YUYING LI

Senior Research Associate

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Department of Computer Science
Upson Hall, Cornell University
Ithaca, New York 14853
(607) 254-8843, `yuying@cs.cornell.edu`

21 Hartwood Road
Ithaca, New York 14850

Personal Data:

Citizenship Chinese, permanent resident of the United States

Education:

Ph.D Computer Science, University of Waterloo, Canada, August, 1988.

M.S. Computer Science, University of Waterloo, Canada, August, 1985.

B.S. Mathematics Department, Sichuan University, China, August, 1982.

Employment:

1995-present Senior Research Associate, Department of Computer Science, Cornell University.

1989-1995 Research Associate, Department of Computer Science, Cornell University.

1988-1989 Postdoctoral Fellow, Mathematical Sciences Institute, Cornell University.

Awards:

1993 The First Prize Winner of the **Sixth Fox Prize Competition**, Oxford, England.

1988 Mathematical Science Institute (MSI) Postdoctoral Fellowship, Cornell University.

Teaching:

- *Introduction to Computer Programming* (CS100), Cornell University, Fall, 1992.
- *Introduction to Scientific Computing* (CS222), Cornell University, Spring 1993.
- *Introduction to Scientific Computing* (CS222), Cornell University, Spring 1995.
- *Numerical Solution of Algebraic Equations* (CS421), Cornell University, Fall, 1990.
- *Computational Linear Algebra*, Supercomputing Program for Undergraduate Research (SPUR), Cornell Theory Center, June, 1996.

Professional Activities:

Recent Invited Lectures

- A Newton acceleration of the Weiszfeld algorithm for minimizing the sum of Euclidean distances, Optimization Days, Montreal, Canada, May 15, 1996.
- What can optimization do for image restoration? Mathematics Department Colloquium, Dartmouth College, November 30, 1995.
- An interior and trust region approach for nonlinear programming, 1995 SIAM annual meeting, Charlotte, North Carolina, October 25, 1995.
- Minimization methods for regulating ill-posed inverse problems, Workshop on Large-scale Optimization, Minneapolis, Minnesota, July 1995.
- Image enhancement using optimization techniques, Applied Math. Seminar, University of Deleware, October 1994.

Workshop and Invited Session Organizer

- *Interior Point Methods for Nonlinear Programming*, invited session in Nonlinear Programming cluster at DALLAS INFORMS, October 26-29, 1997.
- *Large-scale Optimization and Application*, invited session in Nonlinear Programming cluster at Atlanta INFORMS, November 3-6 1996.
- *Workshop on Large-Scale Numerical Optimization*, Workshop Organizer (co-organized with T. F. Coleman), Mathematical Science Institute, October 19-20, 1989, Ithaca, New York.

Memberships

- Society for Industrial and Applied Mathematics (SIAM)
- Mathematical Programming

Referees

- Math Programming, SIAM J. Opt., Computational Optimization and Applications.

Research Interests: My general research interests are numerical optimization and scientific computing. In particular, I am interested in applying optimization techniques to application problems, e.g., continuous location problems, geophysical tomographic inversion and image processing.

My current interests include combining the trust region idea for nonlinear minimization and interior point methods for linear programming to a general (nonconvex) minimization with linear constraints. Our objective is to develop an algorithm for general nonlinear programming problems which has strong convergence theory and efficient computational performance for large-scale problems. We have been developing an affine scaling Newton method for nonlinear minimization with linear inequality constraints. We intend to generalize this algorithm to a general nonlinearly constrained minimization problem using an exact penalty approach.

In addition, we have been working on applying the affine scaling Newton approach for image restoration, enhancement and segmentation. We use a l_1 minimization related approach and investigate efficient implementation in a parallel computing environment and via an iterative approach.

Research Grant:

- DOE, Applied Mathematical Sciences, *Efficient Algorithms for Large-Scale Optimization with Applications to Inverse Problems*, DE-FGO2-86ER25013, Sept 14, 1994 – Sept 15, 1997. ($300,000). PI: Thomas F. Coleman and Fadil Santosa, Co-investigator: Yuying Li.
- NSF, *Computational and Mathematical Investigations in Optimization*, DMS-9505155. August 1, 95 - July 31, 98 ($492,000). PI: Mike Todd. CO-PI: Robert G. Bland, Yuying Li and Leslie E. Trotter, Jr.
- ONR, *Computational and Mathematical Investigations in Optimization*, N00014-96-1-0050. October 1, 1995 - September 30, 1998 ($374,997). PI: Mike Todd. CO-PI: Robert G. Bland, Yuying Li and Leslie E. Trotter, Jr.

