

Agathe **Fernandes Machado**

PHD STUDENT · DEPARTMENT OF MATHEMATICS

UNIVERSITÉ DU QUÉBEC À MONTRÉAL (UQAM), MONTREAL

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Research topics

- **Machine Learning** Models,
- Trustworthy Artificial Intelligence (AI)
 - **Algorithmic Fairness** via **Causal Inference** and Optimal Transport Theory,
 - Explainability (XAI): Cooperative Game Theory, Counterfactual Explanations,
 - Model Reliability: **Calibration**,
 - Uncertainty Quantification: Conformal Prediction,
- Applied Mathematics: Actuarial Science (Climate Risks).

Technical Skills

- Programming Languages: Python, R, MATLAB, SQL, Java,
- Machine Learning & Data Science: scikit-learn, PyTorch, Pandas, NumPy,
- Tools & Platforms: GitHub, Jupyter, VS Code, Linux.

Education

PhD student in Mathematics

UNIVERSITÉ DU QUÉBEC À MONTRÉAL

Montréal (Canada)

2023 – 2027

- Thesis title: **Algorithmic Fairness and Discrimination in Predictive Models**;
- Supervisors: Arthur Charpentier, Ewen Gallic;
- **PhD Courses** at Mila Institute (Montreal)
 - **Probabilistic and Graphical Models** (Simon Lacoste-Julien, Fall 2023): Directed and Undirected Graphical Models, Gaussian Networks, Approximate Inference,
 - **Representation Learning** (Aaron Courville, Winter 2024): CNNs, RNNs, LSTM, Transformers, GANs, Applications on PyTorch.

Master's in Actuarial Science (with High Honors)

EURIA, UNIVERSITÉ DE BRETAGNE OCCIDENTALE

Brest (France)

2021 – 2023

Double Degree with IMT Atlantique

Master's from a Generalist Engineering School

IMT ATLANTIQUE

Brest (France)

2019 – 2023

Major: Mathematical and Computational Engineering: Statistical Learning, Stochastic Processes and Numerical Optimization

Classes Préparatoires aux Grandes Ecoles, Physics, Chemistry, and Engineering Sciences (Equivalent to a Bachelor's degree) (with Honors)

LYCÉE CHATEAUBRIAND

Rennes (France)

2017 – 2019

- Major: Mathematics, Physics, Chemistry;
- Second year in PC*, called "star class".

Work experience

Internship in actuarial science (1 year) - Reinsurance pricing and Climate modeling

GENERALI, INSURANCE COMPANY

Nantes (France)

2022 – 2023

- Programming: RMS (natural disaster modeling), Python, R, PySpark.

Internship in actuarial science (3 months) - Climate modeling (Drought risk)

SEABIRD, CONSULTING FIRM IN INSURANCE/FINANCE

Paris (France)

2023

- **Extreme value theory**: analysis of clay shrinkage and swelling risk based on drought index values (KBDI, SSWI) and portfolio claims experience;
- Participation in a mission to merge loan insurance products.

Internship Data scientist (4 months)

CRÉDIT AGRICOLE, BANK, MARKETING RESEARCH AND DEVELOPMENT DEPARTMENT

- Optimization of scores from machine learning methods based on tracking and customer profile data (XGBoost, Random Forest, etc.);
- Programming: SAS Guide, Python and Big Data tools.

Vannes (France)

2021

Internship JavaScript Development (1 month)

DAWIZZ, START-UP IN IT

Vannes (France)

2019

Research projects

Visiting researcher (4 months) - Causal Inference: Potential Outcomes Framework

AIX-MARSEILLE SCHOOL OF ECONOMICS (AMSE)

- Robustness of **Average Treatment Effect** (ATE) estimators to the miscalibration of propensity scores (with **Inverse Probability Weighting** and **Double Machine Learning**).

Marseille (France)

2025/2026

Visiting researcher (2 months) - Discrimination in Mortality Scores

MILLIMAN FRANCE - CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS (CNAM)

- Theoretical development and implementation of a **mitigation technique for a group-fairness criterion**, **Predictive Parity**;
- Writing an article intended for submission within the year 2026.

Paris (France)

2025

Development of the Python package EquiPy

UNIVERSITÉ DU QUÉBEC À MONTRÉAL

- **Post-processing method to mitigate discrimination** in the predictions of a machine learning model, **Sequential Fairness**;
- Documentation: <https://equilibration.github.io/equipy/>.

