Imen AYADI

Postdoctoral Researcher Candidate

University Paris-Saclay, France

(+33) 0760332730 | imenayadi3005@gmail.com | ia3005.github.io/ | IA3005

Education

Tunisian baccalaureate diploma in Math specialization — *Sfax, TUNISIA*

Higher Secondary Certificate — *June 2014*

- Ranked 1st at the national level, 19.76/20
- Got a grant of excellence from the Tunisian government to pursue university education in France

Lycée Louis-Le-Grand — *Paris, FRANCE*

Preparatory Classes with a major in Math and Physics (MPSI, MP*) — *2014-2017*

CentraleSupélec (Centralian Cursus) — *Paris, FRANCE*

Engineering Degree — *2017-2021*

- Selected in the Research track (track of excellence) for first and second years
- Graduated with a specialization in "Applied Mathematics for Data Science" and in the stream "Careers in Research", with the highest honor‡

ENS Paris-Saclay — *Paris, FRANCE*

Master's Degree — *2020-2021*

- M2 MVA (Mathematics, Vision & Learning), with the highest honor‡

‡ Main courses: Deep Learning, Reinforcement Learning, computer vision, advanced statistics, optimization, kernel methods, image denoising, speech and language processing, stochastic differential equations, harmonic analysis, geometry and shape spaces, stochastic partial differential equations, random matrix theory, graph models.

Research Experience

CEREMADE (Université Paris-Dauphine) — *Paris, FRANCE*

Caesura Internship — *September 2019 - February 2020*

- Topic: Study of stochastic optimizers in Deep Learning
- Supervisor: Gabriel TURINICI

L2S Lab (Université Paris-Saclay) — *Paris, FRANCE*

Final-year Internship — *May 2021 - October 2021*

- Topic: Robust Geometric Classification of SSVEP-EEG signals
- Supervisors: Frédéric PASCAL, Florent BOUCHARD

L2S Lab (Université Paris-Saclay) — *Paris, FRANCE*

PhD — *November 2021 - June 2025*

- Topic: Robust Geometric Learning for electroencephalography
- Supervisors: Frédéric PASCAL, Florent BOUCHARD

Publications& Presentations

Conference papers:

- I. Ayadi and G. Turinici, "**Stochastic Runge-Kutta methods and adaptive SGD-G2 stochastic gradient descent**," 2020 25th International Conference on Pattern Recognition (ICPR), 2021, pp. 8220-8227, doi: 10.1109/ICPR48806.2021.9412831.
- I. Ayadi, F. Bouchard and F. Pascal, '**Elliptical Wishart Distribution: Maximum Likelihood Estimator from Information Geometry**," ICASSP 2023 - 2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Rhodes Island, Greece, 2023, pp. 1-5, doi: 10.1109/ICASSP49357.2023.10096222.
- I. Ayadi, F. Bouchard and F. Pascal, "**t-WDA: A novel Discriminant Analysis applied to EEG classification**," EUSIPCO 2023 - 2023 IEEE European Signal Processing Conference(EUSIPCO), Helsinki, Finland, 2023.
- I. Ayadi, F. Bouchard and F. Pascal, "**Distribution matricielle t-Wishart: géométrie d'information, estimation et application pour la classification de signaux EEG**," GRETSI 2023 - Colloque Sur Le Traitement Du Signal et Des Images, GRETSI - Groupe de Recherche en Traitement du Signal et des Images, Grenoble, 2023, pp. 777–780.

Journal papers:

- I. Ayadi, F. Bouchard and F. Pascal, "**On Elliptical and Inverse Elliptical Wishart distributions**," arXiv preprint arXiv:2404.17468 (2024).
- I. Ayadi, F. Bouchard and F. Pascal, "**Elliptical Wishart distributions: information geometry, maximum likelihood estimator, performance analysis and statistical learning**," Signal Processing (2025): 109981.

