Shaden Smith
Curriculum Vitæ

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Research Interests

My research is primarily concerned with the development of scalable, high performance algorithms for applications in data mining and machine learning. *Irregular* applications are of particular interest to me, such as those that operate on sparse graphs, matrices, and tensors. My thesis work has focused on large-scale sparse tensor factorization and is culminated in SPLATT, an open source software toolkit for tensor factorization and related kernels. SPLATT has been scaled to over 16,000 cores and is actively used by academic, industry, and government researchers.

Education

- **UNIVERSITY OF MINNESOTA–TWIN CITIES**   **Minneapolis, MN**
  Ph.D., Computer Science. 2012 – 2018 (expected)
  Thesis title: "Algorithms for Large-Scale Sparse Tensor Factorization"
  Thesis advisor: Dr. George Karypis

- **UNIVERSITY OF KENTUCKY**   **Lexington, KY**
  B.S., Computer Science. 2009 – 2012
  Minor in Mathematics

Awards & Honors

- **ACM/IEEE-CS George Michael HPC Fellowship**, 2017.

- **Distinguished Paper Award**, Euro-Par 2017, *Accelerating the Tucker Decomposition with Compressed Sparse Tensors.*

- HPEC GraphChallenge Finalist, 2017, *Truss Decompositions on Shared-Memory Parallel Systems.*

- HPEC GraphChallenge Finalist, 2017, *Exploring Optimizations on Shared-memory Platforms for Parallel Triangle Counting Algorithms.*

- **Best Student Paper Finalist**, Supercomputing 2016, *An Exploration of Optimization Algorithms for High Performance Tensor Completion.*

- **Doctoral Dissertation Fellowship**, 100% stipend, tuition, and fees for 2016-2017 academic year

- Outstanding Graduating Senior Award, University of Kentucky, 2012 One award is given each year to a graduating computer science senior

- Student Symposium Winner, Lexmark Student Symposium, 2011. Awarded top prize in a symposium of student internship projects

- Travel Awards: SIAM CSE'17, IPDPS'16, SIAM PP'16, IPDPS'15

Professional Experience

- **INTEL LABS**   **Santa Clara, CA**
  Graduate Research Intern – Parallel Computing Laboratory   *Summer 2017*
  – Optimized sparse tensor and graph algorithms on many-core processors
  – Hardware/software co-design to optimize sparse matrix and graph computations

- **LAWRENCE LIVERMORE NATIONAL LABORATORY**   **Livermore, CA**
  Graduate Intern – High Energy Density Physics Department   *Summer 2013*
  – Developed OpenACC implementation of LULESH, a hydrocode proxy application
  – Provided regular feedback on compiler implementation and language design

- **LEXMARK INTERNATIONAL**   **Lexington, KY**
  Graduate Intern – Material Technology Department   *Summer 2012*
  – Lead developer on a massively parallel particle flow modeling engine in CUDA

- **Lexmark International**   **Lexington, KY**
  Undergraduate Intern – Material Technology Department   *Summer 2011*
  – Designed and implemented a high-performance particle flow modeling engine in C++
  – Project awarded 1st place prize in student symposium

Teaching Experience

- **Co-Instructor, Introduction to Parallel Computing**   **Spring 2017**
  Department of Computer Science and Engineering, University of Minnesota

- **Teaching Assistant, Introduction to Parallel Computing**   **Spring 2014, Spring 2015**
  Department of Computer Science and Engineering, University of Minnesota

- **Teaching Assistant, Introduction to Internet Programming**   **Fall 2012, Spring 2013, Fall 2013**
  Department of Computer Science and Engineering, University of Minnesota

- **Teaching Assistant, Introduction to Algorithm Design & Analysis**   **Fall 2011, Spring 2012**
  Department of Computer Science, University of Kentucky

Publications

Book Chapters

[B 1] David C. Anastasiu, Jeremy Iverson, **Shaden Smith**, and George Karypis. Big data frequent pattern mining. In *Frequent Pattern Mining*, pages 225–260. Springer International Publishing, Switzerland, 2014.

Journals

[J 1] **Shaden Smith**, Jongsoo Park, and George Karypis. HPC formulations of optimization algorithms for tensor completion. *Accepted to Parallel Computing*, 2017.

[J 2] David C. Anastasiu, Evangelia Christakopoulou, **Shaden Smith**, Mohit Sharma, and George Karypis. Big data and recommender systems. *Novática: Journal of the Spanish Computer Scientist Association*, (240), October 2016.

