

Yohan Chatelain

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SUMMARY

Postdoctoral Fellow at the Centre for Addiction and Mental Health (CAMH) institute, I specialize in high-performance computing, numerical analysis, neuroimaging, and artificial intelligence. My research is dedicated to improving the computational efficiency and reliability of scientific applications. By developing tools at the interface of numerical analysis and computational architecture optimizations, I aim at optimizing the performance and accuracy of computational applications across various scientific domains.

EXPERIENCE

POSTDOCTORAL FELLOW, CENTRE FOR ADDICTION AND MENTAL HEALTH Toronto, ON, Canada Quantify numerical instability in neuroimaging to enable more reliable mental-health diagnosis. <ul style="list-style-type: none">Quantify numerical variability of MRI-derived biomarkers of Parkinson's DiseaseFast Stochastic Arithmetic instrumentation of Pytorch with LLVM IR (x50 speedup compare to standard approach)	01/2025 - 09/2025
POSTDOCTORAL FELLOW, CONCORDIA UNIVERSITY Montreal, QC, Canada Numerical stability evaluation in neuroimaging, bioinformatics and AI. <ul style="list-style-type: none">Numerical stability evalution of CNN in bioinformatics and neuroimaging applicationsImprove the generalizability and robustness of MRI-derived biomarkers of Parkinson's Disease [McGill]Providing a modular and scalable platform to analyze floating-point arithmetic [ANR grant France]Evaluating and improve the reproducibility of scientific results in the field of medical imaging [CNRS France]Statistical tests using numerical uncertainties to quantify acceptable variation bounds in MRI [Udem, Lausanne, Standford]Numerical stability evaluation of human brain tractometry within PyAFQ, AccelNet IN-BIC funding [University of Washington]Pytracer, a trace-based Python tool for visualizing numerical instabilities of Python codesFuzzy, an ecosystem for evaluating the effect of numerical errors on computational tools [UVSQ]Significantdigit, Python package for solid statistical analysis of stochastic arithmetic [UVSQ]	09/2020 - 10/2024
PHD STUDENT, PARIS-SACLAY UNIVERSITY Versailles, France Research and tool development in high-performance computing, focusing on computational reduction. <ul style="list-style-type: none">VPREC, tool to simulate reduced floating-point formats [Intel]VeriTracer, visualiser for numerical instabilities in clang-supported languages, integrated in Java IDEVerificarlo, clang-based compiler to instrument floating-point arithmetics operations (LLVM IR level) [Intel]	10/2016 - 12/2019
SOFTWARE ENGINEER, INTEL Hillsboro, OR, US Part of the Numerics US team (MKL, IML, VML) to enhance Intel's numerical computing performance and reliability. <ul style="list-style-type: none">Modernised Intel Mathematical Library (IML) by optimising 50% of its functionsImplemented continuous integration for test validation, bolstering mathematical library quality.	01/2019 - 06/2019
SOFTWARE DEVELOPER, UNIVERSITY OF VERSAILLES Versailles, France Developed a novel multi-threaded capture for capturing and replaying independent pieces of code within CERE tool <ul style="list-style-type: none">Developed multi-threaded capture for CERE in C; x2 experiment scalability and improving memory replayUsed the new capture model to microbenchmark NAS for energetic prediction model	04/2016 - 09/2016
SOFTWARE DEVELOPER, EXASCALE COMPUTING RESEARCH Bruyères-le-Châtel, France Developed tool to specialise C code based on value profiling <ul style="list-style-type: none">Implemented automatic functions specialiser in LLVM and value profiling analysis in PythonBenchmarked specialised versions to measure speedups gains	05/2015 - 09/2015
SOFTWARE DEVELOPER, LABORATOIRE RECHERCHE EN INFORMATIQUE Saclay, France Implementation of program termination criterion for a generic first-order call-by-value language in ML style in OCaml	03/2014 - 05/2014

EDUCATION

- PhD – Université Paris-Saclay, Versailles, France
Title: "Tools for debugging and optimizing floating-point computations in HPC" 2019
- Master – Université Paris-Saclay, Versailles, France
Field: High Performance Computing 2016
- Bachelor – Université Paris-Saclay, Orsay, France
Field: Computer Science 2014

TEACHING

CONCORDIA UNIVERSITY

Montreal, QC, Canada

- **Fundamentals of programming**, Course Instructor, **Bachelor level** 09/2023 - 12/2023
Introductory course to the basic principles of programming with classes and objects using C++

UNIVERSITY PARIS-SACLAY

Saclay, France

- **Compilers**, Teaching Assistant, **Bachelor level** 09/2018 - 12/2019
From language parsing to assembly generation with practical implementation in LLVM
- **Advanced Algorithm**, Teaching Assistant, **Bachelor level** 09/2016 - 06/2018
Time and space complexity, recursive schemes and graph traversal
- **Parallel Architecture**, Teaching Assistant, **Master level** 09/2016 - 06/2018
Shared and distributed memory parallelisation, cache policy, network topology

