SAUGATA GHOSE

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Pittsburgh PA 15213

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RESEARCH INTERESTS

- **Data-oriented computer architectures:** programming interfaces and devices for processing-in-memory, energy-efficient memory systems, near-memory compute for mobile and edge computing
- **Memory and storage systems:** virtual memory management, application-aware memory and storage controllers, low-latency main memory, NAND flash reliability/endurance, non-volatile memories
- **Computer architecture and related systems-level interactions:** non-von-Neumann architectures, system optimizations for GPGPU, architectural support for bioinformatics, instruction/load criticality

EDUCATION

Cornell University, Ithaca, NY
Ph.D., Computer Engineering, minor in Computer Science — August 2014
Dissertation Title: Criticality-Aware Memory Systems

M.S., Computer Engineering — January 2014

Cumulative GPA: 4.05
Advisor: José F. Martínez

State University of New York at Binghamton (Binghamton University)
B.S., dual degree in Computer Engineering and Computer Science — May 2007

Cumulative GPA: 3.99 (All-University Honors, *summa cum laude*)
Research advisor: Aneesh Aggarwal

PROFESSIONAL WORK EXPERIENCE

Special Faculty Systems Scientist — September 2016 – present
Carnegie Mellon Univ., Dept. of Electrical and Computer Engineering (Pittsburgh, PA)

Postdoctoral Research Associate — September 2014 – August 2016
Carnegie Mellon Univ., Dept. of Electrical and Computer Engineering (Pittsburgh, PA)
Postdoc Advisor: Onur Mutlu

Web Consultant — January 2007 – August 2007
H2 Innovations (Binghamton, NY)

College Student Technical Specialist — May 2006 – August 2006
Lockheed Martin Systems Integration (Owego, NY)

Student Enterprise Application Developer — February 2006 – December 2006
State Univ. of New York at Binghamton, Computing Services & Educational Technology

Web Developer — November 2005 – May 2007
State Univ. of New York at Binghamton, Office of Campus Life

Pre-Professional Co-op — May 2005 – December 2005
IBM, Business Transformation and CIO Group (Endicott, NY)

HONORS & AWARDS

- Wimmer Faculty Fellowship, Carnegie Mellon University — April 2019
- Best Poster Award, RECOMB-Seq Workshop — April 2018
- Best Paper Award, DFRWS Digital Forensics Research Conference Europe — March 2017
- Director's Ph.D. Teaching Assistant Award, School of Electrical & Computer Engineering, Cornell University — May 2013
- ASEE National Defense Science and Engineering Graduate Fellowship — Fall 2008 – Summer 2011
- Honorable Mention, NSF Graduate Research Fellowship — Fall 2008
- Cornell University Fellowship — Fall 2007 – Spring 2008
- Binghamton Foundation Award for Student Excellence – Watson School — May 2007
- Outstanding Achievement in Baccalaureate Studies, Computer Engineering — May 2007
- Service Award, Electrical & Computer Engineering Dept., SUNY Binghamton — May 2007
- University Award for Student Excellence, SUNY Binghamton — January 2007
- Upsilon Pi Epsilon – Computer Science Honor Society — Fall 2006
- Tau Beta Pi – Engineering Honor Society — Fall 2005
- Eta Kappa Nu – Electrical Engineering Honor Society — Spring 2005
- Kunis Scholarship for Computing Excellence, SUNY Binghamton — Fall 2003 – Spring 2007
- Binghamton Scholars Program — Fall 2003 – Spring 2007

PEER-REVIEWED PUBLICATIONS

S. Ghose, A. Boroumand, J. S. Kim, J. Gómez-Luna, and O. Mutlu. "Processing-in-Memory: A Workload-Driven Perspective." In *IBM Journal of Research and Development (JRD)*, Vol. 63, No. 6, Nov./Dec. 2019.

S. Ghose, T. Li, N. Hajinazar, D. Senol Cali, and O. Mutlu. "Demystifying Workload–DRAM Interactions: An Experimental Study." In *ACM SIGMETRICS / IFIP Performance*, Jun. 2019. To be published in *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, Vol. 3, No. 3, Dec. 2019.

A. Boroumand, **S. Ghose**, M. Patel, H. Hassan, B. Lucia, K. Hsieh, K. T. Malladi, H. Zheng, and O. Mutlu. "CoNDA: Enabling Efficient Near-Data Accelerator Communication by Optimizing Data Movement." In *Int'l. Symp. on Computer Architecture (ISCA)*, Jun. 2019.

