Lorena León

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scholar.google.com/citations?hl=en&user=RcUb6hUAAAAJ

Keywords: Statistical signal and image processing, computational imaging, Bayesian methods, multifractal analysis, machine learning, biomedical applications

ACADEMIC POSITIONS

Mar. 2023 - Present **Postdoctoral Researcher**
CREATIS, UNIVERSITÉ CLAUDE BERNARD LYON 1, LYON, FRANCE
Research Topic: *Data Science for Quantitative Acoustic Microscopy*
Supervisor: Adrian Basarab (Professor at UCBL)

2018 - 2019 **Assistant Professor***
UNIVERSIDAD DE LA HABANA, LA HABANA, CUBA
*This is a permanent teaching/research position equivalent to Maître des Conférences in France.

2016 - 2018 **Junior Professor***
UNIVERSIDAD DE LA HABANA, LA HABANA, CUBA
*This is a permanent teaching/research position leading to the qualification of Instructor after 2 years of experience, a position equivalent to Assistant Professor in some academic systems and Maître des Conférences in France.

EDUCATION

2019 - 2022 **PhD in Signal, Image, Acoustics, and Optimization**
INSTITUT NATIONAL POLYTECHNIQUE DE TOULOUSE (INPT), TOULOUSE, FRANCE
Thesis: *Bayesian Estimation of the Parameters of the Joint Multifractal Spectrum of Signals and Images*
Manuscript: https://theses.hal.science/tel-04066275v1/document
Supervisors: Jean-Yves Tourneret (Professor at INPT) and Herwig Wendt (CNRS Researcher)
Defense Date: Dec. 13, 2022
Defense Committee: J. Delon (**president**), Professor at University of Paris Cité; C. Chaux (**reviewer**), CNRS Research Director; A. Ferrari (**reviewer**), Professor at University of Côte d'Azur; J.-Y. Tourneret (**director**), Professor at INPT; H. Wendt (**director**), CNRS Research Scientist; J.-C. Pesquet (examiner), Professor at Paris-Saclay University; C. Melot (examiner), Associate Professor at Aix-Marseille University; M. Pereyra (examiner), Associate Professor at Heriot-Watt University; M. Jonckheere (invited), CNRS Research Director; P. Abry (invited), CNRS Research Director

2016 - 2019 **Master in Mathematics, specialization in Numerical Analysis**
UNIVERSIDAD DE LA HABANA (UH), LA HABANA, CUBA
MSc Thesis: *Classification of Mass Malignancy in Digital Mammography Using Multifractal Analysis*
Supervisor: Angela M. León Mecías (Professor at UH)

2012 - 2016 **Bachelor in Mathematics**
UNIVERSIDAD DE LA HABANA (UH), LA HABANA, CUBA
BSc Thesis: *A Probabilistic Model for Mobile Robot Self-Localization*
Supervisor: Yudivian Almeida Cruz (Professor at UH)

SCHOLARSHIPS AND AWARDS

Jan. - Apr. 2019 **CARMIN-IHP-CIMPA Scholarship**
INSTITUT HENRI POINCARÉ (IHP), PARIS, FRANCE
I was awarded a full scholarship to participate in the Thematic Semester "The Mathematics of Imaging", funded by Labex CARMIN, IHP, and CIMPA. Total funding: 3,200 euros, covering travel expenses from Cuba to France and accommodation in Paris.
Activities: I attended the Winter School *Mathematics for Imaging* (Jan. 7-11, 2019), held at Centre International de Rencontres Mathématiques, Marseille, France. I also attended three workshops at IHP: *Variational Methods and Optimization in Imaging* (Feb. 4-8, 2019), *Statistical Modelling for Shapes and Imaging* (Mar. 11-15, 2019), and *Imaging and Machine Learning* (Apr. 1-5, 2019).
https://www.ihp.fr/en/news-research-activities/t1-2019-mathematics-imaging

INTERNATIONAL ACTIVITIES

Academic Visits

Oct. 24 - Nov. 9, 2024 **Postdoctoral Visit**
WEILL CORNELL MEDICINE, NEW YORK CITY, UNITED STATES
Duration: 2 weeks
Invited by: Jonathan Mamou (Professor at Weill Cornell Medicine)
Activities: I participated in regular meetings of the Biomedical Imaging team and attended several work-related discussions. I took part in acquisition experiments using the quantitative acoustic microscopy instruments. I gave the seminar "Demystifying Multifractal Analysis" in the Radiology Department.

