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.**, Martos, G. (2024). Domain Selection for Gaussian Process Data: An application to electrocardiogram signals. Biometrical Journal, 66(8).
2. **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.
3. **Hernández, N.**, Muñoz, A. Martos, G. Density kernel depth for outlier detection in functional data. Int J Data Sci Anal 16, 481–488 (2023).
4. **Hernández, N.**, et al. The flashfm approach for fine-mapping multiple quantitative traits. Nature Communications 12.1 (2021): 1-14.
5. 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.
6. Muñoz, A., **Hernández, N.**, Moguerza, J. M. & Martos, G. (2018). Combining entropy measures for anomaly detection. Entropy, 20(9), 698.
7. **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.

WORKING PAPERS

1. Common support function with applications (2024). Joint Work with Stanislav Nagy (Charles University)
2. Bayesian optimisation for interval selection in PLS models (2024). Joint work with Choi, Yoonsun. and Prof. Tom Fearn (UCL).
3. A Functional Extreme Value Regression Model (2024). Joint work with Dr. Miguel De Carvalho (University of Edinburgh).
4. Functional History Matching for Tsunami warnings (2024). Joint work with Prof. Serge Guillas and Ryuichi Kanai (UCL).

RESEARCH FUNDING

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

- Research project: "Statistical Inference for High-Dimensional and Functional Data".
- Role: PI
- Amount: £160.000

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. 02/2025
- "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

@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.