Montréal (Canada)

2023

Actuarial research thesis (1 year) - Reinsurance pricing and Climate modeling

GENERALI, EURIA (UNIVERSITÉ DE BRETAGNE OCCIDENTALE)

- Thesis title: Marginal contribution of industrial sites to the reinsurance cost of an excess of loss per event treaty;
- Application of reinsurance pricing methods for an excess of loss per event treaty to industrial risks (companies) using Monte-Carlo methods.

Nantes (France)

2022 – 2023

Actuarial research project with Sia Partners (1 year) - Climate modeling

SIA PARTNERS, EURIA (UNIVERSITÉ DE BRETAGNE OCCIDENTALE)

- Projection of drought risk in France, measured by the KBDI index, using temperature and precipitation data (<https://data.nasa.gov>) and IPCC scenarios;
- Implementation of a climate scenario generator with R.

Paris (France)

2021 – 2022

Publications

Published articles

1. Fernandes Machado, A., Charpentier, A., & Gallic, E. (2025). Optimal Transport on Categorical Data for Counterfactuals using Compositional Data and Dirichlet Transport. *34th International Joint Conference on Artificial Intelligence (IJCAI 2025)*.
2. Il Idrissi, M., Fernandes Machado, A., & Charpentier, A. (2025). Beyond Shapley Values: Cooperative Games for the Interpretation of Machine Learning Models. *34th International Joint Conference on Artificial Intelligence (IJCAI 2025) Workshop on Explainable Artificial Intelligence (XAI)*.
3. Fernandes Machado, A., Charpentier, A., & Gallic, E. (2025). Sequential conditional transport on probabilistic graphs for interpretable counterfactual fairness. *The 39th Annual AAAI Conference on Artificial Intelligence (AAAI 2025)*.
4. Fernandes Machado, A., Charpentier, A., Flachaire, E., Gallic, E. & Hu, F. (2024). Post-Calibration Techniques: Balancing Calibration and Score Distribution Alignment. *Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS 2024) BDU Workshop*.

Preprints

1. Il Idrissi, M., Fernandes Machado, A., Gallic, E., & Charpentier, A. (2025). *Unveil Sources of Uncertainty: Feature Contribution to Conformal Prediction Intervals*. <https://arxiv.org/abs/2505.13118>
2. Fernandes Machado, A., Grondin, S., Ratz, P., Charpentier, A., & Hu, F. (2025). *EquiPy: Sequential Fairness using Optimal Transport in Python*. <https://arxiv.org/abs/2503.09866>

3. Fernandes Machado, A., Charpentier, A., Flachaire, E., Gallic, E., & Hu, F. (2024). *Probabilistic scores of classifiers, calibration is not enough*. <https://arxiv.org/abs/2408.03421>
4. Fernandes Machado, A., Charpentier, A., Flachaire, E., Gallic, E., & Hu, F. (2024). *From uncertainty to precision: Enhancing binary classifier performance through calibration*. <https://arxiv.org/abs/2402.07790>
5. Fernandes Machado, A., Hu, F., Ratz, P., Gallic, E., & Charpentier, A. (2024). *Geospatial disparities: A case study on real estate prices in paris*. <https://arxiv.org/abs/2401.16197>

