

Curriculum vitae

Arnaud Breloy

32 years old (29/05/1989), French

Associate professor at University Paris Nanterre

Electrical Engineering department & LEME (EA4416) laboratory

🏠 50, rue de Sèvres, 92410 Ville d'Avray

☎ pers. : +33.06.74.51.65.34., pro. : +33.01.40.97.48.15.

✉ abreloy@parisnanterre.fr, a.breloy@gmail.com

🌐 [<https://abreloy.github.io/>]

Previous work experience

- **2015-2016 full-time temporary assistant professor (ATER)**
University Paris Nanterre, Electrical Engineering department
- **2012-2015 Ph.D student** CNRS (DGA grant) and **Teaching Assistant** (Monitorat)
SATIE (ENS-Cachan) and SONDRRA (CentraleSupélec)
University Paris Nanterre, Electrical Engineering department

Education

- **2020 HDR** (Research Directorship Habilitation) **of University Paris Nanterre**
Title: “*Some flavours of PCA*”
Jury: ★ Cédric Richard, Professor, University Côte d’Azur (Reviewer)
 ★ Jean-Yves Tournet, Professor, INP-ENSEEIH (Reviewer)
 ★ Olivier Besson, Professor, ISAE-SUPAERO (Examinator)
 ★ Emilie Chouzenoux, CR, Inria Saclay (OPIS) (Examinator)
 ★ Nicolas Le Bihan, DR, GIPSA-lab (Examinator)
 ★ Mohammed Nabil El Korso, MCF University Paris Nanterre (Local Examinator)
- **2015 Ph.D of University Paris Saclay**
Title: “*Estimation/detection algorithms in low-rank heterogeneous context*”
Laboratories: SATIE (ENS-Cachan) and SONDRRA (CentraleSupélec)
Jury: ★ Pierre Comon, CNRS research director, GIPSA-Lab (Chairman)
 ★ Olivier Besson, Professor, ISAE-SUPAERO (Reviewer)
 ★ Pascal Chevalier, Professor, CNAM (Reviewer)
 ★ Chin Yuan Chong, Research Engineer, DSO (Examinator)
 ★ Guillaume Ginolhac, Professor, University Savoie-Mont-Blanc (Director)
 ★ Frédéric Pascal, Professor, CentraleSupélec (Advisor)
 ★ Philippe Forster, Professor, University Paris Nanterre (Advisor)
- **2013 Engineer degree from Ecole Centrale Marseille (ECM)**
- **2012 Master’s degree of University Aix-Marseille**

Research activities

Themes

My research activities concern statistics and optimization methods for various applications in machine learning and signal processing:

- **Dimension reduction** and variable selection: probabilistic/sparse PCA, robust subspace recovery, low-rank matrix factorization.
- **Information geometry**: performance bounds, Riemannian optimization, and classification/clustering with metrics induced by statistical models.
- **Statistical signal processing**: robust signal subspace and structured covariance matrix estimation, adaptive detection/beamforming.
- **Applications** in array processing (RADAR, interferometer calibration for radioastronomy), satellite image time-series analysis (change detection, clustering), and EEG signal classification.

I also recently started to work on the links between these approaches with graphical models, and their use for graph learning problems.

Conferences activities

Tutorials, lectures

- **SLSIP Workshop 2021**: “Riemannian geometry in elliptical distributions”
- **IEEE RadarConf 2020**: “Robust statistical framework for radar change detection applications”. with G. Ginolhac.
- **EUSIPCO 2018**: “Robust Covariance and Subspace Learning: dealing with high-dimensionality and small sample support”. with F. Pascal and G. Ginolhac.

Special sessions organization and invitations

- **EUSIPCO 2020**: “Recent advances in differential geometry for signal and image processing”
- **EUSIPCO 2018**: “Emerging Data Structure Paradigms for Subspace Estimation”
- 6 invited conference papers in special sessions.

Committees

- **NCMIP 2019**: Scientific committee member
- **EUSIPCO 2018, 2020**: TPC member

Reviewing service

- **Associate Editor** for Elsevier Digital Signal Processing (DSP) since April 2021
- **International journals** : IEEE Trans. on Signal Processing, IEEE Signal Processing letters, IEEE Trans. on Aerospace And Electronic Systems, Signal Processing Elsevier, Digital Signal Processing Elsevier, EURASIP Journal on Advances in Signal Processing.
- **International conferences** : EUSIPCO, SSP, ISIT, IEEE RadarConf.