H. Hassan, M. Patel, J. S. Kim, A. G. Yağlıçkı, N. Vijaykumar, N. Mansourighiasi, **S. Ghose**, and O. Mutlu. "CROW: A Low-Overhead Substrate for Improving DRAM Performance and Energy-Efficiency." In *Int'l. Symp. on Computer Architecture (ISCA)*, Jun. 2019.

Y. Li, C. R. Lefurgy, K. Rajamani, M. S. Allen-Ware, G. J. Silva, D. D. Heimsoth, **S. Ghose**, and O. Mutlu. "A Scalable Priority-Aware Approach to Managing Data Center Server Power." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, industrial session, Feb. 2019

Y. Wang, A. Tavakkol, L. Orosa, **S. Ghose**, N. Mansouri Ghiasi, M. Patel, J. S. Kim, H. Hassan, M. Sadrosadati, and O. Mutlu. "Reducing DRAM Latency via Charge-Level-Aware Look-Ahead Partial Restoration." In *Int'l. Symp. on Microarchitecture (MICRO)*, Oct. 2018

S. Ghose, A. G. Yağlıçkı, R. Gupta, D. Lee, K. Kudrolli, W. X. Liu, H. Hassan, K. K. Chang, N. Chatterjee, A. Agrawal, M. O'Connor, and O. Mutlu. "What Your DRAM Power Models Are Not Telling You: Lessons from a Detailed Experimental Study." In *ACM SIGMETRICS*, Jun. 2018. Published in *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, Vol. 2, No. 3, Dec. 2018.

Y. Luo, **S. Ghose**, Y. Cai, E. F. Haratsch, and O. Mutlu. "Improving 3D NAND Flash Memory Lifetime by Tolerating Early Retention Loss and Process Variation." In *ACM SIGMETRICS*, Jun. 2018. Published in *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, Vol. 2, No. 3, Dec. 2018.

R. Ausavarungnirun, J. Landgraf, V. Miller, **S. Ghose**. J. Gandhi, C. J. Rossbach, and O. Mutlu. "Mosaic: Enabling Application-Transparent Support for Multiple Page Sizes in Throughput Processors." In *ACM SIGOPS Operating Systems Review (OSR)*, Vol. 52, No. 1, Jul. 2018. Extended version of MICRO 2017 paper.

A. Tavakkol, M. Sadrosadati, **S. Ghose**, J. S. Kim, Y. Luo, Y. Wang, N. M. Ghiasi, L. Orosa, J. Gómez-Luna, and O. Mutlu. "FLIN: Enabling Fairness and Enhancing Performance in Modern NVMe Solid State Drives." In *Int'l. Symp. on Computer Architecture (ISCA)*, Jun. 2018.

D. Senol Cali, J. S. Kim, **S. Ghose**, C. Alkan, and O. Mutlu. "Nanopore Sequencing Technology and Tools for Genome Assembly: Computational Analysis of the Current State, Bottlenecks and Future Directions." In *Briefings in Bioinformatics*, Apr. 2018.

A. Boroumand, **S. Ghose**, Y. Kim, R. Ausavarungnirun, E. Shiu, R. Thakur, D. Kim, A. Kuusela, A. Knies, P. Ranganathan, and O. Mutlu. "Google Workloads for Consumer Devices: Mitigating Data Movement Bottlenecks". In *Int'l. Conf. on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, Mar. 2018.

R. Ausavarungnirun, V. Miller, J. Landgraf, **S. Ghose**, J. Gandhi, A. Jog, C. J. Rossbach, and O. Mutlu. "MASK: Redesigning the GPU Memory Hierarchy to Support Multi-Application Concurrency". In *Int'l. Conf. on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, Mar. 2018.

Y. Luo, **S. Ghose**, Y. Cai, E. F. Haratsch, and O. Mutlu. "HeatWatch: Improving 3D NAND Flash Memory Device Reliability by Exploiting Self-Recovery and Temperature Awareness." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, Feb. 2018.

A. Tavakkol, J. Gomez-Luna, M. Sadrosadati, **S. Ghose**, and O. Mutlu. "MQSim: A Framework for Enabling Realistic Studies of Modern Multi-Queue SSD Devices." In *USENIX Conf. on File and Storage Technologies (FAST)*, Feb. 2018.

J. S. Kim, D. Senol Cali, H. Xin, D. Lee, **S. Ghose**, M. Alser, H. Hassan, O. Ergin, C. Alkan, and O. Mutlu. "GRIM-Filter: Fast Seed Location Filtering in DNA Read Mapping Using Processing-in-Memory Technologies." In *Asia Pacific Bioinformatics Conf. (APBC)*, Jan. 2018. In *BMC Genomics*, Vol. 19, Suppl. 2, May 2018.

