Catherine Fontaine

e-mail: catherine.fontaine2@mail.mcgill.ca

EDUCATION

McGill University 09/2021 – 04/2025
B.Sc. Joint Honours Mathematics and Computer Science GPA: 3.90

- Courses: Advanced Probability Theory I, Mathematics for Machine Learning, Honours Analysis III, Honours Algebra IV, Honours Algorithm Design

COMPLEMENTARY TRAINING

CRM-PIMS Summer School in Probability Centre de Recherches Mathématiques, 07/2024

- Attended conferences on random matrices, random walks and other topics in stochastic processes.

CRM-ISM Probability Seminar Centre de Recherches Mathématiques, 09/2024-Present

Accelerated Introduction to ML McGill Artificial Intelligence Society, 01/2023-04/2023

- One of twenty students selected to participate in a ten-week intensive course on machine learning.
- Implemented various machine learning algorithms including KNN, linear regression, naive Bayes, SVM and random forest.

SKILLS

Languages: French (native), English (fluent)
Programming Languages: Java, Python, C, Bash, MIPS
Libraries and Tools: Scikit-Learn, NumPy, SageMath, Pandas

RESEARCH PROJECTS

McGill University School of Computer Science 2024/09 – 2024/12
Research Project Course
Project: Clique Dimension in the Contradiction Graph of a Concept Class.
Supervisor: Prof. Hamed Hatami

- Investigate the clique dimension of contradiction graphs for various concept classes.
- Improve the known upper bound as a function of the Littlestone dimension.
- Tackle a problem introduced in "A Unified Characterization of Private Learnability via Graph Theory" by Alon, Moran, Schefler, and Yehudayoff.

McGill University Department of Mathematics and Statistics 2024/05 – 2024/11
Summer Undergraduate Researcher
Project: Impossibility of Source Detection on Random Graphs.
Supervisor: Prof. Louigi Addario-Berry

- Conduct research on root-finding algorithms in random growing trees generated using the uniform attachment model.
- Improve known bounds from "Finding Adam in Random Growing Trees" by Bubeck, Devroye and Lugosi.
- Co-author a paper that outlines these findings, to be submitted for publication.

McGill University Department of Computer Science 2024/02 – 2024/04
Graduate course project on Mathematics for Artificial Intelligence
Project: Differential Privacy in the Non-Interactive Setting
Professor: Prof. Prakash Panangaden

- Conducted a critical analysis of the paper "A Learning Theory Approach to Non-Interactive Database Privacy" by Blum et al., which presented a direct method for protecting sensitive data.

McGill University Department of Mathematics and Statistics 2023/05 – 2023/08
Summer Undergraduate Researcher
Project: Computing Counterexamples to Serre's Modularity Conjecture
Supervisor: Prof. Patrick Allen

- Designed and implemented a Python algorithm using SageMath to compute counterexamples to a part of Serre's Modularity Conjecture in the fields of modular forms and Galois representations.

PUBLICATION

L. Addario-Berry, C. Fontaine, R. Khanfir, L.-R.. Langevin, S. Têtu, (2024) *Optimal root recovery for uniform attachment trees and d-regular growing trees,* https://arxiv.org/abs/2411.18614,

SCIENTIFIC TALKS

C. Fontaine, R. Aron and Z. Horton, (2023), *Computing Counterexamples to Serre's Modularity Conjecture*, McGill University
C. Fontaine, (2024), *Where does a random tree begins?* McGill University.

ACADEMIC AWARDS AND RESEARCH FUNDING

Undergraduate Student Research Award — NSERC 8,700 CAD, 2024
Supplement to the Undergraduate Student Research Award — FRQ 1,500 CAD, 2024
Science Undergraduate Research Awards — McGill 8,350 CAD, 2023

SERVICE

VP Events — McGill Artificial Intelligence Society 11/2024 – Present

- Will organize MAIS Hacks and the Learnathon.

Podcast Producer — McGill Artificial Intelligence Society 04/2024 – 11/2024

- Planned podcasts featuring AI experts from academia and industry, exploring emerging trends and challenges in AI.

VP Event — McGill Artificial Intelligence Society 04/2023 – 04/2024

- Organized MAIS Hacks, a 150-participant AI/ML hackathon featuring industry partnerships and technical workshops.
- Organized MAIS Learnathon, a conference series with 80 participants, showcasing AI/ML experts.

CODING PROJECTS

File System in C McGill University, 10/2023

- Designed a file system in C for low-level memory management, allowing users to create, delete, read and write files.

AI Model for Image Classification of Bird Species McGill University, 03/2023-04/2023

- Developed an image classification model in Python, applying gradient descent for bird species identification and incorporating image augmentation techniques, achieving over 95% accuracy.

WORK EXPERIENCE

Assistant Manager — Hogg Hardware Jun. 2020 – Jan. 2024

- Worked part-time at a hardware store during school semesters, assisting with stock management.