for Gaussian Processes". Dept. of Mathematics, University of Southampton, UK. 02/2024
- "Domain selection for Gaussian Processes". Dept. of Mathematics, KCL, UK - 10/2023
- "Domain selection for Gaussian Processes". School of Business and Economics, Humboldt University, Germany - 10/2023
- "Simultaneous predictive bands for functional time series using minimum entropy sets". Torcuato Di Tella (Argentina), Mathematics and Statistics seminar series (Online talk), 12/2022.
- "Domain selection for Gaussian Processes". ERIC Lab, University Lyon 2, France - 05/2021
- "Predictive confidence bands using minimum entropy sets. ERCIM, Pisa, Italy - 12/2018.

Services

- In2Science volunteer for 2024 summer programme.

- Organiser of the weekly seminar of the Department of Statistical Science at UCL, (2023-2024).

- Session chair and Session organiser: 'Inference for Functional Data' at RSS, 2024. London, UK.

- Session chair and Session organiser: 'Causal Inference and Functional Data Analysis' at COMPSTAT, 2023. London, UK.

- Reviewer for AISTAT *(PMLR)*, Bayesian Analysis, JRSC-C, Neurocomputing, Entropy.

TEACHING

@QMUL

- *Biostatistics and Medical Statistics. MSc in Applied Statistics and Data Science. 5 students.* *2025*
- *Time Series Analysis for Business. MSc in Applied Statistics and Data Science & MSc in Business Analytics. 91 students.* *2025*

@UCL

- *Further Probability, and Statistics. BSc in Statistics and Data Science. 21 students.* *2024*
- *Probability, Statistics and Inference. BSc in Maths, Statistics and Data Science. 42 students.* *2022*
- *Time Series. London NERC - DTP. 26 students.* *2023*

@University of Cambridge

- *Lecturer (teaching) of the Cohort Analysis module in MPhil in Population Health Sciences.*
  25 students at master degree level. 2020
- *TA in Applied Statistics and Epidemiology in MPhil in Population Health Sciences.*
  25 students at master degree level. 2020

@University Carlos III of Madrid

- *Lecturer (teaching) in Quantitative Methods in Management.* *2015-2021*
  Rate 3.84/5. It was a 1 week introductory course of Statistics for management in the Master in Business Administration, approx 30 students (depending the year).

- *TA (practicals) in Statistics. Engineering Program for International Students and BSc in Business Studies.* *2015-2019*
  Rate 4.54/5. The course revolved around probability, discrete and continuous RV and probability models. 30 students (depending the year and degree). Undergraduate level.

- *Lecturer in Prediction Techniques and Time Series Analysis. BSc in Statistics; BA International Studies.* *2015-2019*
  Rate 4.86/5. 30 students approx, (depending the year and degree). Undergraduate level.

@University ORT

- *TA in Principle of Economics.* *2009-2013*
  30 students approx, (depending the year and degree). Undergraduate level.
- *TA in Mathematical Economics.* *2009-2013*
  30 students approx, (depending the year and degree). Undergraduate level.

STUDENT SUPERVISION (@UCL)

- *Alexander Luo, 'Two Sample Test for Functional Data'. Phd in Statistics, UCL. Co-supervisor (Jointly with P. Chakravarti).* *2024-*
- *Ryuichi, Kanai, 'Uncertainty Quantification of Multi-scale and Multi-physics Computer Models'. PhD in Statistics, UCL. Co-supervisor (Jointly with Prof. S. Guillas).* *2023*
- *Yoonsun Choi, 'Optimising interval Partial-Least-Squares via History Matching'. MSc in Data Science, UCL - 1st Supervisor.* *2023*
- *Harjot Singh Khera, 'Visualization, Clustering and Prediction of Bitcoin prices: a functional time series approach'. MSc in Data Science, UCL - 1st Supervisor. 2023*
- *Sharon Schmidt-Burkhardt, 'Simulation, Estimation, Prediction methods for functional time series: a benchmark approach'. MSc in Data Science, UCL - 1st Supervisor.* *2022*
- I have also supervised Undergraduate projects.

CONFERENCE CONTRIBUTIONS

1. "Functional History Matching for Tsunami Warnings" *2^{nd} Joint Workshop on Functional Data Analysis and Nonparametric Statistics*, Universidad Autónoma de Madrid, Madrid, Spain, 10-13 September, 2024.
2. "Optimising interval PLS via GP regression" – *26^{th} International Conference on Computational Statistics*. University of Giessen, Germany,27-30 August 2024.
3. "Inference for functional data analysis" *Chair and Session Organiser – 2024 RSS International Conference*. 2-5 September 2024, Brighton, UK.
4. "Optimising interval PLS via History Matching" *2023 IMS International Conference on Statistics and Data Science*, Lisbon, Portugal, 18-21 December 2023.
5. "Causal inference and functional data analysis" *Chair and Session Organiser - 25^{th} International Conference on Computational Statistics*, Birkbeck, University of London, UK, 22-25 August 2023.
6. "Joint feature selection for ECG Signals" *1^{st} Joint Workshop on Functional Data Analysis and Nonparametric Statistics*, Universidad Autónoma de Madrid, Madrid, Spain, 6-9 June, 2023.
7. "Domain Selection for Gaussian Processes" *24^{th} International Conference on Computational Statistics*, University of Bologna, Italy. August, 2022.
8. "A Flexible and Shared Information Fine-mapping Approach with an application to 33 cardiometabolic traits from a Ugandan cohort". (ePoster). *Conference of the European Society of Human Genetics*, August, 2021.
9. "Forecasting Functional Time Series under a Reproducing Kernel Hilbert Space Model". *CM-Statistics – ERCIM*, Pisa, Italy, December, 2018.
10. "Domain selection For functional Data Classification". *CRoNoS Summer Course on Functional Data Analysis (FDA 2018)* , Iasi, Romania, August, 2018.
11. "A novel domain selection to boost classification problems in Functional Data". *1^{st} CRoNoS International Workshop on Multivariate Data Analysis (MDA 2018)* , Limassol, Cyprus, April, 2018.

12. "Domain selection For functional Data Classification". *11^{th} International Conference on Computational and Financial Econometrics (CFE 2017)*, London, UK, 2017.
13. "Kernel Depth Function for Functional Data" (Poster). *Statlearn'17 - 8^{th} Statlearn workshop a conference of the French Society of Statistics (SFdS)*, Lyon, France, April 2017.
14. "Kernel Depth Functions for Functional Data with Application to Outlier Detection". *25^{th} International Conference on Artificial Neural Networks*, Barcelona, Spain, September, 2016.