MENTORING

PH.D. LEVEL

- Mina ALIZADEH, **Concordia University** 10/2023 -
Montreal, QC, Canada
Subject: "Numerical stability of functional neuroimaging"
Supervisor: Tristan Glatard, Gregory Kiar
- Ines Gonzales PEPE, **Concordia University** 09/2023 -
Montreal, QC, Canada
Subject: "Numerical stability of deep learning in bioinformatics"
Supervisor: Tristan Glatard, Mentoring: Gregory Kiar
- Mathieu DUGRE, **Concordia University** 09/2022 -
Montreal, QC, Canada
Subject: "Impacts of reduced precision for neuroimaging applications"
Supervisor: Tristan Glatard
- Ali SALARI, **Concordia University** 10/2020 - 10/2022
Montreal, QC, Canada
Subject: "The effect of Computational Environments on Big Data Processing Pipelines in Neuroimaging"
Supervisor: Tristan Glatard, Mentoring: Gregory Kiar

MASTER LEVEL

- Ines Gonzales PEPE, **Concordia University** 09/2021 - 09/2023
Montreal, QC, Canada
Subject: "Numerical Stability of DeepGOPlus Inference"
Supervisor: Tristan Glatard (50%)
- Damien THENOT, **Université Paris-Saclay** 06/2018 - 09/2018
Versailles, France
Subject: "Development of a Java IDE for Veritracer"
Supervisor: Pablo de Oliveira Castro (50%)

UNDERGRADUATE LEVEL

- Nigel YONG, **Concordia University** 05/2021 - 06/2021
Montreal, QC, Canada
Subject: "Optimizing performance of PyTracer"
Supervisor: Tristan Glatard (50%)
- Marc VICUNA, **Concordia University** 01/2021 - 05/2021
Montreal, QC, Canada
Subject: "Reducing numerical precision preserves classification accuracy in Mondrian Forests"
Supervisors: Martin Khannouz (33%), Tristan Glatard (33%)

GRANTS

ACCELNET IN-BIC

10/2021

PI: Yohan Chatelain — \$10,000 (USD)

Understanding the magnitude, origins, and implications of numerical instabilities for human brain tractometry within PyAFQ

CONCORDIA HORIZON POST-DOCTORAL FELLOWSHIP

09/2020 - 09/2022

PI: Yohan Chatelain — \$50,000/yr. (USD)

Studying numerical instabilities in neuroimaging

RESEARCH

PEER-REVIEWED PUBLICATIONS IN JOURNALS

1. Open-source platforms to investigate analytical flexibility in neuroimaging
J.S. Robinson, M. Wang, B. McPherson, [Y. Chatelain](#), D. Kennedy, T. Glatard, J.B. Poline. *Imaging Neuroscience*.
2. An Analysis of Performance Bottlenecks in MRI Pre-Processing
M. Dugre, [Y. Chatelain](#), T. Glatard. *GigaScience* 14.
3. A numerical variability approach to results stability tests and its application to neuroimaging
[Y. Chatelain](#), L. Tetrel, C. J. Markiewicz, M. Goncalves, G. Kiar, O. Esteban, P. Bellec, T. Glatard. *IEEE Transactions on Computers* (2024).
4. Longitudinal brain structure changes in Parkinson's disease: a replication study
A. Sokolowski, N. Bhagwat, [Y. Chatelain](#), M. Dugre, A. Hangani, O. Monchi, B. McPherson, M. Wang, J.B. Poline, M. Sharp, T. Glatard. *PLOS ONE* (2024).
5. Numerical Stability of DeepGOPlus Inference
I. G. Pepe, [Y. Chatelain](#), G. Kiar, T. Glatard. *In PLOS ONE* (2024).
6. PyTracer: Automatically profiling numerical instabilities in Python
[Y. Chatelain](#), N. Yong, G. Kiar, T. Glatard. *IEEE Transactions on Computers (IEEE TC)* (2022).
7. Data Augmentation Through Monte Carlo Arithmetic Leads to More Generalizable Classification in Connectomics
G. Kiar, [Y. Chatelain](#), A. Salari, A. C. Evans, T. Glatard. *In Neurons, Behavior, Data Analysis and Theory*, 2021.
8. Numerical Uncertainty in Analytical Pipelines Lead to Impactful Variability in Brain Networks
G. Kiar, [Y. Chatelain](#), P. de Oliveira Castro, E. Petit, A. Rokem, G. Varoquaux, B. Misic, A. C. Evans, T. Glatard. *In PLOS ONE* (2021).
9. Piecewise holistic autotuning of parallel programs with CERE
M. Popov, C. Akel, [Y. Chatelain](#), W. Jalby, and P. de Oliveira Castro. *Concurrency and Computation: Practice and Experience*, vol. 29, 2017.