Refereed Conference & Workshop Proceedings

[C 1] **Shaden Smith**, Kejun Huang, Nicholas D Sidiropoulos, and George Karypis. Streaming tensor factorization for infinite data sources. *Proceedings of the 2018 SIAM International Conference on Data Mining (SDM'18)*, 2018.

[C 2] Jee W. Choi, Xing Liu, **Shaden Smith**, and Tyler Simon. Blocking optimization techniques for sparse tensor computation. *32nd IEEE International Parallel & Distributed Processing Symposium (IPDPS'18)*, 2018.

[C 3] **Shaden Smith**, Xing Liu, Nesreen K. Ahmed, Ancy Sarah Tom, Fabrizio Petrini, and George Karypis. Truss decompositions on shared-memory parallel systems. In *IEEE High Performance Extreme Computing Conference (HPEC)*, 2017, **GraphChallenge Finalist**.

[C 4] Ancy Sarah Tom, Narayanan Sundaram, Nesreen K. Ahmed, **Shaden Smith**, Stijn Eyerman, Midhunchandra Kodiyath, Ibrahim Hur, Fabrizio Petrini, and George Karypis. Exploring optimizations on shared-memory platforms for parallel triangle counting algorithms. In *IEEE High Performance Extreme Computing Conference (HPEC)*, 2017, **GraphChallenge Finalist**.

[C 5] **Shaden Smith** and George Karypis. Accelerating the Tucker decomposition with compressed sparse tensors. *European Conference on Parallel Processing (Euro-Par '17)*, 2017, **Distinguished Paper Award**.

[C 6] **Shaden Smith**, Alec Beri, and George Karypis. Constrained tensor factorization with accelerated AO-ADMM. *46th International Conference on Parallel Processing (ICPP '17)*, 2017.

[C 7] Michael Anderson, **Shaden Smith**, Narayanan Sundaram, Mihai Capotă, Zheguang Zhao, Subramanya Dulloor, Nadathur Satish, and Theodore L. Willke. Bridging the gap between HPC and Big Data frameworks. *Proceedings of the VLDB Endowment (PVLDB '17)*, 2017.

[C 8] **Shaden Smith**, Jongsoo Park, and George Karypis. Sparse tensor factorization on many-core processors with high-bandwidth memory. *31st IEEE International Parallel & Distributed Processing Symposium (IPDPS'17)*, 2017.

[C 9] **Shaden Smith**, Jongsoo Park, and George Karypis. An exploration of optimization algorithms for high performance tensor completion. *Proceedings of the 2016 ACM/IEEE Conference on Supercomputing (SC'16)*, 2016. **Finalist, Best Student Paper**.

[C 10] **Shaden Smith** and George Karypis. A medium-grained algorithm for distributed sparse tensor factorization. *30th IEEE International Parallel & Distributed Processing Symposium (IPDPS'16)*, 2016.

[C 11] **Shaden Smith** and George Karypis. Tensor-matrix products with a compressed sparse tensor. In *Proceedings of the 5th Workshop on Irregular Applications: Architectures and Algorithms (IA3'15)*, page 7. ACM, 2015.

[C 12] **Shaden Smith**, Niranjay Ravindran, Nicholas D. Sidiropoulos, and George Karypis. SPLATT: Efficient and parallel sparse tensor-matrix multiplication. *29th IEEE International Parallel & Distributed Processing Symposium (IPDPS'15)*, 2015.

[C 13] Niranjay Ravindran, Nicholas D. Sidiropoulos, **Shaden Smith**, and George Karypis. Memory-efficient parallel computation of tensor and matrix products for big tensor decomposition. *Proceedings of the Asilomar Conference on Signals, Systems, and Computers*, 2014.

[C 14] Yuliya Lierler, **Shaden Smith**, Miroslaw Truszczynski, and Alex Westlund. Weighted-sequence problem: ASP vs CASP and declarative vs problem-oriented solving. In *Practical Aspects of Declarative Languages (PADL'12)*, pages 63–77. Springer, 2012.

Under Review & In Preparation

[P 1] Zhuliu Li, Raphael Petegrosso, Rui Kuang, **Shaden Smith**, David Sterling, and George Karypis. On scalable label propagation on tensor product graphs. *Under review*, 2017.

Invited Talks & Posters

[U 1] **Shaden Smith** and George Karypis. Accelerating the tucker decomposition with compressed sparse tensors. *SIAM Conference on Parallel Processing for Scientific Computing (PP'18), Minisymposium: Tensor Decomposition for High Performance Data Analytics*, 2018.