Commitments to the Scientific Community

Dec. 2024 **Member of the EURASIP Academy**
I was selected as a member of the prestigious EURASIP Academy, recognizing early-career researchers in signal processing. Responsibilities include peer-review activities and editorial tasks for EURASIP journals, under the mentorship of Magnus Jansson (KTH Royal Institute of Technology, Sweden). This role supports professional networking, leadership skill development, and contributions to the international signal processing community. https://academy.eurasip.org/

Aug. 2024 **Session Chair on *Biomedical Image Processing* at EUSIPCO 2024**
LYON, FRANCE

Aug. 2024 **Leader of The Volunteer Student Team at EUSIPCO 2024**
LYON, FRANCE
Responsabilities: I contributed to recruiting, planning, and coordinating a team of approximately 40 student volunteers. The volunteers managed participant registration and provided support during oral and poster sessions. The conference hosted 800 participants.

Peer reviewing

- IEEE Open Journal of Signal Processing (1 article)
- EUSIPCO 2023 and 2024 (8 articles)

SCIENTIFIC PRODUCTION

Preprints

1. L. Leon, J. Mamou, D. Kouame and A. Basarab, *"A weighted Hankel approach and Cramér-Rao bound analysis for quantitative acoustic microscopy imaging"* pp. 1-10.

   Submitted on Dec. 2024. | arXiv |

Journal articles

2. L. Leon, H. Wendt and J.-Y. Tourneret, *"Bounds for the estimation of matrix-valued parameters of a Gaussian random process"*, **Signal Processing**, vol. 211, 2023. | HAL | DOI |

1. L. Leon, H. Wendt, J.-Y. Tourneret and P. Abry, *"A Bayesian framework for multivariate multifractal analysis"*, **IEEE Transactions on Signal Processing**, vol. 70, pp. 3663-3675, 2022. | HAL | DOI |

Proceedings of international conferences

5. L. Leon, J. Mamou, D. Kouame and A. Basarab, *"Hankel-based spectral method for quantitative acoustic microscopy"*, **IEEE International Symposium on Biomedical Imaging (ISBI)**, pp. 1-5, Athens, Grece, May 2024. | HAL | DOI |

4. L. Leon, H. Wendt, J.-Y. Tourneret and P. Abry, *"A robust model and its EM algorithm for the estimation of the multifractality parameter"*, **European Signal Processing Conference (EUSIPCO)**, pp. 1808-1812, Helsinki, Finland, Sept. 2023. | HAL | DOI |

3. H. Wendt, L. Leon, J.-Y. Tourneret and P. Abry, *"Multifractal anomaly detection in images via space-scale surrogates"*, **IEEE International Conference on Image Processing (ICIP)**, pp. 556-560, Bordeaux, France, Oct. 2022. | HAL | DOI |

2. L. Leon, H. Wendt, J.-Y. Tourneret and P. Abry, *"A comparison of Bayesian estimators for the parameters of the bivariate multifractal spectrum"*, **European Signal Processing Conference (EUSIPCO)**, pp. 2116-2120, Belgrade, Serbia, Aug. 2022. | HAL | DOI |

1. L. Leon, H. Wendt, J. -Y. Tourneret and P. Abry, *"Bayesian estimation for the parameters of the bivariate multifractal spectrum"*, **European Signal Processing Conference (EUSIPCO)**, pp. 1930-1934, Dublin, Ireland, Aug. 2021. | HAL | DOI |

Proceedings of national conferences

1. L. Leon, H. Wendt, J.-Y. Tourneret, P. Abry, *"Estimation du paramètre de multifractalité : régression linéaire, maximum de vraisemblance ou inférence Bayésienne ?"*, **XXVIIIème Colloque Francophone de Traitement du Signal et des Images (GRETSI)**, pp. 1293-1296, Nancy, France, Sept. 2022. | HAL |

Softwares

1. **Multivariate Multifractal Analysis toolbox**

   Toolbox for multivariate multifractal analysis of signals and images.

