

Haw-ren Fang

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FIELD OF WORK EXPERIENCE

- Machine Learning and Data Mining
- Scientific Computing, Numerical Parallel Computing

TECHNICAL SKILLS

- Programming languages: C/C++, Matlab/Octave, Java, Perl, Visual Basic, Fortran.
- Parallel computing: Intel MKL for multi-core threading, MPI for distributed memory systems.
- Development skills: knowledgeable of object oriented design with C++ and Java, fast prototyping with Matlab/Octave, automated testing with Perl.
- Code example: FILTLAN, filtered Lanczos eigensolver for large scale eigenvalue problems
<http://www.cs.umn.edu/~saad/software/filtlan/>

EDUCATION

- **University of Maryland** College Park, USA
August 2000 – August 2006, Ph.D., Computer Science
- **University of Maryland** College Park, USA
August 2000 – May 2003, M.S., Computer Science
- **National Taiwan University** Taipei, Taiwan
September 1995 – June 1997, M.S., Computer Science and Information Engineering
- **National Taiwan University** Taipei, Taiwan
September 1991 – June 1995, B.S., Mathematics

POST-PHD EMPLOYMENT

November 2010 – Present: Research Associate

November 2009 – November 2010: Postdoctoral Associate

Department of Computer Science and Engineering, University of Minnesota.

- Lead programmer of FILTLAN, an efficient large scale symmetric eigensolver.
<http://www.cs.umn.edu/~saad/software/filtlan/>
 - Development tools: C/C++, BLAS and LAPACK, Intel MKL, mex
 - Applications: electronic structure calculations, spectral methods for data mining
 - Results: Reported in [M3], FILTLAN can be a few times faster than the popular ARPACK (used by the Matlab/Octave routine `eigs`) for large scale sparse symmetric eigenvalue computations, arising from physics simulation and other applications.
- Lead programmer of Matlab/Octave and C code for multilevel nonlinear methods for manifold learning, clustering, and multilevel hypergraph methods for latent semantic indexing.
 - Development tools: Matlab/Octave, C, mex

- Applications: data visualization, data clustering, text information retrieval
- Results: Reported in [P3], our multilevel method/code speeds up manifold learning and improves the clustering results. Enhancement for the embedding quality of manifold learning is given in [M2]. A hypegraph model for latent semantic indexing with appealing results is given in [P4].
- Incorporated Matlab/Octave code for tensor (2D) methods into a face recognition system.
 - Development tools: Matlab/Octave
 - Applications: face recognition, classification of tensor objects
 - Results: Reported in [M1], our repulsion tensor (2D) technique significantly improves the recognition performance of existing tensor (2D) methods, and speeds up the classical (1D) dimensionality reduction methods for face recognition.

October 2008 – November 2009: Postdoctoral Appointee
 Mathematics and Computer Science Division, Argonne National Laboratory.

- Lead programmer of LPCC, an optimization solver based on pivoting algorithms for linear programming with linear complementarity constraints.
 - Development tools: Matlab/Octave, Perl, shell script
 - Applications: solving mathematical models of economic and engineering problems
 - Results: Reported in [P2], our technique is significantly faster than the existing methods which are based on nonlinear programming reformulation.

September 2006 – September 2008: Postdoctoral Associate
 Department of Computer Science and Engineering, University of Minnesota.

- Incorporated two classes of nonlinear acceleration methods into PARSEC.
<http://parsec.ices.utexas.edu/>
 - Development tools: Fortran 90, MPI
 - Applications: nonlinear acceleration, mixing, and solving general nonlinear equations
 - Results: Reported in [P6], the SCF iterations in electronic structure calculations are speeded up significantly.
- Assisted a student for Matlab/Octave code for multilevel linear methods for face recognition and latent semantic indexing.
 - Development tools: Matlab/Octave
 - Applications: face recognition, text information retrieval
 - Results: Reported in [P9], our multilevel method/code improves the efficiency of dimensionality reduction methods for face recognition and latent semantic indexing.
- Lead programmer of Matlab/Octave code for unsupervised divisive clustering [P10].

PHD PROJECTS

- Lead programmer of code for modified Newton methods based on Cholesky-like factorizations for nonlinear programming, with application to distance matrix completion problems.
 - Development tools: C/C++, Perl, shell script, Matlab/Octave
 - Applications: protein structure prediction, sensor network localization, nonconvex optimization

- Results: Reported in [P1], our methods/code are more robust and efficient than some existing works in the application of molecule/protein structure prediction. Part of our methods utilize the stable factorizations we developed in [P11]. Reported in [P8], our new development of modified Newton methods is more efficient than existing ones in a comparative study.
- Our code is incorporated into OPT++ (not in public, research code available upon request). <https://software.sandia.gov/opt++/>

INTERNSHIP PROJECT

Summer intern 2005, Children’s Hospital of Philadelphia.