Thesis manuscript:

- I. Ayadi. "**Robust Geometrical Learning for Electroencephalography**,". Université Paris-Saclay, 2025. English. ⟨NNT : 2025UPAST043⟩. ⟨tel-05227786⟩

Software:

- Contribution to *Benchopt*, a sub-library of the **Inria** project *Benchmark_Bci* : code available at `https://github.com/benchopt/benchmark_bci.git`

Talks:

- Demonstration on *Photovoltaic Panels* in the stand "un Chercheur, une Manip" of Palais De La Découverte on October,26th 2018 as a scientific vulgarization activity of the Research track of CentraleSupélec
- Short talk about *Robust Geometric Classification of EEG signals* in the 3rd Statistical Learning for Signal and Image Processing Workshop **SLSIP** (October 2021) in Germany
- Pitch about *Robust Geometric Classification of EEG signals* in the first **UDOPIA Doctoral Student Day** in December 2021
- Presentation about *Variable importance with Permutation Approach and Conditional Sampling Approach* in the Artificial Intelligence for Signal and Image Processing **AI4SIP** Program at the Pascal institute, in July 2022
- Oral presentation of conference paper in the **ICASSP** conference in June 2023
- Oral presentation of conference paper in the **GRETSI** conference in August 2023
- Oral presentation of conference paper in the **EUSIPCO** conference in September 2023
- Talk about *Robust geometric classification of EEG signals* on the **PhD day** of L2S in September 2023 (won the Award of best talk in the AI session)

Projects

Undergraduate & graduate research projects:

- Project of the Research track in CentraleSupélec: "Discretization of stochastic differential equations driven by a Lévy process":
  - keywords: jumping parameter, Lévy-Khintchine decomposition, numerical scheme, weak convergence
- Third-year project in CentraleSupélec research stream: "Study of different approaches to out-of-distribution generalization", available on `https://github.com/IA3005/Out-of-distributions-generalization`:
  - keywords: Invariant risk minimization, domain adaptation, adversarial information factorization, invariance, causal inference, Information Bottleneck criterion.

Academic Service

Peer Reviewing:

- Reviewing a regular manuscript for the IEEE Transactions on Information Theory journal
- Reviewing a regular manuscript for AIMS Mathematics journal

Scientific event organization:

- Participation in the organization and the animation of the third PhD students day of the DATAIA institute

Teaching Experience

Private Tutoring

Paris, FRANCE

September 2019 - June 2020

Mathematics and Physics tutor for high-school students, and Mathematics tutor for undergraduate students

Tutoring in Engineering Schools

Paris, FRANCE

February 2023 - June 2024

Teaching with pedagogic training courses as part of the "**Doctoral careers: Teaching in Higher Education**" label of the University of Paris-Saclay

- Tutorials on "Statistics and Machine" Learning for first-year engineering students in *CentraleSupélec*:
  - parametric estimation, Bayesian estimation, statistical tests, linear regression, model selection, logistic regression, principal component analysis, clustering, introduction to neural networks
- Tutorials on "Optimization" for second-year engineering students in *CentraleSupélec*:
  - existence and uniqueness of local and global minimizers, convexity, duality, Lagrange multipliers, gradient-descent methods, linear and integer programming, branch and bound algorithm, introduction to stochastic optimization
- Computer labs of "Algebra on Matlab" for first-year engineering students in *Polytech Paris-Saclay*
  - image of a vector by a matrix, rotation matrices, polygraphic encryption, eigenvalues and eigenvectors, solving a system of differential equations, matrix power calculation
- Computer labs of "Fourier analysis on Matlab" for first-year engineering students in *Polytech Paris-Saclay*:
  - Fourier series for common periodic signals, effect of sampling and truncation on the spectrum of a signal, Shannon's theorem, effect of the shape of weighting windows, convolution, Fourier transform
- Tutorials on "Probabilities" for first-year engineering students in *Polytech Paris-Saclay*:
  - conditional probabilities, discrete random variables, real random variables with density

Technical Skills

Programming, Python (Pytorch, Tensorflow, Keras), MATLAB, R, VBA
Web Development, HTML, CSS, PHP
Computer-aided design Software, AutoCAD
Database, SQL, MongoDB, Neo4j

Languages

Arabic, mother tongue
French, bilingual
English, proficient C1
Spanish, intermediate B1