

Name: Srivastava, Nikhil

Worked for more than 160 Hours: Yes

Contribution to Project:

Nikhil is a 2nd year graduate student, who is just beginning to do research on smoothed analysis.

Name: Daitch, Samuel

Worked for more than 160 Hours: Yes

Contribution to Project:

Sam is a 3rd year graduate student who is working with me on multi-level algorithms.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

YALE UNIVERSITY

I spent th 04-05 year at Yale on sabbatical, and they provided me with financial support.

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

The major research activities we engaged in this year have been:

1. Analyzing the effect on interior point algorithms of noise in the output of linear system solvers.
2. Developing tools for applying random matrix theory to graph sparsification.

We have also continued to update the list of papers on smoothed analysis on the smoothed analysis home page, and provide commentaries on these papers where appropriate.

We have begun to write a survey on Smoothed Analysis.

Findings: (See PDF version submitted by PI at the end of the report)

The major research findings this year have been:

1. By using fast but inaccurate linear systems solvers inside interior point algorithms, one can obtain the asymptotically fastest algorithms for some combinatorial problems, including

maximum flow, minimum cost flow, and their generalized versions.

2. By choosing a random, re-weighted, sub-graph of any graph (from the proper distribution), one can construct a high-quality sparsifier of that graph, with high probability.

Training and Development:

The two people who have been trained during this year are Nikhil Srivastava, and Samuel Daitch.

Nikhil Srivastava is a third-year graduate student, who has worked with me on applying ideas from random matrix theory to graph sparsification.

Samuel Daitch is a 3rd year graduate student who had already produced one significant paper, and this year worked on the analysis of interior point methods. The results from this paper will form the bulk of his thesis.

Outreach Activities:

This year, I have begun to write a survey on Smoothed Analysis, which will accompany a tutorial talk that I will give on the topic in a plenary session at NIPS 2008.

Journal Publications

Michal Elkin, Yuval Emek, Daniel Spielman, Shang-Hua Teng, "Lower-Stretch Spanning Trees", Proceedings of the thirty-seventh annual ACM symposium on Theory of computing, p. 494, vol. 37, (2005). Published,

Amit Deshpande, Daniel Spielman, "Improved Smoothed Analysis of the Shadow Vertex Simplex Method", 46th Annual IEEE Symposium on Foundations of Computer Science, p. , vol. 2005, (). Submitted,

Daniel A. Spielman and Shang-Hua Teng, "Smoothed Analysis of Algorithms and Heuristics", Foundations of Computational Mathematics, Santander 2005, Cambridge University Press, p. 274, vol. , (2006). Published,

Jonathan Kelner and Daniel A. Spielman, "A Randomized Polynomial-Time Simplex Algorithm for Linear Programming", Proceedings of the 38th Annual ACM Symposium on the Theory of Computing, p. 51, vol. 38, (2006). Published,

M. Cao, D. A. Spielman, and A. S. Morse, "A Lower Bound on Convergence of a Distributed Network Consensus Algorithm", Proceedings of the 44th IEEE Conference on Decision and Control, p. 2356, vol. 44, (2005). Published,

Daniel A. Spielman and Shang-Hua Teng, "Parallel Delaunay Refinement: Algorithms and Analyses", International Journal of Computational Geometry & Applications, p. 1, vol. 17, (2007). Published,

Ming Cao, Daniel Spielman and Edmund Yeh, "Accelerated Gossip Algorithms for Distributed Computation", 44th Annual Allerton Conference on Communication, Control, and Computation, p. , vol. 44, (2006). Accepted,

Daniel A. Spielman and Nikhil Srivastava, "Graph sparsification by effective resistances", Proceedings of the 40th annual ACM symposium on Theory of computing, p. , vol. , (2008). Published,

Samuel I Daitch and Daniel A. Spielman, "Faster approximate lossy generalized flow via interior point algorithms", Proceedings of the 40th annual ACM symposium on Theory of computing, p. , vol. , (2008). Published,

Books or Other One-time Publications

Arvind Sankar, "Smoothed Analysis of Gaussian Elimination", (2004). Thesis, Published
Bibliography: M.I.T., Ph.D. Thesis

Samuel I. Daitch, Daniel A. Spielman, "Support-Graph Preconditioners for 2-Dimensional Trusses", (2007). technical report, Published
Collection: arXiv technical report
Bibliography: <http://arxiv.org/abs/cs/0703119>

Daniel A. Spielman, Shang-Hua Teng, "Nearly-Linear Time Algorithms for Preconditioning and Solving Symmetric, Diagonally Dominant Linear Systems", (2006). arXiv technical report, Published
Bibliography: <http://www.arxiv.org/abs/cs.NA/0607105>

Web/Internet Site

URL(s):

<http://www.cs.yale.edu/homes/spielman/SmoothedAnalysis/>

Description:

This site is a compendium of papers, tutorials, and talks on smoothed analysis.

Other Specific Products

Contributions

Contributions within Discipline:

The primary research contribution during this year has been the discovery of the asymptotically fastest-known algorithm for minimum-cost flow. The algorithm paradigm employed by our algorithm is new, and will probably be exploited by others.

Contributions to Other Disciplines:

It is too early for this work to have impacts outside our discipline.

Contributions to Human Resource Development:

This project has greatly benefited the training as researchers of Srivastava and Daitch.

Contributions to Resources for Research and Education:

We have begun to write a survey on Smoothed Analysis, which will serve as an introduction to this field for a general scientific audience.

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None