Christopher J. Swierczewski

Résumé

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Summary of Qualifications

- **Mathematics**: linear analysis, numerical analysis, algebraic geometry, computer algebra systems, optimization, and machine learning.
- **Programming**: (Expert) Python, Cython. (Advanced) C, CUDA. (Intermediate) C++, OpenMP, MPI. (Additional) object-oriented design, software architecture, test-driven development.
- Lead the design, development, and testing of high performance scientific software used to solve abstract mathematical problems using a huge range of mathematical and computational tools.
- Dedicated to discovering optimal solution techniques and improving software performance by focusing on mathematical and programmatical details.
- Exceptional ability to clearly present technical information as evidenced by recognition for teaching performance in computational mathematics courses.
- Detailed in-person and remote collaborator with experience in pair-programming environment, code review processes, as well as in giving numerous talks and presentations.

Education

- **Ph.D. in Applied Mathematics**, University of Washington, Seattle, *In Progress*,
  Thesis: *Computational Approach to Riemann Surfaces and the Kadomtsev-Petviashvili Equation*
  - Led the design and development of "Abelfunctions", an open-source mathematics software package for computing with Abelian functions and Riemann surfaces.
  - Designed and improved new and existing algorithms using a wide variety of tools from various branches of mathematics, such as numerical analysis, linear analysis, and algebraic geometry; as well as using high-performance software development strategies.
  - Used object-oriented design principles to create software that was easy for mathematicians to use yet maintained high performance standards while providing extendibility to future developers.
  - Mentored team of bright undergraduate students in developing algorithms for quickly and accurately computing the Riemann theta function.
  - Open-source code available on GitHub: `https://github.com/abelfunctions/abelfunctions`
- **M.S. in Applied Mathematics**, University of Washington, Seattle, June 2010
  Thesis: *A Python Implementation of Chebyshev Functions*
  - Studied high-performance and high-accuracy function interpolation using Chebyshev polynomials.
  - Created "Pychebfun", a Python library implementing these interpolation algorithms using tools from the Numpy and Scipy libraries: `https://github.com/cswiercz/pychebfun`
- **B.S. in Mathematics with Distinction**, University of Washington, Seattle, June 2008
  Thesis: *Connections Between the Sato-Tate Conjecture and the Generalized Riemann Hyptothesis*
  - Proved equivalence of the Sato-Tate Conjecture and the Generalized Riemann Hypothesis for elliptic curves over the rational numbers.
  - Performed computational experiments with elliptic L-functions to computationally verify the Sato-Tate conjecture and related number theory conjectures.

Professional Experience

- **Research Mathematician**, Institute for Defense Analysis: Center for Communications Research, La Jolla, CA. June - August 2012
  - Applied number theoretic, optimization, and statistical techniques to solving cryptographic problems in a high-performance computing setting.
- **Software Developer**, Simulab Corporation, Seattle, WA. January 2009 - March 2009.
  - Applied Hidden Markov Models, an early machine learning technique, to problems in control theory and optimization with application to classifying surgical proficiency.
  - Implemented mathematical algorithms as well as data gathering routines from cameras and sensors in a C++ library.
- **Sage: Mathematics Software Developer**, Department of Mathematics, University of Washington, Seattle, WA. September 2007 - September 2008.
  - Designed new Sage finance module around the Opentick financial data acquisition API. Devised methods of wrapping asynchronous functions in a synchonous environment.
  - Designed tests and wrote documentation for mathematical functions in Python, Cython, and C/C++ under a UNIX environment.
- **Applied Research Mathematician**, National Security Agency, Ft.Meade, MD. June - August 2007.
  - Applied algebraic, probabalistic, and statistical methods to improve cryptanalytic attacks against telecommunication encryption standards.
  - Collaborated with mathematicians in researching cryptographic algorithm weaknesses. Implemented algorithms in C.
- **Teaching Assistant and Math Camp Counselor**, Department of Mathematics, University of Washington, Seattle, WA. June - August 2005 and 2006.

Additional Research Projects

- **Kaggle**
  - Top 17% in "Digit Recognizer": used a custom convolutional neural network implementing batch learning and dropout for managing over-fitting.
  - Top 20% in "Titanic": applied principal component analysis and polynomial interpolation to data which is then fed into both decision tree and neural network models.
- **Zipper**
  - Advised graduate students on the development of "Zipper", a high-performance library for computing with conformal maps.
  - Integrated the library into Sage and added a web-based, interactive front-end. Open-source code available on Google Code: `https://code.google.com/p/zipper`

Awards

- Boeing Teaching Award, University of Washington, Applied Mathematics, June 2016.
- Student Chapter Award, Society for Industrial and Applied Mathematics (SIAM), June 2014.
- Boeing Service Award, University of Washington, Applied Mathematics, June 2013.
- American Mathetmatical Society Sectional Meeting Travel Grant, October 2011.
- University of Alaska Fairbanks Travel Grant, January 2011.