

Aurélie FISCHER

Laboratoire de Probabilités, Statistique et Modélisation (LPSM)

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Positions held

Since 2012 Associate professor, Université Paris Cité, Campus des Grands Moulins.

2011–2012 Temporary teaching and research associate, IUT Paris Descartes.

2008–2011 Research and teaching assistant, Université Pierre et Marie Curie.

Academic curriculum

2022 **Habilitation à diriger des recherches**, *Theoretical issues and practical applications in statistical learning and nonparametric statistics. Principal curves, clustering, predictive models, aggregation of estimators*, defended on June 21, 2022 at Université Paris Cité.

Jury : Gérard Biau (Sorbonne Université), Gilles Blanchard (Referee, Université Paris Saclay), Stéphane Boucheron (Local referee, Université Paris Cité) Jérôme Dedecker (Chairman of the jury, Université Paris Cité), Mathilde Mougeot (ENSIE), Anne Philippe (Nantes Université), Wolfgang Polonik (Referee, University of California at Davis).

2008–2011 **PhD thesis** in Mathematics prepared in the Laboratoire de Statistique Théorique et Appliquée (LSTA), *Unsupervised statistical learning : high dimensionality and principal curves*, defended on June 9, 2011 at Université Pierre et Marie Curie, *summa cum laude*.

→ Prize Marie-Jeanne Laurent-Duhamel of the French Statistical Society.

Supervisor : Gérard BIAU (Université Paris 6).

Jury : Gérard Biau (Supervisor), Jérôme Dedecker (Université Paris 5), Paul Deheuvels (Chairman of the jury, Université Paris 6), Fabrice Gamboa (Referee, Université Toulouse 3), Balázs Kégl (Université Paris 11), Gábor Lugosi (Referee, Université Pompeu Fabra de Barcelone), Pascal Massart (Université Paris 11).

2005–2008 Ecole Normale Supérieure – Interuniversity Program in Fundamental and Applied Mathematics.

◇ L3 & M1 (Bachelor) in Mathematics.

◇ M2 (Master) in Probability and Statistics – Université Paris-Sud 11.

Thesis supervised by Pascal MASSART, entitled *On some functional data analysis methods*.

◇ Agrégation (teaching competitive exam) in Mathematics (option Probability and Statistics).

Teaching activities

Master responsibility

Since 2022, I have been in charge of the double Master 2 in Mathematics, Computer Science and Data Science (Mathématiques, Informatique et Data Science, MIDS), and since 2023, of the single version of this Master 2, opened as a work-study program.

Courses taught since 2020 at UFR de Mathématiques

2020–2024

Introduction to Machine Learning (R and Python software), M2 Random modeling (MO) and MIDS. Statistical learning (R software), M2 Statistical and Computer Engineering for Finance, Insurance and Risk (ISIFAR).

Teaching at other institutions

2021 : Ecole Polytechnique, Master tutorials in Regression, Statistics, Machine Learning.

2024 : Institut d'Etudes Politiques de Paris (Sciences Po), Master course IA & Society.

Supervisory and jury activities

Supervision

PhD

- 2014–2019 : PhD thesis of Maëlle Amand, with Nicolas Ballier (Université Paris Diderot) and Karen Corrigan (Newcastle University).
→ *A sociophonetic analysis of Newcastle English in the DECTE corpus : The case of FACE, GOAT, PRICE and MOUTH.* (Use of data analysis and statistical learning tools in phonetics).
- 2018-2022 : PhD thesis of Sothea Has, with Mathilde Mougeot (Centre Borelli, ENS Paris-Saclay).
→ *Consensus aggregation and distance measures for statistical learning. Theoretical contributions and applications to the energy sector.*

Post-doc

- Lucie Montuelle, with Dominique Picard and Mathilde Mougeot, LPSM, ANR project FOREWER (Modeling, forecasting and risk evaluation of wind energy production), 2015-2016.
- Sothea Has, with Riwal Plougouven, Laboratoire de Météorologie Dynamique, project of the Institut des Mathématiques pour la Planète Terre (Institute of Mathematics for Planet Earth), 2022-2024.
- Marina Gomtsyan, with Cyril Jayet, Groupe d'Etude des Méthodes de l'Analyse Sociologique de la Sorbonne (Study group for sociological analysis methods), project-team Estimia of Institut des Sciences des Données et du Calcul de Sorbonne Université (Institute for data science and computation), 2023-2025.

