Nicolás J. Hernández Banadik

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RESEARCH INTERESTS

Statistical inference and Machine Learning for high-dimensional and functional data; Variable selection; Functional Time Series forecasting, uncertainty quantification, classification and outlier detection. Areas of application: the environment, demography, energy, economics, finance, 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: 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: Juan Romo Urroz.

B.Sc. in Economics 2011
University ORT, Uruguay
- GPA: 8.8/Top 5%

EMPLOYMENT HISTORY

Senior Research Fellow 2021 - Present
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" research 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, Uruguay.
Projects:
- Models for Risk Mapping for different Government Offices: Customs, Social Security, and Tax authorities."
- Sample design for the survey of net energy consumption in the industrial sector for the Ministry of Industry and Energy.

- Impact analysis on financial inclusion of banking policies; and analyisis 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 of the Institute of Social Security Housing Program.

Research Assistant 2009
CIU (Uruguayan Chamber of Industry), Uruguay
- 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), Uruguay
- RA in the oversight and evaluation office.
- Evaluation of research and innovation programmes designed and executed by ANII.

PUBLICATIONS

1. **Hernández, N.**, et al. "Density kernel depth for outlier detection in functional data." Int J Data Sci Anal (2023).
2. **Hernández, N.**, et al. "The flashfm approach for fine-mapping multiple quantitative traits." Nature Communications 12.1 (2021): 1-14.
3. 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.
4. Muñoz, A., **Hernández, N.**, Moguerza, J. M. & Martos, G. (2018). "Combining entropy measures for anomaly detection". Entropy, 20(9), 698.
5. **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. **Hernández, N. & Martos, G.** "Domain selection for Gaussian Processes data: An applicationg to ECG signals" (2023). Under review in the *Biometrical Journal*.
2. **Hernández, N., Cugliari, J. & Jacques, J.** "Simultaneous predictive bands for functional time series using minimum entropy sets" (2022). Under review (2^{nd} round) in the *International Journal of Forecasting*.
3. **Hernández, N. & Fearn T.** "Ordinal Functional Partial Least Regression with applications to Olvie Oil quality data" (2023).
4. **Choi, Y., Hernández, N., & Fearn T.** "Optimising interval PLS via History Matching" (2023).

RESEARCH FUNDING

Research @UCL focusses on machine learning and statistical methods for high-dimensional and functional data problems.

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

- Research project: "Statistical Inference for High-Dimensional and Functional Data".

- Role: PI
- Amount: £160.000

EPSRC mathematical sciences Grant – Under review *2024*

- *Research project: "Cost-effectiveness analysis for multidimensional, continuous interventions using functional data analysis".*
- *Role: Co-I*
- *Amount: £80,123*

UCL Global Engament Funds – Under review *2024*

- *Research project: "Cross-national approach to Understand Homicides: boosting criminological analysis using advanced multivariate and functional data methods".*
- *Role: PI*
- *Amount: £5,000*

UCL Global Engament Funds – Under review *2024*

- *"Advanced Health Economic Evaluation: training and knowledge sharing of new methods and software".*
- *Role: Co-I*
- *Amount: £4,900*

SPECIAL ACHIEVEMENTS

Awards

- Early Career Development Travel Grant. *Faculty of Mathematical & Physical Science, UCL, 2022-2023. £3,600*
- 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)

- *TBC. 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), December 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

- *Reviewer for AISTAT(PMLR), Bayesian Analysis, JRSC-C, Neurocomputing, Entropy.*
- *Session chair and Session organiser: 'Causal Inference and Functional Data Analysis' at COMPSTAT, 2023. London, UK.*
- *Organiser of the seminars for the Department of Statistical Science at UCL, (2023-2024).*

TEACHING

@UCL

- *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 of the Cohort Analysis module in MPhil in Population Health Sciences. 25 students at master degree level.* *2020*

@University Carlos III of Madrid

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

STUDENT SUPERVISION (@UCL)

- *Ryuichi, Kanai, 'Tsunami Modelling Propagation'. PhD in Statistics, 2023, Statistical Science, UCL - 3rd Co-supervisor.*
- *Yoonsun Choi, 'Interval Partial Least Square Regression algorithm'. MSc in Data Science, 2023, Statistical Science, UCL - 1st Supervisor.*

- *Harjot Singh Khera, 'Visualization, Clustering and Prediction of Bitcoin prices: a functional time series approach'. MSc in Data Science, 2023, Statistical Science, UCL - 1st Supervisor.*
- *Sharon Schmidt-Burkhardt, 'Simulation, Estimation, Prediction methods for functional time series: a benchmark approach'. MSc in Data Science, 2022, Statistical Science, UCL - 1st Supervisor.*
- *I have also supervised several Undergraduate projects.*

CONFERENCE CONTRIBUTIONS

1. *"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.*
2. *"Domain Selection for Gaussian Processes"* 24th International Conference on Computational Statistics, *University of Bologna, Italy. August, 2022.*
3. *"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.*
4. *"Forecasting Functional Time Series under a Reproducing Kernel Hilbert Space Model".* CM-Statistics – ERCIM, *Pisa, Italy, December, 2018.*
5. *"Domain selection For functional Data Classification".* CRoNoS Summer Course on Functional Data Analysis (FDA 2018) , *Iasi, Romania, August, 2018.*
6. *"A novel domain selection to boost classification problems in Functional Data".* 1st CRoNoS International Workshop on Multivariate Data Analysis (MDA 2018) , *Limassol, Cyprus, April, 2018.*
7. *"Domain selection For functional Data Classification".* 11th International Conference on Computational and Financial Econometrics (CFE 2017), *London, UK, 2017.*
8. *"Kernel Depth Function for Functional Data" (Poster).* Statlearn'17 - 8th Statlearn workshop a conference of the French Society of Statistics (SFdS), *Lyon, France, April 2017.*
9. *"Kernel Depth Functions for Functional Data with Application to Outlier Detection".* 25th International Conference on Artificial Neural Networks, *Barcelona, Spain, September, 2016.*