

# Agathe **Fernandes Machado**

PHD STUDENT · DEPARTMENT OF MATHEMATICS

UNIVERSITÉ DU QUÉBEC À MONTRÉAL (UQAM), MONTRÉAL

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she/her

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fer-agathe

## Research topics

- Machine Learning;
- Actuarial Science;
- Applied Mathematics.

## Work experience

### Internship in actuarial science (1 year) - Reinsurance and Natural hazards (Storms)

Nantes (France)

GENERALI, INSURANCE COMPANY

2022 – 2023

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

### Internship in actuarial science (3 months) - Drought risk

Paris (France)

SEABIRD, CONSULTING FIRM IN INSURANCE/FINANCE

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)

Vannes (France)

CRÉDIT AGRICOLE, BANK, MARKETING RESEARCH AND DEVELOPMENT DEPARTMENT

2021

- 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.

### Internship JavaScript Development (1 month)

Vannes (France)

DAWIZZ, START-UP IN IT

2019

## Research projects

### Visiting researcher (2 months) - Discrimination in Mortality Scores

Paris (France)

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

2025

- Theoretical development and implementation of a mitigation technique for a group-fairness criterion, [Predictive Parity](#);
- Writing an article intended for submission within the year 2025.

### Development of the Python package EquipPy

Montréal (Canada)

UNIVERSITÉ DU QUÉBEC À MONTRÉAL

2023

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

### Actuarial research thesis (1 year) - Reinsurance and Storm risk

Nantes (France)

GENERALI, EURIA (UNIVERSITÉ DE BRETAGNE OCCIDENTALE)

2022 – 2023

- 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 the Monte-Carlo method.

### Actuarial research project with Sia Partners (1 year)

Paris (France)

SIA PARTNERS, EURIA (UNIVERSITÉ DE BRETAGNE OCCIDENTALE)

2021 – 2022

- 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.

## Education

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### PhD student in Mathematics

UNIVERSITÉ DU QUÉBEC À MONTRÉAL

- Thesis title: Algorithmic Fairness and Discrimination;
- Supervisors: Arthur Charpentier, Ewen Gallic.

Montréal (Canada)

2023 – In progress

### Master's in Actuarial Science (with High Honors)

EURIA, UNIVERSITÉ DE BRETAGNE OCCIDENTALE

Double Degree with IMT Atlantique

Brest (France)

2021 – 2023

### Master's from a Generalist Engineering School

IMT ATLANTIQUE

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

Brest (France)

2019 – 2023

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

LYCÉE CHATEAUBRIAND

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

Rennes (France)

2017 – 2019

## Publications

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### Published articles

1. 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*.
2. 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)*.

### Preprints

1. 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>
2. 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>
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., Grondin, S., Ratz, P., Charpentier, A., & Hu, F. (2025). *EquiPy: Sequential Fairness using Optimal Transport in Python*. <https://arxiv.org/abs/2503.09866>
5. Fernandes Machado, A., Charpentier, A., & Gallic, E. (2025). *Optimal Transport on Categorical Data for Counterfactuals using Compositional Data and Dirichlet Transport*. <https://arxiv.org/abs/2501.15549>

### Other scientific publications

1. Python package EquiPy. <https://github.com/equilibration/equipy.git>

## Conferences, Workgroups, Seminars

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1. 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](https://github.com/fer-agathe/AFM_2025.git).
2. 01/2025 Workshop (Milliman France, Paris): *Analyzing Discrimination in Mortality Scores*.
3. 01/2025 Seminar PSPP (EDF Lab Chatou, Paris): *Challenging the performance of binary classifiers through the notion of calibration*.
4. 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/>.

5. 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](https://github.com/TommyMastro/Seminaire_actu_stats_UQAM.git).
6. 08/2024 Seminar *Seminario de Matemáticas Aplicadas* (Quantil, Colombia, remote): package EquiPy, [https://github.com/fer-agathe/quantil\\_seminar.git](https://github.com/fer-agathe/quantil_seminar.git).
7. 06/2024 Insurance Data Science Conference (Stockholm University): *Probabilistic scores of classifiers, calibration is not enough.*, [https://github.com/fer-agathe/IDSC\\_2024.git](https://github.com/fer-agathe/IDSC_2024.git).
8. 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](https://github.com/fer-agathe/scse_2024.git).
9. 05/2024 Workshop on Fairness and Discrimination in Insurance 2024 (Université Laval, Québec): package EquiPy.
10. 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](https://github.com/fer-agathe/projet_recherche_court.git).
11. 05/2024 Workshop in Insurance Mathematics 2024 (Concordia University, Montréal): poster presentation, package EquiPy, [https://github.com/fer-agathe/WIM\\_2024\\_equipy.git](https://github.com/fer-agathe/WIM_2024_equipy.git).

## Scholarships

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### 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

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### Statistics

#### 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

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### Bachelor

#### 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

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### Research

1. 09/2024 Organization of the Quantact seminar (Université du Québec à Montréal): Presentation by Adel Cherchali (Milliman, France) on applications of Large Language Models in insurance.
2. 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).

## Langues

ENGLISH: Fluent  
SPANISH: Intermediate  
FRENCH: Native

## Computer Skills

Programming Languages:	R (advanced), Python (advanced), SAS (advanced), SQL (advanced), PyTorch (basics), MATLAB (basics), Java (basics), JavaScript (basics), C++ (basics)
Markup Languages:	LaTeX, Markdown
Office software:	Ms Office (Word, Excel, PowerPoint, Access), LibreOffice