[U 2] Ancy Sarah Tom, **Shaden Smith**, and George Karypis. Triangle counting and truss decomposition on modern parallel architectures (*talk given by Ancy Sarah Tom*). *SIAM Conference on Parallel Processing for Scientific Computing (PP'18), Minisymposium: Architecture-Aware Graph Analytics*, 2018.

[U 3] **Shaden Smith**, Jongsoo Park, and George Karypis. An exploration of optimization algorithms for high performance tensor completion. SIAM Conference on Computational Science and Engineering (CSE'17), Minisymposium: Tensor Decompositions: Applications and Efficient Algorithms, 2017.

[U 4] **Shaden Smith** and George Karypis. High performance sparse tensor factorization. Intel Research, invited talk, 2016.

[U 5] **Shaden Smith**. Algorithms for large-scale sparse tensor factorization. University of Minnesota Doctoral Disseration Fellowship (DDF) showcase, poster, 2017.

[U 6] **Shaden Smith** and George Karypis. SPLATT: Enabling large-scale sparse tensor analysis. Workshop on Algorithms for Modern Massive Data Sets (MMDS'16), poster, 2016.

[U 7] **Shaden Smith**, Jongsoo Park, and George Karypis. An exploration of optimization algorithms for high performance tensor completion. The 9th International Workshop on Parallel Matrix Algorithms and Applications (PMAA'16), Minisymposium: Sparse Matrix and Tensor Computations, 2016.

[U 8] **Shaden Smith** and George Karypis. Efficient factorization with compressed sparse tensors. SIAM Conference on Parallel Processing for Scientific Computing (PP'16), Minisymposium: Parallel Algorithms for Tensor Computations, 2016.

[U 9] **Shaden Smith** and Peter Robinson. LULESH and OpenACC: To exascale and beyond!!! PGI OpenACC Workshop, 2013.

[U 10] **Shaden Smith** and Jerry Fish. 2010: A GPU odyssey. Lexmark Celebrate Success Seminar, 2012.

[U 11] **Shaden Smith** and Jerry Fish. Particle flow modeling or: How I learned to stop worrying and love DEM. Lexmark Student Symposium, 2011.

Software

[S 1] **Shaden Smith** and George Karypis. SPLATT: the Surprisingly Parallel spArse Tensor Toolkit. `http://cs.umn.edu/~splatt/`, 2015.

[S 2] **Shaden Smith**, Jee W. Choi, Jiajia Li, Richard Vuduc, Jongsoo Park, Xing Liu, and George Karypis. FROSTT: The formidable repository of open sparse tensors and tools. `http://frostt.io/`, 2017.

Professional Service

- *Panelist*:

    - Student Success Stories (at *Supercomputing 2016*)
    - Experiencing HPC for Undergraduates (at *Supercomputing 2016*)

- *Program Committee*:

    - The Seventh Workshop on Irregular Applications: Architectures and Algorithms (IA3 '17)

- *Journal reviewer*:

    - Journal of Parallel and Distributed Computing (JPDC)
    - Transactions on Parallel and Distributed Systems (TPDC)
    - International Journal of Pattern Recognition and Artificial Intelligence (IJPRAI)
    - International Journal of Information Technology and Management (IJITM)

- *Conference reviewer*:

    - International Conference on Data Mining (ICDM)
    - SIAM International Conference on Data Mining (SDM)
    - International Conference on Parallel Processing (ICPP)
    - International Parallel and Distributed Processing Symposium (IPDPS)
    - International Conference on Big Data (BigData)
    - International Conference on Data Science and Advanced Analytics (DSAA)

- *Workshop reviewer*:

    - Knowledge Representation and Automated Reasoning (RCRA)

- *Benchmark Contributor*: Answer Set Programming Competition (ASPCOMP)
  Co-authored the following benchmarks:

    - ASPCOMP 2013 – *Weighted-Sequence Problem*

    – ASPCOMP 2011 & 2013 – *Hanoi Tower*

- *Student President*: Association for Computing Machinery (ACM)– University of Kentucky Student Chapter (Fall 2011 – Spring 2012)

Membership in Professional Organizations

- Association for Computing Machinery (ACM) student member
- ACM Special Interest Group on High Performance Computing (SIGHPC) student member
- Institute of Electrical and Electronics Engineers (IEEE) student member
- Society for Industrial and Applied Mathematics (SIAM) student member