International collaborations

- **HKUST, Hong Kong**, with Prof. Daniel P. Palomar: 1 month as invited Ph.D student in July 2015. Two journal and three conferences articles (latest in 2021).
- **Aalto University, Finland**, with Prof. Esa Ollila: 6 months as invited researcher in 2021 (CRCT). One conference (December 2019) and one submitted journal article (september 2021).
- **Xidian University, China**, with Prof. Yongchan Gao: one journal article in 2021.
- **NC State University (NCSU), Raleigh, USA**, with Prof. Hamid Krim: 2 weeks as invited researcher in October 2016. One conference article and co-organization of a special session at the conference EUSIPCO 2018.

Supervision experience

Ph.D. Students (current)

- **Hugo Brehier** defense expected for 2024
Title: “*Detection and Classification for Radar Through The Wall from subspaces model*”
Co-supervisors: G. Ginolhac (director), C. Ren, I. Hinostroza
Funding: SONDRRA
- **Hoa Vu**, ONERA, defense expected for 2023
Title: “*Robust SAR interferometry*”
Co-supervisors: G. Ginolhac (director), Y. Yan, F. Brigui
Funding: ONERA
- **Yassine Mhiri**, SATIE, defense expected for 2023
Title: “*Statistical processing of signals observed by the future large radio telescopes*”
Co-supervisors: P. Larzabal (director), M.N. EL Korso
Funding: Paris-Saclay ADUM grant
- **Antoine Collas**, SONDRRA, defense expected for 2022
Title: “*Robust clustering for satellite image time series*”
Co-supervisors: J-P. Ovarlez (co-director), G. Ginolhac (co-director), C. Ren
Funding: SONDRRA

Ph.D. Students (past)

- **Bruno Meriaux**, SONDRRA, defended the 05/10/2020
Title : “*Robust adaptive signal processing without secondary data*”
Co-supervisors: P. Forster (director), M.N. El Korso, C. Ren
Funding: 1/2 DGA grant completed by SONDRRA
- **Gordana Drašković**, L2S, defended the 27/09/2019
Title : “*Robust estimation analysis for signal and image processing*”
Co-supervisors: F. Pascal (director), F. Tupin
Funding: DigiCosme grant, Paris-Saclay
- **Rayen Ben Abdallah**, LEME, defended the 4/11/2019
Title: “*Statistical signal processing exploiting low-rank priors with applications to detection in Heterogeneous Environment*”
Co-supervisors: D. Lautru (director), M.N. El Korso
Funding: University Paris Nanterre, ED 139

Master's degree students

- **Douba Jafuno**, M2 Sciences Sorbonne Université, March-September 2021

Topic : “Feature selection for EEG signals classification”

Co-supervisors: L. Boubchir, M.N. El Korso

- **Hugo Brehier**, ENSAI Master's degree, March-September 2020

Topic : “Robust sparse PCA”

Co-supervisors: M.N. El Korso

- **Bruno Meriaux**, ENS Paris Saclay Master's degree, April-September 2017

Topic : “Robust estimation of structured scatter matrices”

Co-supervisors: P. Forster, M.N. El Korso, C. Ren

- **Taha Essalih**, Ecole Centrale Marseille Master's degree, April-September 2017

Topic: “Robust calibration of large radio-interferometers”