PEER-REVIEWED PUBLICATIONS IN CONFERENCES

1. The Impact of Hardware Variability on Applications Packaged with Docker and Guix: a Case Study in Neuroimaging
G. Vila, E. Medernach, I. Gonzalez Pepe, A. Bonnet, [Y. Chatelain](#), M. Sdika, T. Glatard, and S. Camarasu-Pop. *2nd Conference on Reproducibility and Replicability*
2. Numerical Uncertainty of Convolutional Neural Networks Inference for Structural Brain MRI Analysis
I. Gonzalez Pepe, V. Sivakolunthu, H. Lang Park, [Y. Chatelain](#), T. Glatard. *Uncertainty for Safe Utilization of Machine Learning in Medical Imaging (UNSURE 2023)*
3. Reproducibility of tumor segmentation outcomes with a deep learning model
M. Des Ligneris, A. Bonnet, [Y. Chatelain](#), T. Glatard, M. Sdika, G. Vila, V. Wargnier-Dauchelle, S. Pop, C. Frindel. *International Symposium on Biomedical Imaging (ISBI)*
4. Reducing numerical precision preserves classification accuracy in Mondrian Forests
M. Vicuna, M. Khannouz, G. Kiar, [Y. Chatelain](#), T. Glatard. *In 2021 IEEE International Conference on Big Data (Big Data)*
5. Accurate simulation of operating system updates in neuroimaging using Monte-Carlo arithmetic
A. Salari, [Y. Chatelain](#), G. Kiar, T. Glatard. *Uncertainty for Safe Utilization of Machine Learning in Medical Imaging (UNSURE, MICCAI)* (2021)
6. Automatic exploration of reduced floating-point representations in iterative methods
[Y. Chatelain](#), E. Petit, P. de Oliveira Castro, G. Lartigue, D. Defour. *European Conference on Parallel Processing (Euro-Par)* (2019, August).
7. VeriTracer: Context-enriched tracer for floating-point arithmetic analysis
[Y. Chatelain](#), P. de Oliveira Castro, E. Petit, D. Defour, J. Bieder, and M. Torrent. *2018 IEEE 25th Symposium on Computer Arithmetic (ARITH)*

PREPRINTS

1. Numerical Uncertainty in Linear Registration: An Experimental Study
N. Mirhakimi, [Y. Chatelain](#), J.B. Poline, T. Glatard. *arXiv:2508.00781*
2. The Impact of FreeSurfer versions on structural neuroimaging analyses of Parkinson's disease
A. Sokolowski, N. Bhagwat, D. Kirbizakis, [Y. Chatelain](#), M. Dugré, J.B. Poline, M. Sharp, T. Glatard. *bioRxiv:2024.11.11.623071*
3. Predicting Parkinson's disease progression using MRI-based white matter radiomic biomarker and machine learning: a reproducibility and replicability study
M. Arafe, N. Bhagwat, [Y. Chatelain](#), M. Dugre, A. Sokolowski, M. Wang, Y. Xiao, M. Sharp, J.B. Poline, T. Glatard. *bioRxiv:2023.05.05.539590*

COMMUNICATIONS AT INTERNATIONAL CONFERENCES (SUMMARY)

1. Testing the long-term reproducibility of fMRIprep results.
[Y. Chatelain](#), L. Tetrel, C. J. Markiewicz, G. Kiar, O. Esteban, P. Bellec and T. Glatard. *OHBM 2022, Glasgow, Scotland*.
2. Fuzzy environments for the perturbation, evaluation, and application of numerical uncertainty via MCA in the scientific Python ecosystem
G. Kiar, [Y. Chatelain](#), A. Salari, E. Petit, P. de Oliveira Castro, and T. Glatard. *SciPy Conference*, 2021.
3. Towards Abinit on ExaScale supercomputers: the challenge for electronic structure physicists
J. Bieder, M. Torrent, and [Y. Chatelain](#). *APS Meeting Abstracts*. 2018

WORKSHOPS, TUTORIALS, AND SUMMER PROGRAMS

1. IXPUT 2019: Intel Extreme Performance Users Group, CERN, Geneva, Switzerland
2. IXPUT 2018: Intel Extreme Performance Users Group, Intel Corporation, Hillsboro, OR, USA
3. ESTN 2018: 8èmes École Thématique de Simulation Numérique, Cargèse, France
4. RAIM 2017: 9èmes Rencontres «Arithmétique de l'Informatique Mathématique», Lyon, France
5. ABIDEV 2017: The 8th ABINIT developer's workshop, Frejus, France

LANGUAGES

- French (Native)
- English (Professional)