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Brendan Gavin

Summary

Strong written and oral communication skills: published scientific author and experienced public speaker.

Experienced researcher: experience in solving abstract, open-ended problems both individually and in teams.

Advanced mathematics background: linear algebra and probability, with an emphasis on mathematical analysis for advanced numerical algorithms and quantum mechanics simulations.

Extensive experience in computation: background in numerical algorithm development and development (Julia, C/C++, Fortran, Matlab, MPI, Linux, cluster computing), particularly for scientifc computing.

Education

Ph.D. in Electrical and Computer Engineering *(September 2018)*
University of Massachusetts Amherst
Dissertation title:"Inexact and Nonlinear Extensions of the FEAST Eigenvalue Algorithm"
M.S. in Electrical and Computer Engineering (*May 2013*)
University of Massachusetts Amherst
Thesis title:"A Non-Linear Eigensolver-Based Alternative to Traditional Self-Consistent Electronic Structure Calculation Methods"
B.S. in Electrical and Computer Engineering (*Feb 2011*)
University of Massachusetts Amherst

Professional Experience

UMass Nanoelectronics Theory and Simulation Laboratory
Graduate Research Assistant, 2011-present

Researched and implemented numerical algorithms for solving problems in scientific computing, with an emphasis on large linear algebra calculations for physics simulations.

- Developed and implemented a variation of the FEAST eigenvalue algorithm that can perform calculations 30 times faster than prior implementations.
- Collaborated on-site with researchers at University of Kansas to develop an efficient and novel contour-integral based method for solving nonlinear eigenvalue problems.
- Proved the equivalence of contour-integral subspace iterations and standard Krylov eigenvalue methods when using inexact linear system solves.
- Developed and implemented an initial guess-free contour integral-based subspace method for solving nonlinear eigenvector problems in density functional theory for quantum chemistry simulations.
- Collaborated on-site at the French Commission for Atomic and Alternative Energies (CEA) with the developers of the BigDFT software package to develop a Julia-based software framework for easily experimenting with numerical algorithms on parallel computing systems.

MIT Lincoln Laboratory
Graduate Research Intern, 2015

- Developed and implemented sparse non-negative matrix factorization algorithms for use in topic modeling applications with big data sets, to allow for performing data analysis inside of databases.
- Developed performance metrics and custom text data sets and for testing topic modeling algorithms.

Lawrence Berkeley National Laboratory
Graduate Research Intern, 2013

- Prototyped algorithms for the solution of eigenvalue problems arising from the GW approximation in many-body quantum mechanics.
- Benchmarked the performance of parallel eigensolvers for use at the NERSC supercomputing center.

UMass Center for Advanced Sensor and Communication Antennas
Undergraduate Research Intern, 2009-2010
- Developed custom 3D visualization software in C++ for interpretting data from finite elements electromagnetics simulations.

Mentorship and Teaching

Undergraduate Research Mentor
- Directed and mentored undergraduate students in research projects related to developing and implementing numerical algorithms.
- Projects included eigenvalue solvers using numerical quaternion linear algebra, high performance sparse singular value decomposition, and differential equation-based image classification algorithms.

Course Teaching Assistant: Introduction to Probability
- Lead review sessions and provided office hours to help undegraduate students with learning material related to probability, stochastic processes, and basic statistical inference.
- Graded assignments and proctored tests.

Shotokan Karate
- Lead classes and mentored students learning traditional martial arts, with a focus on developing mental and physical strength and emotional control.

Selected Publications and Conference Proceedings

"FEAST Eigensolver for Nonlinear Eigenvalue Problems", B. Gavin, A. Miedlar, E. Polizzi, *arXiv:1801.09794 Journal of Computational Science*, accepted for publication 2018.

"Krylov eigenvalue strategy using the FEAST algorithm with inexact system solves", B. Gavin, E. Polizzi, *arXiv:1706.00692 Numerical Linear Algebra with Applications*: e2188, 2018.

"Enforced Sparse Non-Negative Matrix Factorization", B. Gavin, V. Gadepally, and J. Kepner, *arXiv:1510.05237*, *Parallel and Distributed Processing Symposium Workshops*, IEEE International. IEEE, 2016.

"Non-linear eigensolver-based alternative to traditional SCF methods", B. Gavin, E. Polizzi, *arXiv:1211.4261*, *J. Chem. Phys.*, 138(19), 194101. 2013.

Selected Presentations

Invited Talk: "Solving the Non-linear Eigenvector Problem - FEAST-based Alternative to Self-consistent Field Methods," Society of Industrial and Applied Mathematicians (SIAM) Conference on Computational Science and Engineering, Boston MA, 2013

Invited Seminar: "The FEAST Algorithm: Using Complex Contour Integration for Solving Large Eigenvalue Problems", University of Kansas, Lawrence KS, 2017

Presentation: "Enforced Sparse Non-Negative Matrix Factorization", IEEE Parallel and Distributed Processing Symposium, Chicago IL 2016.

Presentation: "The FEAST Eigenvalue Algorithm with Inexact Solves," ILAS, Ames IA 2017.

Presentation: "Applying the Feast Sparse Eigensolver to the Singular Value Decomposition," SIAM CSE 2017, Atlanta GA 2017.

Poster Presentation: "Sparse Non-Negative Matrix Factorization for Big Data Topic Modeling," North East Database Day 2016, Cambridge MA 2016.

Awards

David H. Navon Scholarship, in recognition of excellence in the areas of Solid-State and Microelectronics research.