- Lead programmer of a gene name normalization system which automatically extracts synonym dictionaries from four websites in the internet.
 - Development tools: Java, Perl, shell script
 - Applications: biomedical text information retrieval
 - Results: performance evaluation (recall-precision) of different methods with different databases are reported in [P12].
 - Our code is used to support FABLE: <http://fable.chop.edu/>

MANUSCRIPTS FOR JOURNAL PUBLICATIONS

- [M1] H.-r. Fang and Y. Saad, *Classification with Repulsion Tensors: A Case Study on Face Recognition* (22 pages).
- [M2] H.-r. Fang and Y. Saad, *Enhanced Multilevel Manifold Learning* (48 pages).
- [M3] H.-r. Fang and Y. Saad, *A filtered Lanczos procedure for Extreme and Interior Eigenvalue Problems* (22 pages).

SELECTED PUBLICATIONS

- [P1] H.-r. Fang and D. P. O’Leary, *Euclidean Distance Matrix Completion Problems*, Opt. Meth. Soft., Vol. 27, No. 3–4, 2012.
- [P2] H.-r. Fang, S. Leyffer, and T. S. Munson, *A Pivoting Algorithm for Linear Programming with Linear Complementarity Constraints*, Opt. Meth. Soft., Vol. 27, No. 1, pp. 89–114, 2012.
- [P3] H.-r. Fang, S. Sakellari, and Y. Saad, *Multilevel Manifold Learning with Application to Spectral Clustering*, Proc. ACM Conf. Information and Knowledge Management (CIKM) 2010, pp. 419–428.
- [P4] H.-r. Fang and Y. Saad, *Hypergraph-based Multilevel Matrix Approximation for Text Information Retrieval*, Proc. ACM Conf. Information and Knowledge Management (CIKM) 2010, pp. 1597–1600.
- [P5] J. Chen, H.-r. Fang, and Y. Saad, *Fast Approximate kNN Graph Construction for High Dimensional Data via Recursive Lanczos Bisection*, J. Mach. Learn. Res., Vol. 10, pp. 1989–2012, 2009.
- [P6] H.-r. Fang and Y. Saad, *Two Classes of Multisecant Methods for Nonlinear Acceleration*, Numer. Linear Algebra Appl., Vol. 16, pp 197–221, 2009.
- [P7] H.-r. Fang, J. Glenn, and C. P. Kruskal, *Retrograde Approximation Algorithms for Jeopardy Stochastic Games*, ICGA J., Vol. 28(2), pp. 77–96, 2008.
- [P8] H.-r. Fang and D. P. O’Leary, *Modified Cholesky Algorithms: A Catalog with New Approaches*, Mathematical Programming A, Vol. 115(2), pp. 319–349, 2008.

- [P9] S. Sakellaridi, H.-r. Fang, and Y. Saad, *Graph-based Multilevel Dimensionality Reduction with Applications to Eigenfaces and Latent Semantic Indexing*, Proc. IEEE Inter. Conf. Mach. Learn. Appl. 2008, pp. 194–200.
- [P10] H.-r. Fang and Y. Saad, *Farthest Centroids Divisive Clustering*, Proc. IEEE Inter. Conf. Mach. Learn. Appl. 2008, pp. 232–238.
- [P11] H.-r. Fang and D. P. O’Leary, *Stable Factorizations of Symmetric Tridiagonal and Triadic Matrices*, SIAM J. Matrix Anal. Appl., Vol. 28(2) pp. 576–595, 2006.
- [P12] H.-r. Fang, K. Murphy, Y. Jin, J. S. Kim, and P. S. White, *Human Gene Name Normalization using Text Matching with Automatically Extracted Synonym Dictionaries*, BioNLP’06 Proceedings, pp. 41–48, 2006.

SERVICES

- Reviewer for Journal of Computer Physics Communications (CPC), International Computer Games Association Journal (ICGA), Journal of the Franklin Institute, Journal of Electronic Science and Technology of China (JESTC), Neurocomputing (NEUCOM), Journal of Numerical Linear Algebra with Applications (NLAA), Journal of Pattern Analysis and Applications (PAA), SIAM Journal on Matrix Analysis and Applications (SIMAX), SIAM Journal on Numerical Analysis (SINUM), IEEE Transactions on Neural Networks (TNN).
- Program committee member of Computers and Games conferences (2006, 2008), Advances in Computer Games 12 conference (2009).

REFERENCES

- Available upon request.