Yohan Chatelain

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Summary

Former researcher with 10 publications in international conferences and journals, I wish to devote myself full time to software engineering. I have acquired experience in software engineering for nearly 7 years through the 5 open-source projects I contributed to or led in C, C++ and Python; and background knowledge in scientific computations and HPC. I loved teaching algorithms and architecture for 3 years to students from bachelor to master level. I am continuously learning new technologies and processes to make better code.
What I'm learning now: C#, Unity, Javascript/Typescript, Angular.

Experience

Concordia University | Canada, Quebec, Montreal
Postdoctoral Fellowship | 09/2020 - Present
Goal: Studying numerical instabilities in neuroimaging pipelines

- **Pytracer author**, a trace-based Python tool for visualizing numerical instabilities of Python codes (open-source project / paper)
  - Automatically instruments function with duck-typing and fully written in Python and visualizer in Plotly
  - Supervised an undergraduate internship for optimizing the backend part
- **Fuzzy maintainer**, an ecosystem for evaluating the effect of numerical errors on computational tools (open-source project / paper)
  - Provides Python interpreter & scientific stack (libm, BLAS/LAPACK, NumPy, SciPy, Scikit-learn) using stochastic arithmetic
  - Standalone ready-to-use Docker containers
  - Bug fixer, code reviewer, designer, and new release maker.
- **Significantdigit author**, Python package for solid statistical analysis of Stochastic Arithmetic (open-source project / paper)

University of Versailles Saint Quentin-en-Yvelines | France, Île-de-France, Versailles
PhD student | 10/2016 - 12/2019
Goal: Developing tools for debugging and optimizing floating-point computations in HPC

- **Veritracer author**, a tool for visualizing numerical instabilities over time (open-source project / paper)
  - Automatically instruments floating-point instructions for clang-supported languages (extends Verificarlo project)
  - Implement instrumentation and debug information findings in an LLVM pass (C++) and a post-processing analysis in Python
  - Supervised an undergraduate intern for the development of VeritracerGUI, a Java GUI visualizer backend.
- Development of a Python tool for automatically tuning floating-point precision over time in HPC applications (paper)
  - Demonstrate that lowering the precision is viable and achieves 28% to 67% reduction in the communication volume, lowering the energy and runtime cost for large distributed memory applications (up to 1024 cores)
- **Verificarlo maintainer** (open-source project / paper):
  - Development and optimization of C backends for floating-points manipulations with x2 speedup
  - Development of a C backend to simulate reduced floating-point formats
  - Bug fixer, code reviewer, designer, and new release maker

Intel Corporation | USA, Oregon, Hillsboro
Software Engineer Intern | 01/2019 - 07/2019
Goal: Development of optimized mathematic libraries (Numerics US team)

- Contribution to the development of elementary mathematical functions (libm)
- Code modernization (half of the library's function) for ensuring quality standards
- Setting up continuous integration for validation tests suite with internal tools

University of Versailles Saint Quentin-en-Yvelines | France, Île-de-France, Versailles
Software Developer Intern | 04/2016 - 09/2016
Goal: Internship for Master's degree validation

- **CERE contributor** (open-source project / paper)
  - Development of a new parallel capture in C for shared memory system into the CERE tool
  - Capture memory pages touched by a thread (with the ptrace) to replay them in a new environment
  - CERE's experiments have been scaled up (strong scaling)
- Construction of an energetic prediction model in the HPC context
  - Characterization of applications by a piecewise method by using the CERE tool
  - Microbenchmarking applications to collect hardware performance counters and energy consumption

Exascale Computing Research (CEA, Intel, UVSQ) | France, Île-de-France, Bruyères-le-Châtel
Software Developer Intern | 05/2015 - 09/2015
Goal: C codes piecewise specialization based on value profiling

- Implementation of an automatic functions specializer in LLVM (C++)
- Implementation of a value profiling method in Python
- Characterization of speedups gained with specialization

Laboratoire de Recherche en Informatique | France, Île-de-France, Bruyères-le-Châtel
Software Developer Intern | 05/2015 - 09/2015
Goal: Implementation of program termination criterion for a generic first-order call-by-value language in ML style in OCaml

Teaching Assistant

University of Versailles Saint Quentin-en-Yvelines | France, Île-de-France, Versailles
2016 - 2019

- Compilers | Bachelor level | 72h
- Advanced Algorithms | Bachelor level | 72h
- Parallel Architectures | Master level | 40h