Refereed Publications:

1. A Newton acceleration of the Weiszfeld algorithm for minimizing the sum of Euclidean distances, to appear in *Computational Optimization and Applications*, Computer Science Department, Cornell University, TR95-1552.
2. A computational algorithm for minimizing total variation in image restoration, *IEEE Transactions on Image Processing*, Vol. 5, no. 6, June 1996, pp. 987-995 (With Fadil Santosa).
3. Piecewise differentiable minimization for ill-posed inverse problems, to appear in proceedings of the workshop on Large-Scale Optimization with Applications to Inverse Problems, Optimal Control and Design, and Molecule and Structure Optimization in IMA, Minnesoda, July 1995.
4. An interior, trust region approach for nonlinear minimization subject to bounds, *SIAM Journal on Optimization*, Vol. 6. no 2, May 1996, pp. 418-445 (with T.F. Coleman).
5. A reflective Newton method for minimizing a quadratic function subject to bounds on the variables, *SIAM Journal on Optimization*, Vol. 6, 1996, pp. 1040-1058 (with T.F. Coleman).
6. On the convergence of reflective Newton methods for large-scale nonlinear minimization subject to bounds, *Mathematical Programming*, Vol. 67, pp. 189-224. 1994 (with T.F. Coleman).
7. A Globally Convergent Method for l_p Problems, *SIAM Journal on Optimization*, Vol. 3, No. 3, pp. 609-629, 1993.

8. A globally and quadratically convergent method for linear l_1 problems, *Mathematical Programming*, Vol. 56. 189-222, 1992 (with T.F. Coleman);
9. A global and quadratically-convergent method for l_∞ problems, *SIAM Journal on Numerical Analysis*, Vol. 29, 1166-1186, 1992 (with T.F. Coleman);
10. An efficient algorithm for nonlinear Minimax Problems, *SIAM Journal on Optimization*, Vol. 2, 242-264, 1992 (with A. R. Conn);
11. A quadratically-convergent algorithm for the linear programming problem with lower and upper bounds, in *Large-Scale Numerical Optimization*, T. Coleman and Y. Li, eds., SIAM, pp. 49-57, 1990 (with T.F. Coleman).
12. An approach to nonlinear l_∞ approximation, in *Advances in Numerical Partial Differential Equations and Optimization*, S. Gómez, J.P. Hennart and R.A. Tapia eds., SIAM, pp. 346-365, 1990 (with A. R . Conn).
13. A global and quadratic affine scaling method for (augmented) linear l_1 problems, in *Numerical Analysis 1989*, D.F. Griffiths and G.A. Watson eds., Longman Scientific & Technical, pp. 60-73, 1990 (with T.F. Coleman).
14. Primal methods are better than dual methods for solving overdetermined linear systems in the l_∞ sense? *SIAM Journal on Numerical Analysis,* Vol. 26, pp. 693-726, 1989, (With A.R. Conn and R.H. Bartels).

Other Publications:

1. A subspace, interior and conjugate gradient method for large-scale bound-constrained minimization problems, Computer Science Department, Cornell University, TR95-1525, (With Mary Ann Branch and Thomas F. Coleman).
2. A trust region and affine scaling method for nonlinearly constrained minimization, Computer Science Department, Cornell University,TR 94-1463, submitted to *SIAM Journal on Optimization.*
3. On global convergence of a trust region and affine scaling method for nonlinearly constrained minimization, Computer Science Department, Cornell University, TR 94-1462, submitted to *SIAM Journal on Optimization*.
4. Centering, Trust Region, Reflective Techniques for Nonlinear Minimization Subject to Bounds, the proceeding of 1993 Conference on Scientific and Engineering Computing for Chinese Young Scientists, pp 241-246, 1993.
5. Solving l_p problems and applications, Computer Science Department, #TR 93-1331, Cornell University, 1993.

Books:

- Large-Scale Numerical Optimization, (ed., with T.F. Coleman), SIAM, Philadelphia, 1990.