Miles Crosskey, Ph.D.

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SUMMARY

I have a strong mathematical background focused on machine learning, and experience with algorithm design and visualization 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

Proficient in: Matlab, Maple, Mathematica, LaTeX
Knowledge of: C++, Python, Bash, Linux, html, Gromacs, SQL, MS Access

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

CURRENT APPOINTMENT

Information Initiative at Duke, Research Assistant   May 2014 - Present

- Collaborating with professors in mathematics, computer science, and engineering as well as other research assistants to visualize data.
- Collecting, cleaning, and analyzing data using regression, classification, and dimensionality reduction for visualization purposes.
- Analyzing data related to: news articles, social networks, hyperspectral images, and protein folding.

PROJECT EXPERIENCE

Geometric Multi-Resolution Analysis (GMRA), Matlab
Information Initiative at Duke

- Testing GMRA on data obtained from collaborators for classification, regression, and density estimation.
- Comparing with other researcher's algorithms found in papers and code found on the web.
- Preparing figures and descriptions for papers involving the GMRA framework.

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.

Atlas simulation algorithm, Matlab, Bash, some C++
Graduate thesis work, Duke University

- 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.
- Collaborated with chemists at Rice University coding scripts and analyzing molecular simulation data.
- Automated execution of the Atlas algorithm on a supercomputer cluster using Bash scripts to call Gromacs, Matlab and C++ code.
- Collaborated with a visualization expert to design an interactive interface to explore results in real time.

Gaussian measurement algorithm, Matlab
Graduate thesis work, Duke University

- 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.

Invisibility cloaking simulation, Matlab
Undergraduate thesis work, Rensselaer Polytechnic Institute

- 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.

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.

OTHER EXPERIENCES

Undergraduate Research Mentor, Duke University   Summer 2011, Summer 2012, Summer 2013

- Designed three short projects for undergraduate research students, one each year.

- Mentored 1-3 students on small data analysis research projects ranging in length from one week to one month.

- Gave topics lectures on necessary mathematical skills used to solve research projects.

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.

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