   Available at: https://www.irit.fr/Herwig.Wendt/software.html

Invited seminars

9. **Extraordinary Seminar on Medical Physics.** Physics Institute of the National Autonomous University of Mexico (UNAM), Ciudad de Mexico, Mexico

   Talk: *"High Frequency Signal Processing in Quantitative Acoustic Microscopy"*

   Jan. 8, 2025. Organizer: María-Ester Brandan

8. **Department of Radiology Seminar.** Weill Cornell Medicine College, New York, USA
   Talk: *"Demystifying Multifractal Analysis"*
   Apr. 15, 2024. Organizer: Carly Skudin

7. **ULTIM Team Seminar.** CREATIS, Lyon, France
   Talk: *"A Robust Hankel-Based Spectral Framework for Quantitative Acoustic Microscopy"*
   May 3, 2024. Organizer: Damien Garcia

6. **Workshop on Deep Learning, Image Analysis, Inverse Problems, and Optimization (DIPOpt).** Lyon, France
   Poster: *"Spectral Parameter Estimation for Quantitative Acoustic Microscopy"*
   Nov. 27-30, 2023. Organizer: Nelly Pustelnik

5. **MLSP Seminar: Machine Learning and Signal Processing.** ENS Lyon, Lyon, France
   Talk: *"A Bayesian Approach for Multivariate Multifractal Analysis"*
   May 2, 2023. Organizer: Julian Tachella

4. **AI Tasting Seminar.** TorusAI, Toulouse, France
   Talk: *"A Bayesian Framework for Multivariate Multifractal Analysis of Signals and Images"*
   Jan. 26, 2023. Organizer: Milad Mozafari

3. **SIMUL Team Seminar.** Centre de Recherche en Automatique de Nancy (CRAN), France
   Talk: *"Bayesian Multivariate Multifractal Analysis with Application to Drowsiness Detection"*
   Nov. 17, 2022. Organizer: Julien Flamant

2. **Workshop: Statistical Learning for Signal and Image Processing.** Cadaqués, Spain
   Talk: *"Multifractal Anomaly Detection in Images Via Space-Scale Surrogates"*
   Oct. 11-14, 2022. Organizer: Jordi Vilà-Valls

1. **GdR Workshop on Multifractal Analysis and Self-Similarity.** Porquerolles, France
   Talk: *"A Bayesian Framework for Bivariate Multifractal Analysis"*
   Sept. 26-30, 2021. Organizer: Valérie Berthé

SCIENTIFIC COMMUNICATION AND INITIATIVES TOWARD THE WIDE AUDIENCE

Oct. 11, 2024 — **Animator of the "Trace ton son" workshop, Fête de la Science 2024**
IUT LYON 1, VILLEURBANNE, FRANCE

INTERNSHIP SUPERVISION

Feb. - Jul. 2025 — **Master's Research Internship**
CREATIS, LYON, FRANCE
Topic: *"Diffusion Models for Quantitative Acoustic Microscopy Image Enhancement"*
Student: Nawal Haidar (École Centrale de Nantes, France)
Duration: 6 months
Supervision at 50% with Adrian Basarab (50%)

Jul. - Sept. 2024 — **Second-Year Engineering School Internship**
CREATIS, LYON, FRANCE
Topic: *"Quantitative Acoustic Microscopy Image Enhancement using Probabilistic Diffusion Models"*
Student: Céleste Tiano (INPT, France)
Duration: 2 months
Supervision at 50% with Adrian Basarab (50%)

Mar. 2023 - Jun. 2024 — **Doctoral Internship**
CREATIS, LYON, FRANCE
Topic: *"Super-resolution and Diffusion Methods for Quantitative Acoustic Microscopy"*
Student: Xuefeng Sun (Harbin Institute of Technology, China)
Duration: 15 months
Supervision at 33% with Adrian Basarab (33%) and Yue Min Zhu (33%)

ATTENDANCE AT CONFERENCES, CONGRESSES, COLLOQUIA, AND RESEARCH SCHOOLS

Aug. 28-30, 2024 — **32th European Signal Processing Conference (EUSIPCO)**
LYON, FRANCE

Feb. 16, 2024 — **POPILS: Journée Parcimonie, Optimisation et Problèmes Inverses Lyon Saint-Etienne**
INSA DE LYON, LYON, FRANCE

Aug. 28 - Sept. 1, 2023 — **XXIXth Francophone Colloquium on Signal and Image Processing (GRETSI)**
GRENOBLE, FRANCE

Jul. 3-14, 2023 — **Summer School: Harmonic and Multifractal Analysis**
CENTRE DE RECHERCHES MATHÉMATIQUES (CRM), UNIVERSITÉ DE MONTRÉAL, MONTRÉAL, CANADA
Topics: *Multivariate multifractal analysis, scale-free dynamics, applications in neuroscience*