Co-supervisors: M.N. El Korso, Rémi Flamary, Franck Iutzeler

Research projects and grants

ANR-JCJC	PI	2022-26	235k€
MASSILIA (Matrices spectral structures in graph learning)			
1/2 CRCT	PI	2020-21	
Semester of remunerated sabbatical leave for research purpose (french CRCT) awarded by National Council of Universities (CNU). Invited stay of 6 months at Aalto University, Helsinki.			
Univ. Paris Lumières research grant	PI	2019-22	14k€
Sparse PCA for EEG signals classification, with M.N. El Korso and L. Boubchir			
PNTS	Collaborator	2019-20	15k€
Statistical learning in SAR image time series with missing data. PI: Y. Yan			
PHC-PROCORE	Co-PI	2019-20	14k€
Robust signal processing, with M.N. El Korso (PI-Fr), M. Pesavento (PI-Ger)			
DGA 1/2 thesis grant	Co-PI	2017-20	50k€
Thesis of Bruno Meriaux, “ <i>Robust adaptive signal processing without secondary data</i> ” Project members: P. Forster (PI), M.N. El Korso, C. Ren.			
ANR-ASTRID	Sub-tasks manager	2017-22	78k€
MARGARITA (Modern Adaptive Radar), Ref. ANR-17-ASTR-0015 [link] . PI: G. Ginolhac			
Digiteo-DigiCosme grant	Co-PI	2016-19	100k€
Thesis of Gordana Drašković, “ <i>Robust estimation analysis for signal and image processing</i> ” Project members : F. Pascal (PI), F. Tupin.			
Young researcher GDR-ISIS	Co-PI	2016-18	7k€
Project ON FIRE (robust calibration of future large interferometers) Project members : M.N. El Korso (PI), Rémi Flamary, Franck Iutzeler.			

Articles

This list is limited to journal publications¹, others can be found on [\[my website\]](#) or [\[my scholar page\]](#)

- [J19] A. Mian, G. Ginolhac, J.P. Ovarlez, **A. Breloy**, F. Pascal, “An overview of covariance-based change detection methodologies in multivariate SAR image time series,” ISTE WILEY (Book chapter), 2021
- [J18] A. Collas, F. Bouchard, **A. Breloy**, G. Ginolhac, C. Ren, J.P. Ovarlez, “A Riemannian Geometry for Probabilistic PCA with Compound Gaussian Signals,” in IEEE Trans. on Sig. Proc., vol. 69, 2021
- [J17] A. Hippert Ferrer, M.N. El Korso, **A. Breloy**, G. Ginolhac, “Robust mean and covariance matrix estimation under heterogeneous mixed-effects model with missing values,” Signal Processing, vol. 188, 2021
- [J16] **A. Breloy**, , G Ginolhac, Y. Gao, F. Pascal, “MIMO Filters based on Robust Rank-Constrained Kronecker Covariance Matrix Estimation,” Signal Processing, vol. 187, 2021
- [J15] **A. Breloy**, S. Kumar, Y. Sun, D.P. Palomar, “Majorization-Minimization on the Stiefel Manifold with application to Robust Sparse PCA,” IEEE Trans. on Sig. Proc., vol. 69, 2021
- [J14] F. Bouchard, **A. Breloy**, G. Ginolhac, A. Renaux, F. Pascal, “A Riemannian Framework for Low-Rank Structured Elliptical Models,” IEEE Trans. on Sig. Proc., vol. 69, 2021
- [J13] B. Mériaux, C. Ren, **A. Breloy**, M. N. El Korso, P. Forster, “Mismatched Robust Estimation of Kronecker Product of Linearly Structured Scatter Matrices,” in IEEE Trans. on Sig. Proc., vol. 69, 2021
- [J12] A. Mian, A. Collas, **A. Breloy**, G. Ginolhac, J-P. Ovarlez, “Robust Low-rank Change Detection for Multivariate SAR Image Time Series,” in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 13, 2020
- [J11] A. Bouiba, M. N. El Korso, **A. Breloy**, P. Forster, M. Hamadouche, M. Lagha, “Two dimensional robust source localization under non-Gaussian noise,” in Circuits, Systems & Signal Processing, 2020.
- [J10] R. Ben Abdallah, **A. Breloy**, M. N. El Korso, D. Lautru, “Bayesian Signal Subspace Estimation with Compound Gaussian Sources,” in Signal Processing, vol. 167, 2020.
- [J9] G. Drašković, **A. Breloy**, F. Pascal, “On the performance of robust plug-in detectors using M-estimators,” in Signal Processing Journal, vol. 167, 2020
- [J8] G. Drašković, **A. Breloy**, F. Pascal, “On the asymptotics of Maronna’s robust PCA,” in IEEE Trans. on Sig. Proc., vol. 67, no. 19, 2019.
- [J7] B. Mériaux, C. Ren, M. N. El Korso, **A. Breloy**, P. Forster, “Robust estimation of structured scatter matrices in (mis)matched models,” in Signal Processing, vol. 165, 2019.
- [J6] R. Ben Abdallah, A. Mian, **A. Breloy**, A. Taylor, M. N. El Korso, D. Lautru, “Detection Methods Based on Structured Covariance Matrices for Multivariate SAR Images Processing,” in IEEE Geoscience and Remote Sensing Letters, vol. 16 , no. 7, 2019.
- [J5] B. Mériaux, C. Ren, M. N. El Korso, **A. Breloy**, P. Forster, “Asymptotic Performance of Complex M -Estimators for Multivariate Location and Scatter Estimation,” in IEEE Signal Processing Letters, vol. 26, no. 2, 2019.
- [J4] **A. Breloy**, G. Ginolhac, A. Renaux, F. Bouchard, “Intrinsic Cramér–Rao Bounds for Scatter and Shape Matrices Estimation in CES Distributions,” in IEEE Signal Processing Letters, vol. 26, no. 2, 2019.
- [J3] **A. Breloy**, G. Ginolhac, F. Pascal, P. Forster, “Robust Covariance Matrix estimation in Low-Rank Heterogeneous Context”, IEEE Trans. on Sig. Proc., vol. 64, no. 22, 2016.
- [J2] Y. Sun, **A. Breloy**, P. Babu, D.P. Palomar, F. Pascal, G. Ginolhac, “Low-Complexity Algorithms for Low Rank Clutter Parameters Estimation in Radar Systems”, IEEE Trans. on Sig. Proc., vol. 64, no. 8, 2016.
- [J1] **A. Breloy**, G. Ginolhac, F. Pascal, P. Forster, “Clutter Subspace Estimation in Low Rank Heterogeneous Noise Context,” in IEEE Trans. on Sig. Proc., vol. 63, no. 9, 2015.