Supervision

- **Master level**, Ines Gonzalez Pepe | 09/2021 - 09/2023
  - Concordia University | Canada, Quebec, Montreal
  - Subject: *"Numerical stability of deep learning in bioinformatics"*
  - Co-supervisor: Tristan GLATARD (50%)
- **Undergraduate level**, Nigel YONG | 05/2021 - 06/2021
  - Concordia University | Canada, Quebec, Montreal
  - Subject: *"Optimizing performance of PyTracer"*
  - Co-supervisor: Tristan GLATARD (50%)
- **Undergraduate level**, Marc VICUNA | 01/2021 - 05/2021
  - Concordia University | Canada, Quebec, Montreal
  - Subject: *"Reducing numerical precision preserves classification accuracy in Mondrian Forests"* (**published paper**)
  - Co-supervisor: Martin KHANNOUZ (33%) | Tristan GLATARD (33%)
- **Master level**, Damien THENOT | 06/2018 - 09/2018
  - University of Versailles Saint Quentin-en-Yvelines | France, Versailles
  - Subject: *"Development of an Jave IDE for Veritracer"*
  - Co-supervisor: Pablo DE OLIVEIRA CASTRO (50%)

Research

Peer-reviewed publications in journals

- **Data Augmentation Through Monte Carlo Arithmetic Leads to More Generalizable Classification in Connectomics**
  Gregory Kiar, **Yohan Chatelain**, Ali Salari, Alan C. Evans, Tristan Glatard In Neurons, Behavior, Data Analysis and Theory, 2021.
- **Numerical Uncertainty in Analytical Pipelines Lead to Impactful Variability in Brain Networks**
  Gregory Kiar, **Yohan Chatelain**, Pablo de Oliveira Castro, Eric Petit, Ariel Rokem, Gaël Varoquaux, Bratislav Misic, Alan C. Evans, Tristan Glatard. In PLOS ONE (2021).
- **Piecewise holistic autotuning of parallel programs with CERE**
  Mihail Popov, Chadi Akel, **Yohan Chatelain**, William Jalby, and Pablo de Oliveira Castro, Concurrency and Computation: Practice and Experience, vol. 29, Aug 2017.

Peer-reviewed publications in conferences

- **Reducing numerical precision preserves classification accuracy in Mondrian Forests**
  Marc Vicuna, Martin Khannouz, Gregory Kiar, **Yohan Chatelain**, Tristan Glatard.
  6th Workshop on Real-time Stream Analytics, Stream Mining, CER/CEP & Stream Data Management in Big Data, 2021.
- **Accurate simulation of operating system updates in neuroimaging using Monte-Carlo arithmetic**
  Yohan Chatelain, Eric Petit, Pablo de Oliveira Castro, Ghislain Lartigue, & David Defour (2019, August).
  In European Conference on Parallel Processing (Euro-Par) (pp. 481-494). Springer, Cham.
- **Automatic exploration of reduced floating-point representations in iterative methods**
  Yohan Chatelain, Eric Petit, Pablo de Oliveira Castro, Ghislain Lartigue, & David Defour (2019, August).
  In European Conference on Parallel Processing (Euro-Par) (pp. 481-494). Springer, Cham.
- **VeriTracer: Context-enriched tracer for floating-point arithmetic analysis**
  Yohan Chatelain, Pablo de Oliveira Castro, Eric Petit, David Defour, Jordan Bieder, and Marc Torrent.
  In 2018 IEEE 25th Symposium on Computer Arithmetic (ARITH) (pp. 61-68). IEEE

Unpublished research reports

- **PyTracer: Automatically profiling numerical instabilities in Python**
  Yohan Chatelain, Nigel Yong, Gregory Kiar, Tristan Glatard. arXiv preprint arXiv:2112.11508. (2021)

Communications at international conferences (summary)

- **Fuzzy environments for the perturbation, evaluation, and application of numerical uncertainty via MCA in the scientific Python ecosystem**
  Gregory Kiar, **Yohan Chatelain**, Ali Salari, Eric Petit, Pablo de Oliveira Castro, and Tristan Glatard. SciPy Conference, 2021.
- **Towards Abinit on ExaScale supercomputers: the challenge for electronic structure physicists**
  Jordan Bieder, Marc Torrent, and **Yohan Chatelain**. APS Meeting Abstracts. 2018

Communications at international conferences (summary)

- **IXPUG 2019**: Intel Extreme Performance Users Group, CERN, Geneva, Switzerland
- **IXPUG 2018**: Intel Extreme Performance Users Group, Intel Corporation, Hillsboro, OR, USA
- **ESTN 2018**: 8èmes École Thématique de Simulation Numérique, Cargèse, 2018
- **RAIM 2017**: 9èmes Rencontres «Arithmétique de l'Informatique Mathématique», Lyon, 2017
- **ABIDEV 2017**: The 8th ABINIT developers workshop, Frejus, 2017

Education

Université Paris-Saclay | Versailles, Île-de-France
Computer sciences | 12/2019

- Ph.D.'s degree | "Tools for debugging and optimizing floating-point computations in HPC"

Université Versailles-Saint-Quentin-en-Yvelines | Versailles, Île-de-France
High-Performance Computing | 09/2016

- Master's degree

Université Paris-Sud XI | Orsay, Île-de-France
Computer sciences | 06/2014

- Bachelor's degree

Skills

Python, C, C++, Unix, DevOps, Git, Docker, HPC, NumPy, OCaml

Languages

French, English

Links

Linkedin | Scholar | Website