Internships

- Master 2 internship : Marie Garin (2017), Sothea Has (2018), Clarisse Thiard (2021), Raphaël Carpintero-Perez (2022).
- Master 1 internship (ENS) : Adam Mourjane (2021).
- 3rd year projects of Ecole Polytechnique, with Riwal Plougouven : Mehdi Kechiar, Côme de Lassus Saint-Geniès (2016-2017) ; Lishan Liao, Rebeca Doctors (2017-2018).

PhD thesis reports and juries

- PhD thesis reports : Etienne Lasalle (december 2022, supervisors Frédéric Chazal and Pascal Massart), Yoann Valero (november 2023, supervisors Myriam Maumy and Frédéric Bertrand).
- Other PhD thesis juries : Sophie Marque-Pucheu (octobre 2018, supervisor Josselin Garnier), Rancy El Nmeir (december 2020, supervisors Gilles Pagès and Rami El Haddad), Naveen Goutham (december 2022, supervisors Riwal Plougonven and Hiba Omrani), Louis Pujol (december 2022, supervisors Marc Glisse and Pascal Massart).

Research topics and participation in projects

Here are my **research topics**, which concern statistical learning and nonparametric statistics :

- Quantization and clustering,
- Curve estimation, connections between statistics and geometry,
- Predictive models, model selection, estimator aggregation,
- Interdisciplinary applications and collaborations, mainly in climate science and sociology.

Collective projects :

- Member of the ANR project TopData, led by Frédéric Chazal (INRIA Saclay), 2013–2017.
- Member of the ANR project FOREWER, led by Peter Tankov (Université Paris Diderot), 2014–2019.
- In charge of a PEPS CNRS young researcher project on Clustering, 2015–2016.
- Member of the PEPS CNRS I3A project GISL, led by Clément Levrard, 2017–2018.
- Coordinator of the PEPS CNRS I3A project DIAG, 2017–2018.
- Winner of the “Dynamique Recherche” call for proposals from Idex Université de Paris, 2019–2022.
- Member of the LabCom LOPF (Large-scale optimization of product flows), led by S. Gaiffas, 2021–2026.
- Winner of the interdisciplinary call for proposals “Climate Change, Environmental Challenges and Mathematics” of the Institut des Mathématiques pour la Planète Terre, with Riwal Plougonven, 2021–2023.
- Member of a Math-AmSud project 2021.
- Coordinator of the ANR GeoDSIC project (Geometry in Data : Statistical Inference and Clustering), 2023–2027.
- Member of the interdisciplinary project-team Estimia of the Institut des Sciences du Calcul et des Données, on the Analysis of spatial inequalities in mobility, led by Cyril Jayet, sociologist (Sorbonne Université, Groupe d’Etude des Méthodes de l’Analyse Sociologique de la Sorbonne), 2022–2025.
- Member of the project Climaths of the Programme et équipements prioritaires de recherche (PEPR) exploratoire (Exploratory priority research programs and equipment) Maths-VivES, led by Anne-Laure Dalibard et Freddy Bouchet, 2024–2028.