¹Underlined authors are interns/Ph.D. students I supervised. Underlined-italics authors are students I worked with (not as supervisor). A switch back to the standard typography displays work conducted after their graduation.

Teaching activities

Degrees: I mostly teach for the first and second years of D.U.T. of the Electrical engineering (GEII) department (I.U.T. de Ville d'Avray). I am also involved in several courses for Master's degree (E2SC) and the FIPMECA formation (engineering degree).

Courses: My courses consist mostly in practicals (TP) and supervised group work (TD). I also supervise several student projects with various formats: individual or group projects, either autonomous or fully supervised on a series of practicals.

Topics : My teachings concern analog electronics, programming, microcontrollers, and digital signal processing. Below is a list of the courses I was involved in

- **Analog Electronics** (1st and 2nd year D.U.T GEII).
- **C/C++/Matlab programming** (1st and 2nd year D.U.T GEII).
- **Mathematics of signal analysis** (1st and 2nd year D.U.T GEII).
- **Microcontrollers, embedded systems** (1st year D.U.T GEII).
- **Digital signal processing** (2nd year D.U.T GEII, FIPMECA, M2-E2SC).
- **Automation, Control theory** (2nd year, D.U.T GEII).
- **Probability and statistics** (2nd year D.U.T GEII, M2-E2SC).
- **Statistical signal processing** (M2-E2SC).
- **Students projects**
 - 1st year **D.U.T. GEII** (semi-autonomous, $\sim 30h$)
 - * Labyrinth challenge (robotC programming, LEGO-NXT)
 - * Line tracking robot challenge (arduino programming)
 - 2nd year **D.U.T. GEII** (autonomous, $\sim 4h/\text{week}$ for 8 months)
 - * GEII Robotics cup, organized by Cachan I.U.T..
 - * BB-8 robot prototype.
 - **M2-E2SC and FIPMECA** (autonomous, $\sim 70h$)
 - * Shazam algorithm.
 - * “Audio beat tracking” (IEEE signal processing cup 2017)
 - * Audio sources localization.

Synthesis: In order to shorten the exposition, my teaching hours are simply reported below:

Teaching service synthesis				
Year	CM	TD	TP	Total (eqTD)
2015-2016	26	55.5	229.5	324 h
2016-2017	0	79	148	227 h
2017-2018	4	108	168	282 h
2018-2019	8	115	201	328 h
2019-2020	0	64.5	179.5	244 h
2020-2021	0	50	92	142 h + 1/2 CRCT

