ANTOINE COLLAS

antoine.collas@inria.fr — www.antoinecollas.fr

PERSONAL DETAILS

- Address: Sceaux (Paris area), France
- Age: 28 years old
- Nationality: French
- Languages: French (mother tongue), English (proficient)

RESEARCH INTERESTS & EXPERTISE

Applied mathematics, machine learning and signal processing:

- Machine learning: domain adaptation, optimal transport, ...
- Statistical signal processing: robust statistics, estimation, bounds, optimization on Riemannian manifolds, ...

Applications:

- Remote sensing: Hyperspectral and SAR images, time series
- Biosignals: Magneto- and Electro-encephalography (MEG/EEG), functional Magnetic Resonance Imaging (fMRI)

EXPERIENCE

Postdoctoral researcher at INRIA Saclay November 2022 - Present
Postdoc in machine learning *Palaiseau, France*

- MIND Team (ex-Parietal), supervisors: Bertrand Thirion, Alexandre Gramfort, Rémi Flamary
- Domain adaptation using Riemannian geometry applied to M/EEG and fMRI data

Lecturer at Polytechnique, CentraleSupélec and University Paris-Saclay November 2020 - Present
Part-time teaching assistant at graduate level *Gif-sur-Yvette, France*

- Optimization: convexity, duality, linear programming, ...
- Digital signal processing: Fourier analysis, linear regression, stochastic process, statistical estimation, ...
- Introduction into machine learning: linear regression, SVM, neural networks, PCA, ...

R&D intern at Safran Electronics & Defense February 2019 - July 2019, 6 months
Computer vision - Deep learning *Eragny, France*

- Deep learning: object detection, style transfer
- Few-shot learning

EDUCATION

Qualification to Maitre de conférences positions 2022

- Sections 61 (signal processing) and 26 (applied mathematics)

PhD at SONDRA lab, CentraleSupélec October 2019 - October 2022
Riemannian geometry for statistical estimation and learning: application to remote sensing *Gif-sur-Yvette, France*

- Supervisors: Jean-Philippe Ovarlez (CentraleSupélec & Onera), Guillaume Ginolhac (Univ. Savoy Mont Blanc), Chenfang Ren (CentraleSupélec), Arnaud Breloy (Univ. Paris Nanterre), Florent Bouchard (CentraleSupélec)
- Jury: Audrey Giremus (Univ. Bordeaux), Nicolas Le Bihan (Univ. Grenoble Alpes), Cédric Richard (Univ. Côte d'Azur), Nicolas Boumal (EPFL), Alexandre Gramfort (Meta & Inria)
- Statistics: estimation, intrinsic Cramér-Rao bounds
- Riemannian geometry: optimization and machine learning
- Applications: hyperspectral and SAR images, earth observation

University of Shanghai - UTSEUS 2016
Exchange student *Shanghai, China*

- One abroad semester in China studying Computer Science

University of Technology of Compiègne - UTC September 2014 - September 2019
Diplôme d'ingénieur- Engineering degree *Compiègne, France*

- Major: Computer Science
- Minor: Applied Mathematics
- Obtained the "Mod Math" (mathematical modelization) label in Applied Mathematics

Lycée Charles De Gaulle September 2011 - July 2014
Baccalauréat Scientifique *Dijon, France*

- Mention Très Bien

COURSES, WORKSHOPS AND SUMMER SCHOOLS ATTENDED

Courses

- "Introduction to Riemannian geometry: application to optimization for the estimation of covariance matrices", given by Florent Bouchard (CNRS/CentraleSupélec) - 14h - Annecy, France - 2020

Workshops

- "5th Sondra Workshop" (link) - Invited speaker - Avignon, France - 2022
- "Statistical Learning for Signal and Image Processing (SLSIP) Workshop" (link) - Invited speaker - Rüdesheim am Rhein, Germany - 2020

Summer schools

- "LOGML, London Geometry and Machine Learning, 2021" (link) - 30h - University College London and Imperial College London. Application of Riemannian optimization algorithms to optimal transport problems, mentored by **Bamdev Mishra**, creator of *Manopt* the leading toolbox of optimization of Riemannian manifolds - 2021
- "Data Sciences for Geosciences 2020" (link) - 30h - ENSEEIHT Toulouse, France - 2020