Publications and prepublications

- [1] A. Fischer (2010). Quantization and clustering with Bregman divergences, *Journal of Multivariate Analysis*, Vol. 101, p. 2207-2221.
- [2] A. Fischer (2011). On the number of groups in clustering, *Statistics and Probability Letters*, Vol. 81, p. 1771-1781.
- [3] G. Biau & A. Fischer (2012). Parameter selection for principal curves, *IEEE Transactions on Information Theory*, Vol. 58, p. 1924-1939.
- [4] B. Auder & A. Fischer (2012). Projection-based curve clustering, *Journal of Statistical Computation and Simulation*, Vol. 82, p. 1145-1168.
- [5] A. Fischer (2013). Selecting the length of a principal curve within a Gaussian model, *Electronic Journal of Statistics*, Vol. 7, p. 342-363.
- [6] M. Alsheh Ali, J. Seguin, A. Fischer, N. Mignet, L. Wendling & T. Hurtut (2013). Automatic analysis of the spatial organization in colorectal tumors using second-order statistics and functional ANOVA, in *Proc. IEEE International Symposium on Image and Signal Processing and Analysis (ISPA)*.
- [7] A. Fischer (2014). Deux méthodes d'apprentissage non supervisé : synthèse sur la méthode des centres mobiles et présentation des courbes principales, *Journal de la Société Française de Statistique*, Vol. 155, p. 2-35.
- [8] J. Dedecker, A. Fischer & B. Michel (2015). Improved rates for Wasserstein deconvolution with ordinary smooth error in dimension one, *Electronic Journal of Statistics*, Vol. 9, p. 234-265.
- [9] A. Fischer (2015). On two extensions of the vector quantization scheme, *Journal de la Société Française de Statistique*, Vol. 156, p. 51-75.
- [10] G. Biau, A. Fischer, B. Guedj & J. Malley (2016). COBRA : A collective regression strategy, *Journal of Multivariate Analysis*, Vol. 146, p. 18-28.
- [11] A. Fischer, L. Montuelle, M. Mougeot & D. Picard (2017). Statistical learning for wind power : a modeling and stability study towards forecasting, *Wind Energy*, Vol. 20, p. 2037-2047.
- [12] B. Alonzo, R. Plougonven, M. Mougeot, A. Fischer, A. Dupré and P. Drobinski (2018). From Numerical Weather Prediction outputs to accurate local surface Wind speed : statistical modelling and forecasts, In *Renewable Energy : Forecasting and Risk Management*, Springer Proceedings in Mathematics & Statistics.
- [13] A. Fischer & M. Mougeot (2019). Aggregation using input-output trade-off, *Journal of Statistical Planning and Inference*, Vol. 200, p. 1-19.
- [14] S. Delattre & A. Fischer (2020). On principal curves with a length constraint, *Annales de l'Institut Henri Poincaré*, Vol. 56, p. 2108-2140.
- [15] A. Fischer & D. Picard (2020). On change-point estimation under Sobolev sparsity, *Electronic Journal of Statistics*, Vol. 14, p. 1648-1689.
- [16] C. Bréchet, A. Fischer & C. Levrard (2021). Robust Bregman Clustering, *The Annals of Statistics*, Vol. 49, p. 1679-1701.
- [17] N. Goutham, B. Alonzo, A. Dupré, R. Plougonven, R. Doctors, L. Liao, M. Mougeot, A. Fischer & P. Drobinski (2021). Using machine learning methods to improve surface wind speed from the outputs of a Numerical Weather Prediction model, *Boundary-Layer Meteorology*, Vol. 179, p. 133-161.
- [18] A. Fischer, S. Has & M. Mougeot (2021). A clusterwise supervised learning procedure based on aggregation of distances, *Journal of Statistical Computation and Simulation*, Vol. 91, p. 2307-2327.
- [19] G. Kluth, J.-F. Ripoll, S. Has, A. Fischer, M. Mougeot & E. Camporeale (2022). Machine learning methods applied to the global modeling of event-driven pitch angle diffusion coefficients during high-speed streams, *Frontiers in Physics*, Vol. 10.
- [20] S. Delattre & A. Fischer (2023). Estimation via length-constrained generalized empirical principal curves under small noise.

- [21] S. Has, R. Plougonven, A. Fischer, R. Raj, F. Lott, A. Hertzog, A. Podglajen & M. Corcos (2023). Reconstructing balloon-observed gravity wave momentum fluxes using machine learning and input from ERA5.