Conferences, Workgroups, Seminars

1. 03/2026 Workshop When Uncertainty Quantification meets Causal Modelling and Inference (SCAI, Paris): *Causal Mediation Analysis via Sequential Transport to Assess Counterfactual Fairness*.
2. 03/2026 Workshop AI in risk assessment and mitigation (ICMS & Bayes centre, Edinburgh): *Measuring Fairness through Calibration in Insurance Scoring Algorithms.*, https://github.com/fer-agathe/calibration_fairness_insurance.git.
3. 02/2026 APSPP/SINCLAIR Seminar (EDF Lab Chatou, Paris): *Unveil Sources of Uncertainty in Machine Learning Models: Feature Contribution to Conformal Prediction Intervals*.
4. 02/2026 Causal Decision Making, Algorithms and Fairness Workshop (Rotterdam School of Management, Erasmus University): *Assessing Counterfactual Fairness via (Marginally) Optimal Transport*.
5. 02/2026 Econometrics and Big Data Seminar (Aix-Marseille School of Economics, France): *Assessing Counterfactual Fairness via (Marginally) Optimal Transport*.
6. 01/2026 Mathematics Seminar (University of Bretagne Occidentale, Brest, France): *Unveil Sources of Uncertainty in Machine Learning Models: Feature Contribution to Conformal Prediction Intervals*.
7. 01/2026 UvA, SIAS Seminar (University of Amsterdam): *Assessing Counterfactual Fairness via (Marginally) Optimal Transport*.
8. 01/2026 QARMA Seminar (University of Aix-Marseille, France): *Assessing Counterfactual Fairness via (Marginally) Optimal Transport*.
9. 10/2025 Quantact Seminar on Actuarial and Financial Mathematics (ULaval, Quebec): *Unveil Sources of Uncertainty in Machine Learning Models: Feature Contribution to Conformal Prediction Intervals*.
10. 10/2025 CIRRELT Monthly Reading group at Polytechnique Montreal: *Assessing Counterfactual Fairness via Optimal Transport Theory*.
11. 09/2025 PrivSec Days 2025 on Privacy and Security of AI (Montreal): *Assessing Counterfactual Fairness via Optimal Transport Theory*.
12. 08/2025 34th International Joint Conference on Artificial Intelligence IJCAI 2025 (Montreal): *Optimal Transport on Categorical Data for Counterfactuals using Compositional Data and Dirichlet Transport.*, Oral Presentation.
13. 08/2025 Doctoral Consortium - 34th International Joint Conference on Artificial Intelligence IJCAI 2025 (Montreal): *Ensuring Reliable and Transparent Algorithmic Fairness through Optimal Transport and Uncertainty Quantification.*, Oral Presentation, <https://2025.ijcai.org/doctoral-consortium-program/>.
14. 08/2025 Actuarial and statistical summer seminar (Université du Québec à Montréal): *EquiPy: A Python Package implementing Sequential Fairness with Optimal Transport.*, https://github.com/TommyMastro/Seminaire_actu_stats_UQAM.git.
15. 06/2025 Workshop Calibrating prediction uncertainty, statistics and machine learning perspectives (Isaac Newton Institute, Cambridge): *Beyond Calibration of Probabilistic Classifier Outputs.*, <https://www.newton.ac.uk/event/rclw02/>.
16. 05/2025 STATQAM Research Day (Université du Québec à Montréal, Montréal): *Assessing Counterfactual Fairness via (Marginally) Optimal Transport*, https://github.com/fer-agathe/statqam_research_day.git.
17. 02/2025 Actuarial and Financial Mathematics Conference (AG Campus, Brussels): *Predicting Unobserved Multi-Class Sensitive Attributes: Enhancing Calibration with Nested Dichotomies for Fairness.*, https://github.com/fer-agathe/AFM_2025.git.
18. 01/2025 Workshop (Milliman France, Paris): *Analyzing Discrimination in Mortality Scores*.
19. 01/2025 Seminar PSPP (EDF Lab Chatou, Paris): *Challenging the performance of binary classifiers through the notion of calibration*.

20. 12/2024 NeurIPS 2024 Workshop on Bayesian Decision-making and Uncertainty (Vancouver): *Post-Calibration Techniques: Balancing Calibration and Score Distribution Alignment.*, <https://hal.science/hal-04916151/>.
21. 08/2024 Actuarial and statistical summer seminar (Université du Québec à Montréal): *Probabilistic scores of classifiers, calibration is not enough.*, https://github.com/TommyMastro/Seminaire_actu_stats_UQAM.git.
22. 08/2024 Seminar *Seminario de Matemáticas Aplicadas* (Quantil, Colombia, remote): package `EquiPy`, https://github.com/fer-agathe/quantil_seminar.git.
23. 06/2024 Insurance Data Science Conference (Stockholm University): *Probabilistic scores of classifiers, calibration is not enough.*, https://github.com/fer-agathe/IDSC_2024.git.
24. 05/2024 Annual Conference *Société Canadienne de Science Economique 2024* (HEC Montréal): *From uncertainty to precision: Enhancing binary classifier performance through calibration.*, https://github.com/fer-agathe/scse_2024.git.
25. 05/2024 Workshop on Fairness and Discrimination in Insurance 2024 (Université Laval, Québec): package `EquiPy`.
26. 04/2024 Science Research Day 2024 (Université du Québec à Montréal): 4-minute presentation of the research project, https://github.com/fer-agathe/projet_recherche_court.git.
27. 05/2024 Workshop in Insurance Mathematics 2024 (Concordia University, Montréal): poster presentation, package `EquiPy`, https://github.com/fer-agathe/WIM_2024_equipy.git.

