Miles Crosskey, Ph.D.

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Summary

I have a strong mathematical background focused on machine learning, and experience with algorithm design for big data problems. I have knowledge of state of the art methods from mathematics, statistics, and computer science. I also have experience with interdisciplinary research and communication skills necessary for business collaboration.

Software Skills

Matlab, C++, Linux, LaTeX, Bash

Education

Duke University, Durham, North Carolina
Doctor of Philosophy in Mathematics GPA: 3.90
May 2014

Rensselaer Polytechnic Institute, Troy, New York
Bachelor of Science in Mathematics, Minor in Economics, GPA: 3.87
May 2008

Research Experience

Information Initiative at Duke, Research Assistant — August 2013 - Present

- Developing and testing state of the art algorithms including: Multiscale Regression, Geometric Multi-Resolution Analysis, Multiscale Analysis of Plane Arrangements, and Atlas Simulation.
- Applying stated algorithms to high dimensional problems including: hyperspectral imaging, news article classification, social networks, and molecular dynamics.
- Collaborating with professors in engineering, statistics, and mathematics.

Graduate Thesis Work, Graduate Researcher — August 2008 - May 2014

- Developed novel algorithms to solve applied problems tested on real data up to 1 TB.
- Proved finite sample accuracy results for newly developed algorithms.
- Communicated complex ideas to collaborators and diverse seminar audiences.

NSF Big Data Research Training Grant, Research Assistant — August 2011 - May 2014

- Learned about new breakthroughs in machine learning, computational topology, and statistics.
- Mentored yearly cohorts of up to three summer undergraduate research students on related topics.
- Traveled to conferences in related fields, delivered six research talks and presented three posters.

NSF Math Biology Research Training Grant, Research Assistant — August 2010 - May 2013

- Learned about ongoing mathematical biology and neuroscience research through weekly seminars and discussion groups.
- Collaborated with chemists at Rice University on high dimensional molecular dynamics problems.

Manuscripts and Publications

Crosskey, Maggioni, *ATLAS: A geometric approach to learning high-dimensional stochastic systems near manifolds.* Pending review in SIAM's Multiscale Modeling and Simulation journal. http://arxiv.org/abs/1404.0667

Crosskey, Nixon, Schick, Kovacic, *Invisibility cloaking via non-smooth transformation optics and ray tracing*, Physics Letters A, Volume 375, Issue 18, 2 May 2011, Pages 1903-1911, ISSN 0375-9601

Selected Workshop Experiences

Modeling Workshop in Industry, Research Assistant   June 2011
Institute for Mathematics and its Applications

- Teamed up with six graduate students working under Sanjiv Kumar from Google Labs.
- Surveyed recent mathematical search algorithms on an image database implemented in Matlab.

Image Processing Summer School, Graduate Researcher   June 2010 - July 2010
Park City Math Institute

- Implemented state of the art image processing techniques in Matlab for: classification, compressed sensing, dictionary learning, and denoising.

Project Descriptions

Atlas simulation algorithm, Matlab
Graduate thesis work

- Reduced running time of the bottleneck in applying dimensionality reduction and clustering to stochastic dynamical systems.
- Developed tests to check assumptions and performance to ensure system wide accuracy.
- Automated execution of the algorithm on a supercomputer cluster using Bash scripts.
- Collaborated with a visualization expert to design an interactive interface to explore results in real time.

Gaussian measurement algorithm, Matlab
Graduate thesis work

- Realized a common assumption which was not being checked in many cases: that the distribution being drawn from is Gaussian.
- Created a fast $O(n)$, automated, algorithm utilizing nearest neighbor searches to measure Gaussianity in high dimensions.
- Designed for easy use; takes only data as input, returns a number between 0 and 1.

Multiscale analysis of plane arrangements, Matlab and C++
Information Initiative at Duke

- Utilized local geometric properties to cluster and optimally fit hyperplanes to high dimensional data.
- Outperforms competing algorithms with fewer assumptions, when the number and dimension of the planes is unknown.
- Translating Matlab code to a C++ package to allow for more visibility and applicability.

Invisibility cloaking simulation, Matlab
Undergraduate thesis

- Collaborated with other undergraduates to solve complex ray tracing equations.
- Created a robust simulator for light passing through invisibility cloaks.
- Generated informative visualizations to include in our publication.

Other Experiences

Calculus Instructor, Duke University   Fall 2010, Fall 2011, Fall 2013

- Explained difficult concepts in lectures to classes of 30 during three 55-75 minute sessions per week.
- Designed three midterm exams each semester to assess student progress.

Programming Intern, Rensselaer at Hartford   2007

- Designed an interactive graphical user interface using SQL and Microsoft Access to collect data and forecast revenue.