TALKS

- **Title:** "Riemannian geometry for statistical estimation and learning: applications to remote sensing and M/EEG" - OPIS Seminar, CentraleSupélec, Gif-sur-Yvette, France - 2024
- **Title:** "Riemannian geometry for statistical estimation and learning: applications to remote sensing and M/EEG" - TAU Seminar, LRI, University Paris-Saclay, Gif-sur-Yvette, France - 2023
- **Title:** "Riemannian geometry for statistical estimation and learning: applications to remote sensing and M/EEG" - S3 Seminar, L2S, CentraleSupélec, Gif-sur-Yvette, France - 2023
- **Title:** "Optimal transport and dimension reduction: Entropic Wasserstein Component Analysis" - ELLIS Unconference, HEC, Jouy-en-Josas, France - 2023
- **Title:** "Entropic Wasserstein Component Analysis" - SIMPAS team, Centre de Mathématiques Appliquées de l'Ecole Polytechnique, Palaiseau, France - 2023
- **Title:** "Estimation and classification of location and covariance matrix using Riemannian geometry: application to remote sensing" - Laboratoire Jean Kuntzmann seminar, Grenoble, France - 2023
- **Title:** "On The Use of Geodesic Triangles Between Gaussian Distributions for Classification Problems" - 5th Sondra Workshop, Avignon, France - 2022
- **Title:** "Optimization and statistical learning using Riemannian geometry: application to remote sensing" - DSO National Laboratories, Singapore - 2022
- **Title:** "Optimization and statistical learning using Riemannian geometry and application to remote sensing" - Inria Saclay, Parietal team, Palaiseau, France - 2022
- **Title:** "Robust Clustering for Satellite Images Time-Series" - ONERA, the French Aerospace Lab, Palaiseau, France - 2022
- **Title:** "Probabilistic PCA from Heteroscedastic Signals: Geometric Framework and Application to Clustering" - Statistical Learning for Signal and Image Processing (SLSIP) Workshop, Rüdesheim am Rhein, Germany - 2021
- **Title:** "Riemannian Geometry to Robust Estimation Covariance Matrices with Application to Machine Learning" - LISTIC laboratory, Annecy, France - 2021

PUBLICATIONS

* indicates equal contribution.

Preprints

[1] T. Gnassounou*, **A. Collas***, R. Flamary, K. Lounici, and A. Gramfort, *Multi-Source and Test-Time Domain Adaptation on Multivariate Signals using Spatio-Temporal Monge Alignment*, 2024.

[2] Y. Lalou*, T. Gnassounou*, **A. Collas***, A. de Mathelin, O. Kachaiev, A. Odonnat, A. Gramfort, T. Moreau, and R. Flamary, *SKADA-Bench: Benchmarking Unsupervised Domain Adaptation Methods with Realistic Validation*, 2024.

[3] **A. Collas**, R. Flamary, and A. Gramfort, *Weakly supervised covariance matrices alignment through Stiefel matrices estimation for MEG applications*, 2024.

Book chapter

[4] F. Bouchard, A. Breloy, **A. Collas**, A. Renaux, and G. Ginolhac, *The Fisher-Rao geometry of CES distributions*. Springer, 2024.

Journals

[5] A. Mellot, **A. Collas**, P. L. C. Rodrigues, D. Engemann, and A. Gramfort, "Harmonizing and aligning M/EEG datasets with covariance-based techniques to enhance predictive regression modeling," *Imaging Neuroscience*, 2023.

[6] A. L. Brigant, J. Deschamps, **A. Collas**, and N. Miolane, "Parametric information geometry with the package Geomstats," *ACM Transactions on Mathematical Software*, 2023.

[7] **A. Collas**, A. Breloy, C. Ren, G. Ginolhac, and J.-P. Ovarlez, "Riemannian optimization for non-centered mixture of scaled Gaussian distributions," *IEEE Transactions on Signal Processing*, 2023.

[8] **A. Collas**, F. Bouchard, A. Breloy, G. Ginolhac, C. Ren, and J.-P. Ovarlez, "Probabilistic PCA From Heteroscedastic Signals: Geometric Framework and Application to Clustering," *IEEE Transactions on Signal Processing*, 2021.

[9] A. Mian, A. **Collas**, A. Breloy, G. Ginolhac, and J.-P. Ovarlez, "Robust Low-Rank Change Detection for Multivariate SAR Image Time Series," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2020.