Oral presentations at conferences

- ◇ May 2009, Research group workshop MASCOT–NUM, Institut Henri Poincaré, Paris.
- ◇ May 2009, 41^{es} Journées de Statistique de la SFdS, Bordeaux.
- ◇ September 2009, 3^{es} Rencontres des Jeunes Statisticiens, Aussois.
- ◇ May 2010, 42^{es} Journées de Statistique de la SFdS, Marseille.
- ◇ August 2010, Statistique Mathématique et Applications, Fréjus.
- ◇ September 2011, 4^{es} Rencontres des Jeunes Statisticiens, Aussois.
- ◇ May 2012, 44^{es} Journées de Statistique de la SFdS, Brussels.
- ◇ May 2013, Congrès SMAI – 6^e Biennale Française des Mathématiques Appliquées et Industrielles, Seignosse.
- ◇ September 2013, Statistique Mathématique et Applications, Fréjus.
- ◇ December 2013, ERCIM – 6th International Conference on Computational and Methodological Statistics, London (invited by A. Grane et A. Arribas-Gil).
- ◇ June 2014, 46^{es} Journées de Statistique de la SFdS, Rennes (invited).
- ◇ August 2014, Journées MAS, Toulouse (invited by S. Loustau).
- ◇ August 2015, Statistique Mathématique et Applications, Fréjus.
- ◇ October 2015, Workshop de l'ANR TopData, Porquerolles.
- ◇ May 2016, 48^{es} Journées de Statistique de la SFdS, Montpellier.
- ◇ May 2017, 49^{es} Journées de Statistique de la SFdS, Avignon.
- ◇ June 2017, ANR TopData workshop, Banyuls.
- ◇ September 2017, ENBIS conference, Napoli (invited by M. Mougeot).
- ◇ May 2018, 50^{es} Journées de Statistique de la SFdS, Saclay.
- ◇ Septembre 2018, PEPS project GISL workshop, Pornichet.
- ◇ June 2019, 51^{es} Journées de Statistique de la SFdS, Nancy.
- ◇ November 2021, Autumn school, IMPPT, Impacts morphologiques du changement climatique, Lyon.
- ◇ Décembre 2021, Journée Data/IA en Mécanique, ENSTA, Palaiseau.
- ◇ June 2022, 53^{es} Journées de Statistique de la SFdS, Lyon.
- ◇ June 2023, Annual meeting of the research group “Défis théoriques pour les sciences du climat”, IHP (invited).
- ◇ June 2024, 54^{es} Journées de Statistique de la SFdS, Bordeaux (invited).

Seminar and working group presentations

- ◇ October 2008, Groupe de travail des thésards, LSTA, Université Pierre et Marie Curie.
- ◇ March 2009, CIES Jussieu.
- ◇ February 2010, Séminaire de Statistique, AgroParisTech.
- ◇ March 2010, Groupe de travail des thésards et jeunes docteurs du MAP5, Université Paris Descartes.
- ◇ October 2010, Groupe de travail des thésards, LSTA, Université Pierre et Marie Curie.
- ◇ January 2011, Groupe de Travail de Statistique de Jussieu, Université Pierre et Marie Curie.
- ◇ October 2011, Groupe de travail de Statistique du MAP5, Université Paris Descartes.
- ◇ October 2011, Séminaire de Probabilités et Statistique, Montpellier SupAgro.

- ◇ November 2011, Séminaire de l'équipe Probabilités et Statistiques du LMO, Université Paris-Sud.
- ◇ November 2011, Groupe de travail en Statistique et Biostatistique, Institut Elie Cartan, Nancy.
- ◇ February 2012, Séminaire du Laboratoire Hubert Curien, Saint-Etienne.
- ◇ February 2012, Séminaire de Statistique, Institut de Mathématiques de Toulouse.
- ◇ March 2012, Séminaire de Statistique, AgroParisTech.
- ◇ March 2012, Séminaire de Probabilités et Statistique, Institut Camille Jordan, Lyon.
- ◇ March 2013, Séminaire de Probabilités et Statistique, LAREMA, Angers.
- ◇ April 2013, Séminaire de Probabilités, LPMA, Université Paris Diderot.
- ◇ May 2013, Séminaire Parisien de Statistique, Institut Henri Poincaré, Paris.
- ◇ December 2013, Journée de lancement du projet ANR TopData, INRIA Saclay.
- ◇ April 2014, Séminaire de l'équipe Geometrica, INRIA Saclay.
- ◇ September 2014, Séminaire de Statistique, Université Libre de Bruxelles.
- ◇ March 2016, Séminaire de l'équipe Probabilités et Statistiques du LMO, Université Paris-Sud.
- ◇ June 2016, Séminaire Parisien de Statistique, Institut Henri Poincaré, Paris.
- ◇ March 2017, Séminaire de Statistique et Econométrie, Université Lille 3.
- ◇ November 2017, Séminaire commun de Statistique P6/P7.
- ◇ October 2018, Séminaire Quetelet, Université de Gand, Belgique.
- ◇ March 2019, Séminaire de Statistique, AgroParisTech.
- ◇ April 2019, Séminaire de Statistique, Université Paul Sabatier de Toulouse.
- ◇ April 2019, Groupe de travail de Statistique du MAP5, Université Paris Descartes.
- ◇ May 2019, Séminaire de l'équipe Probabilités et Statistiques du LMO, Université Paris-Sud.
- ◇ May 2019, Colloquium du MAP5, Université Paris Descartes.
- ◇ November 2019, Groupe de travail de mathématiques appliquées, ENS Rennes.
- ◇ April 2020, Séminaire en ligne du LPSM.
- ◇ May 2020, Séminaire de Probabilité et Statistiques du Laboratoire Paul Painlevé, Université de Lille.
- ◇ May 2021, Séminaire de Probabilités et Statistique, LAREMA, Angers.
- ◇ October 2021, Séminaire de l'équipe Probabilités et Statistiques du LMO, Université Paris-Saclay.
- ◇ January 2022, Séminaire du CMAP, Ecole Polytechnique.
- ◇ December 2023, Groupe de Travail MathsInFluids, ENS Lyon.