Jul. 19-24, 2021 **Summer School: InnEO**
R&D INSTITUTE OF TRANSYLVANIA UNIVERSITY, BRAȘOV, ROMANIA
Topics: *Machine learning, deep learning, and remote sensing. Practical sessions in Python and MATLAB. Development of open science and soft skills*

Jan. 25-29, 2021 **Research School: Mathematics, Signal Processing, and Learning**
CENTRE INTERNATIONAL DE RENCONTRES MATHÉMATIQUES (CIRM), MARSEILLE, FRANCE
Topics: *Machine learning, signal processing, optimization, reinforcement learning, a signal processing perspective on deep learning. Practical sessions in Python*

Apr. 1-5, 2019 **Workshop: Imaging and Machine Learning**
INSTITUT HENRI POINCARÉ (IHP), PARIS, FRANCE

Mar. 11-15, 2019 **Workshop: Statistical Modeling for Shapes and Imaging**
INSTITUT HENRI POINCARÉ (IHP), PARIS, FRANCE

Feb. 4-8, 2019 **Workshop: Variational Methods and Optimization in Imaging**
INSTITUT HENRI POINCARÉ (IHP), PARIS, FRANCE

Jan. 7-11, 2019 **Winter School: Mathematics for Imaging**
CENTRE INTERNATIONAL DE RENCONTRES MATHÉMATIQUES (CIRM), MARSEILLE, FRANCE
Topics: *Variational methods and convex relaxation for computer vision, practical machine learning for imaging in neuroscience, Bayesian methods for imaging*

Jan. 29 - Feb. 2, 2018 **Winter School: CSHab2018**
UNIVERSIDAD DE LA HABANA, HAVANA, CUBA
Topics: *Languages for concurrency, kernel representation and learning, and parallel computing*

Feb. 26 - Mar. 3, 2017 **Winter School: Mathematics and Physics Meet**
UNIVERSIDAD DE LA HABANA, HAVANA, CUBA
Topics: *Tools for signal analysis and quantum physics, semigroups, and spectral theory*

TEACHING

Polytech Lyon, Lyon, France

Biomedical Engineering (4th year)

- **Image Processing Fundamentals** (2024-2025)
  Lecture/Practical exercises/Lab session (30 h)

IUT Lyon 1, Lyon, France

BTech in Electrical Engineering and Industrial Computer Science

- **Mathematical Tools and Software 1st year** (2023-2024, 2024-2025)
  Lab sessions (32 h, 16 h)

- **Mathematical Tools and Software 2nd year** (2023-2024, 2024-2025)
  Lab sessions (32 h, 16 h)

Universidad de La Habana, Havana, Cuba

Bachelor's in Computer Science (1st year)

- **Mathematical Analysis** (2018-2019)
  Lecture (42 h)

Bachelor's in Chemistry (2nd year)

- **Linear Algebra and Group Theory** (2016-2017, 2017-2018)
  Practical exercises (40 h, 40 h)

- **Differential Equations** (2016-2017, 2017-2018)
  Practical exercises (32 h, 32 h)

BACHELOR THESIS DEFENSE COMMITTEE

Jun. 2019 **Examiner**
UNIVERSIDAD DE LA HABANA, CUBA
- Manuel Millares Alvarez (Bachelor's in Computer Science), *"Machine Learning for the Detection of Calcifications in Digital Mammography Images"*
- Armando Heras Tang (Bachelor's in Computer Science), *"Automatic Segmentation of Diabetic Foot Ulcers and its Internal Tissues Using Supervised Learning"*

Jun. 2018 **Reviewer**
UNIVERSIDAD DE LA HABANA, CUBA
- Royland Díaz Olivera (Bachelor's in Computer Science), *"Factorial Analysis and Non-Negative Matrix Factorizations in Corpus Linguistics"*

Jun. 2018 **Examiner**
UNIVERSIDAD DE LA HABANA, CUBA
- Mariella Lorenzo Suarez (Bachelor's in Computer Science), *"Development of an Efficient Fractal Coding Algorithm for the Detection of Masses in Digital Mammograms"*
- Danilo Gómez Gómez (Bachelor's in Computer Science), *"Elimination of Specular Areas in Colposcopy Images using Non-Negative Matrix Factorizations"*

VOLUNTEERING

Jun. - Nov. 2021 Volunteer at the ATPA Shelter - SPA of Toulouse, Animal Protection, Toulouse, France
Activities: I participated in walking and caring for shelter dogs once a week, providing both physical and mental stimulation during their outings.