Majid Rasouli

Curriculum Vitae

Personal Data

Full First Name:	Seyed Majid
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Education

2015 - Present	PhD Candidate in **Computer Science**, University of Utah Research Areas: Scientific Computing, Distributed Systems, High Performance Computing (HPC) Advisor: Dr. Hari Sundar, GPA: 3.90/4
2011 - 2013	Masters in **Mathematics**, Sharif University, GPA: 16.31/20
2006 - 2011	Bachelors in **Mathematics**, Amirkabir University, GPA: 15.03/20 Awarded certificate for graduating with **top 3** GPAs in my class.

Technical Skills

Main:	**C++ (5 years experience)**, git, Linux, LaTeX, CMake Parallel Programming (MPI (cluster), OpenMP (multithread, GPU))
Prototyping:	Julia, MATLAB
Visualization:	Paraview, Javascript, CSS, D3
Familiar:	Python, GPU Programming, Machine Learning, R Studio, Bash, Slurm

Honors

- Ranked in **Top 1 Percent** in The National University Entrance Exam for Masters Degree, 2011, Iran.
- Scholarship for International HPC Summer School 2017, University of Colorado, Boulder
- Scholarship for SDSC Summer Institute 2018, San Diego Supercomputer Center, UCSD
- Certificate for Graduation with Top 3 GPA's in my Class, Bachelors in Mathematics

Experience

Fall 2015 – present: Research Assistant: Developing a C++ Math library as my Ph.D. project.

Fall 2016: Teaching Assistant for Probability and Statistics for Engineers, University of Utah. Taught students to use R Studio.

Fall 2017: Teaching Assistant for Foundations of Data Analysis, University of Utah. Taught students how to use Python for basic Machine Learning.

Selected Courses

Undergraduate:
Basic Programming (C), Advanced Programming (C++), Linear Algebra, Numerical Linear Algebra, Logic, Probability and Stat 1 & 2, Numerical Analysis

Graduate:
Big Data Computer Systems, Parallel Computing HPC, Advanced Scientific Computing 1 & 2, Advanced Algorithms, Algorithms and Approximation, Inverse Problems, Visualization

Research and Projects

Saena (Jan 2016 - Present; Developer)
Saena is a highly scalable algebraic multigrid solver written in C++ parallelized with MPI and OpenMP. It can be used to perform different linear algebra operations in serial and parallel. I am the only developer of the library, under the supervision of Dr. Hari Sundar.

Matrix-Vector Product Optimization (Published; First Author)
Matrix-vector product is the dominant operation in algebraic multigrid. We have presented four different ideas to improve matrix-vector product in both shared memory (OpenMP) and distributed memory (MPI) approaches. It is implemented in Saena (C++). The paper is published in *IEEE HPEC18*: Improving Performance and Scalability of Algebraic Multigrid through a Specialized MATVEC.

A Divide and Conquer Distributed Matrix-Matrix Multiplication (First Author)
Matrix-matrix product is a fundamental operation in the setup phase of algebraic multigrid, and in general in scientific computing. We have implemented a recursive matrix-matrix product. We keep splitting the matrices until reaching a threshold, then we perform a combination of dense and sparse matrix multiplication to speedup the process. We have implemented it in Saena (C++, MPI, OpenMP) and it is at its final stage.

Scalable Lazy-update Multigrid Preconditioners (Published; First Author)
Algebraic multigrid is especially attractive due to its black-box nature. This however comes at the cost of increased setup costs that can be significant in case of systems where the system matrix changes frequently making it difficult to amortize the setup cost. In this work, we investigate several strategies for performing lazy updates to the multigrid hierarchy corresponding to changes in the system matrix. The paper is published in *IEEE HPEC19*: Scalable Lazy-update Multigrid Preconditioners .

Randomized Sparsification for Algebraic Multigrid (Middle Stage; First Author)
Algebraic Multigrid's scalability and performance suffers from loss of sparsity in coarser levels of multigrid due to filling-in. We use randomized sparsification to increase sparsity of coarse matrices at different levels of the Multigrid hierarchy, but still keeping the important information of the matrices. The randomness feature of our method guarantees the whole range of information from the matrix being preserved.

USA Demographic Analysis
We have implemented an interactive map of USA, using Javascript, CSS and D3.
https://majidrp.github.io/DemographicAnalysis/

Workshops

International HPC Summer School 2017, University of Colorado-Boulder
Attendee of multiple workshops including:
Scientific Visualization with Paraview, Performance Analysis And Optimization (Tau), Workflow Tools, Hybrid Programming: MPI+OpenMP, Spark
https://confluence.xsede.org/display/IH17/International+HPC+Summer+School+2017

SDSC Summer Institute 2018, San Diego Supercomputer Center (SDSC)
Attendee of multiple workshops including: Advanced git, GPU Computing and Programming, Performance Tuning, Information Visualization, Globus
https://si18.sdsc.edu

SC17, Denver, Colorado
Student Volunteer for SC17, The International Conference for High Performance Computing, Networking, Storage and Analysis, https://sc17.supercomputing.org/