Administrative activities and collective responsibilities

- ◇ Associate Editor for the journal Computational Statistics.
- ◇ Referee for the journals :
Annales de l'Institut Henri Poincaré (B) Probabilités et Statistiques, Computational Statistics, Electronic Journal of Statistics, IEEE Transactions on Information Theory, Journal of Multivariate Analysis, Journal of the Royal Statistical Society : Series B (Statistical Methodology), Journal de la Société Française de Statistique, Journal of Statistical Planning and Inference, Mathematical Geosciences, SIAM Journal on Imaging Sciences, Statistics and Probability Letters, Wind Energy.
- ◇ Coordination of Forum Entreprises et Mathématiques (Maths-Industry Forum for students) : october 2023, Conservatoire National des Arts et Métiers (National Conservatory of Arts and Crafts); october 2024, La Villette.

- ◇ Organization of the Thematic Quarter “Statistics and Geometry in Data Sciences” at Institut Henri Poincaré (septembre-décembre 2022).
- ◇ With Gilles Blanchard and Matthieu Lerasle, coordination of the creation of a Maths-AI portal on the initiative of the Fondation Sciences Mathématiques de Paris and the Fondation Mathématique Jacques Hadamard (the two Maths Foundations of Paris and surrounding area).
- ◇ Member of the SFdS Council (since 2021).
- ◇ Co-organizer of the LPSM Seminar (since 2019).
- ◇ Co-organizer of the LPSM Statistics Working Group (2015–2018).
- ◇ Organization of Mini-Symposia at the SMAI Conference (2017, 2019).
- ◇ Member of the LPSM Council (elected, since 2018), member of the LPMA Council (2016–2018).
- ◇ Member of the UFR de Mathématiques Council (elected, 2015–2021 ; guest since 2022).
- ◇ Correspondent of the Agence des Mathématiques en Interaction avec l’Entreprise et la Société (since 2015) and correspondent valorization of the Institut National des Sciences Mathématiques et de leurs Interactions, Centre National de la Recherche Scientifique (since 2021) for LPSM.
- ◇ Member of the Section 41 (Mathematics) of the Comité National de la Recherche Scientifique (2017-2021), member of the board (2020-2021).
- ◇ Member of the visiting committee of Institut Camille Jordan de Lyon (2020).
- ◇ Recruitment : member of selection committees for associate professor positions.
 - 2014 : Université de Poitiers.
 - 2015 : Université Paris Diderot.
 - 2016 : Université Pierre et Marie Curie (2 committees), Université Paris Diderot.
 - 2017 : Université Pierre et Marie Curie, Université Paris Diderot.
 - 2018 : Université Paris Diderot.
 - 2020 : Université Paris-Saclay.
 - 2022 : Université de Paris, Université de Bordeaux.
 - 2023 : Université Paris-Nanterre (2 positions).
- ◇ Evaluation of CIFRE (convention university – industry) PhD thesis topics (2016, 2019).