Conferences

[10] A. Mellot*, **A. Collas***, S. Chevallier, A. Gramfort, and D. A. Engemann, "Geodesic optimization for predictive shift adaptation on eeg data," in *Advances in Neural Information Processing Systems (NeurIPS)*, Spotlight paper, Vancouver, Canada, 2024.

[11] A. Mellot, **A. Collas**, S. Chevallier, D. Engemann, and A. Gramfort, "Physics-informed and Unsupervised Riemannian Domain Adaptation for Machine Learning on Heterogeneous EEG Datasets," in *2024 32th European Signal Processing Conference (EUSIPCO), Lyon, France*, 2024.

[12] **A. Collas**, T. Vayer, R. Flamary, and A. Breloy, "Entropic Wasserstein Component Analysis," in *IEEE Machine Learning for Signal Processing (MLSP) - Rome, Italy*, 2023.

[13] **A. Collas**, A. Breloy, G. Ginolhac, C. Ren, and J.-P. Ovarlez , "Apprentissage robuste de distance par géométrie riemannienne," in *GRETSI 2022 XXVIIIème colloque, Nancy, France*, 2022.

[14] **A. Collas**, A. Breloy, G. Ginolhac, C. Ren, and J.-P. Ovarlez, "Robust Geometric Metric Learning," in *2022 30th European Signal Processing Conference (EUSIPCO), Belgrade, Serbia*, 2022.

[15] **A. Collas**, F. Bouchard, G. Ginolhac, A. Breloy, C. Ren, and J.-P. Ovarlez, "On The Use of Geodesic Triangles Between Gaussian Distributions for Classification Problems," in *ICASSP 2022 - 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Singapore*, 2022.

[16] **A. Collas**, F. Bouchard, A. Breloy, C. Ren, G. Ginolhac, and J.-P. Ovarlez, "A Tyler-Type Estimator of Location and Scatter Leveraging Riemannian Optimization," in *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto, Canada (Virtual)*, 2021.

Softwares

[17] T. Gnassounou, O. Kachaiev, R. Flamary, **A. Collas**, Y. Lalou, A. de Mathelin, A. Gramfort, R. Bueno, F. Michel, A. Mellot, V. Loison, A. Odonnat, and T. Moreau, *SKADA : Scikit Adaptation*, Jul. 2024. [Online]. Available: https://scikit-adaptation.github.io/.

AWARD

· **Best Student Paper Award** at the EUSIPCO 2022 conference, Belgrade, Serbia.

SOFTWARE

· **Maintainer of SKADA:** Python library for domain adaptation with a scikit-learn and PyTorch/skorch compatible API - link - 2023 - present
· **Maintainer of Pymanopt:** Python library for optimization on Riemannian manifolds with support for automatic differentiation, implementation of several Riemannian manifolds (complex Grassmann, vectors with strictly positive entries, ...) - link - 2020 - present
· **Contributor of Python Optimal Transport (POT):** Python library for optimal transport, implementation of entropic Wasserstein component analysis - link - 2023 - present
· **Contributor of Geomstats:** Python library for computations and statistics on manifolds with geometric structures, contribution to the information geometry package - link - 2022
· **Creator of pyCovariance:** Python library for statistical estimation and clustering/classification on Riemannian manifolds - link - 2019 - 2022

REVIEWING SERVICE

· Journal: **Reviewer IEEE Transactions on Signal Processing**, **Reviewer TMLR**
· Conferences: **Reviewer Neurips** (2022, 2023, 2024), **ICML** (2023, 2024), **ICLR** (2023), **AAAI** (2024)

COMPETITIONS

· **Kaggle**: "Gendered pronoun resolution". Competition of natural language processing on a coreference problem: pair pronouns to their correct entities - **Result: 31/838** - 2019
· **Kaggle**: "Recursion Cellular Image Classification". Competition of computer vision: disentangling biological signal from experimental noise in cellular images - **Result: 42/865** - 2019
· **Conference CAP 2018**: "Predicting English level by analyzing writing styles". Competition of natural language processing - **Result: 5/14** - 2018

TECHNICAL SKILLS

· **Machine learning and scientific computing:** Python, PyTorch, Tensorflow, Scikit-learn, Matlab, R
· **Optimization on Riemannian manifolds:** Manopt, Pymanopt
· **Version control:** Git
· **Cloud computing:** AWS, GCP
· **Front-end:** Javascript, React, HTML/CSS
· **Back-end:** Python, C++, SQL
· **Other:** LaTeX