Scholarships

Scholarship for a Research internship in France (CRM)

CRM, Montreal

RESEARCH INTERNSHIP SCHOLARSHIPS IN FRANCE FOR CENTRE DE RECHERCHES MATHÉMATIQUES (CRM) STUDENTS

2025

Mobility scholarship (UQAM)

Université du Québec à Montréal

THE INTERNATIONAL MOBILITY AND SHORT STAYS OUTSIDE QUEBEC PROGRAM OF THE MINISTRY OF HIGHER EDUCATION IS INTENDED FOR UQAM STUDENTS WHO WISH TO UNDERTAKE A STUDY STAY OF AT LEAST THREE WEEKS OUTSIDE CANADA.

2025

PhD scholarship Renewal (OBVIA)

Université du Québec à Montréal

SUPPORTING THE NEXT GENERATION SCHOLARSHIP PROGRAM 2025, INTERNATIONAL OBSERVATORY ON THE SOCIETAL IMPACTS OF AI AND DIGITAL TECHNOLOGIES

2025

Scholarship for a Research internship in France (CRM)

CRM, Montreal

RESEARCH INTERNSHIP SCHOLARSHIPS IN FRANCE FOR CENTRE DE RECHERCHES MATHÉMATIQUES (CRM) STUDENTS

2024

PhD scholarship (OBVIA)

Université du Québec à Montréal

SUPPORTING THE NEXT GENERATION SCHOLARSHIP PROGRAM 2024, INTERNATIONAL OBSERVATORY ON THE SOCIETAL IMPACTS OF AI AND DIGITAL TECHNOLOGIES

2024

Teaching experience

Statistics

Interpretability Methods for Machine Learning models (6 hours of lectures)

EURIA, UBO

MASTER'S DEGREE YEAR 1 (40 STUDENTS)

2026

- Introduction to Git, GitHub and Visual Studio Code;
- Overview of interpretability methods for machine learning models and application of `SHAP` and Partial Dependence Plots (`PDP`) in Python.

Statistical learning (3 hours of lectures and 3 hours of laboratory sessions)

Université du Québec à Montréal

FIRST CYCLE (17 STUDENTS)

2024

- Linear models, polynomial regression, linear classification (logistic and multinomial regressions), variable selection methods (best subset method, forward, backward, and stepwise), regression regularization methods (Lasso and Ridge), applications using R;
- Website: <https://etudier.uqam.ca/STT3030>.

IT

Introduction to Python (8 hours of laboratory sessions)

IMT Atlantique

SECONDARY STUDENTS

2021

As part of an academic project titled “Sustainable Development and Social Engagement,” along with 5 other students, we taught 4 Python classes to Secondary 1 to 3 students, targeting girls to encourage gender equality in technological and IT professions.

Student supervision

Bachelor

Allison Lara Nieva

Université du Québec à Montréal

RESEARCH INTERNSHIP OF 3 MONTHS

2025

Combining decision trees and logistic regression models;
Co-supervision of internship with Ewen Gallic and Arthur Charpentier.

Iryna Voitsitska

Université du Québec à Montréal

RESEARCH INTERNSHIP OF 3 MONTHS

2025

Using Optimal Transport theory to estimate counterfactuals within causal inference;
Co-supervision of internship with Ewen Gallic and Arthur Charpentier.

Ana-Maria Patrón Piñerez

Université du Québec à Montréal

RESEARCH INTERNSHIP OF 3 MONTHS

2024

Algorithmic Fairness: Bayesian methods to predict ethnicity following Colorado legislation SB21-169;
Co-supervision of internship with Arthur Charpentier.

Participating in collective tasks

Peer Review Activities

1. 2026 Reviewer for the [International Conference on Machine Learning \(ICML\) 2026](#).
2. 2025/2026 Reviewer for the [AISTATS 2026](#) conference.
3. 2024/2025 Reviewer for the [European Actuarial Journal \(EAJ\)](#).

Research

1. 05/2025 Organization of the 2025 Scientific Day of the OBVIA Community (HEC, Montréal): organization and development of a creative method to present and connect the research work of student members of the OBVIA institute.
2. 09/2024 Organization of the Quantact seminar (Université du Québec à Montréal): Presentation by Adel Cherali (Milliman, France) on applications of Large Language Models in insurance.
3. 05/2024 Co-organization of Quantact Summer Day (Université de Montréal): A day of presentations by students enrolled in master’s or PhD programs in actuarial sciences and financial mathematics, from universities across Quebec (Université de Montréal, Université du Québec à Montréal, HEC Montréal, Université de Sherbrooke, Université Laval and Concordia University).