R. Ausavarungnirun, J. Landgraf, V. Miller, **S. Ghose**, J. Gandhi, C. J. Rossbach, and O. Mutlu. "Mosaic: A GPU Memory Manager with Application-Transparent Support for Multiple Page Sizes." In *Int'l. Symp. on Microarchitecture (MICRO)*, Oct. 2017.

Y. Cai, **S. Ghose**, E. F. Haratsch, Y. Luo, and O. Mutlu. "Error Characterization, Mitigation, and Recovery in Flash Memory Based Solid-State Drives." In *Proceedings of the IEEE*, Vol. 109, No. 9, Sept. 2017.

Y. Li, **S. Ghose**, J. Choi, J. Sun, H. Wang, and O. Mutlu. "Utility-Based Hybrid Memory Management." In *IEEE Cluster Conf. (CLUSTER)*, Sept. 2017.

X. Xiang, W. Shi, **S. Ghose**, L. Peng, O. Mutlu, and N.-F. Tzeng. "Carpool: A Bufferless On-Chip Network Supporting Adaptive Multicast and Hotspot Alleviation." In *Int'l. Conf. on Supercomputing (ICS)*, Jun. 2017

K. K. Chang, A. G. Yağlıçkı, **S. Ghose**, A. Agrawal, N. Chatterjee, A. Kashyap, D. Lee, M. O'Connor, H. Hassan, and O. Mutlu. "Understanding Reduced-Voltage Operation in Modern DRAM Devices: Experimental Characterization, Analysis, and Mechanisms." In *ACM SIGMETRICS*, Jun. 2017. Published in *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, Vol. 1, No. 1, Jun. 2017.

D. Lee, S. Khan, L. Subramanian, **S. Ghose**, R. Ausavarungnirun, G. Pekhimenko, V. Seshadri, and O. Mutlu. "Design-Induced Latency Variation in Modern DRAM Chips: Characterization, Analysis, and Latency Reduction Mechanisms." In *ACM SIGMETRICS*, Jun. 2017. Published in *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, Vol. 1, No. 1, Jun. 2017.

A. Fukami, **S. Ghose**, Y. Luo, Y. Cai, and O. Mutlu. "Improving the Reliability of Chip-Off Forensic Analysis of NAND Flash Memory Devices." In *DFRWS Digital Forensics Research Conference Europe (DFRWS EU)*, Mar. 2017. Published in *Digital Investigation*, Vol. 20, Mar. 2017.

Y. Cai, **S. Ghose**, Y. Luo, K. Mai, O. Mutlu, and E. F. Haratsch. "Vulnerabilities in MLC NAND Flash Memory Programming: Experimental Analysis, Exploits, and Mitigation Techniques." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, industrial session, Feb. 2017.

H. Hassan, N. Vijaykumar, S. Khan, **S. Ghose**, K. Chang, G. Pekhimenko, D. Lee, O. Ergin, and O. Mutlu. "SoftMC: A Flexible and Practical Open-Source Infrastructure for Enabling Experimental DRAM Studies." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, Feb. 2017.

A. Boroumand, **S. Ghose**, M. Patel, H. Hassan, B. Lucia, K. Hsieh, K. T. Malladi, H. Zheng, and O. Mutlu. "LazyPIM: An Efficient Cache Coherence Mechanism for Processing-in-Memory." In *IEEE Computer Architecture Letters (CAL)*, Vol. 16, No. 1, Jan. – Jun. 2017.

N. Vijaykumar, K. Hsieh, G. Pekhimenko, S. Khan, A. Shrestha, **S. Ghose**, A. Jog, P. B. Gibbons, and O. Mutlu. "Zorua: A Holistic Approach to Resource Virtualization in GPUs." In *Int'l. Symp. on Microarchitecture (MICRO)*, Oct. 2016.

X. Xiang, **S. Ghose**, O. Mutlu, and N.-F. Tzeng. "A Model for Application Slowdown Estimation in On-Chip Networks and Its Use for Improving System Fairness and Performance." In *Int'l. Conf. on Computer Design (ICCD)*, Oct. 2016.

K. Hsieh, S. Khan, N. Vijaykumar, K. K. Chang, A. Boroumand, **S. Ghose**, and O. Mutlu. "Accelerating Pointer Chasing in 3D-Stacked Memory: Challenges, Mechanisms, Evaluation." In *Int'l. Conf. on Computer Design (ICCD)*, Oct. 2016.

Y. Luo, **S. Ghose**, Y. Cai, E. F. Haratsch, and O. Mutlu. "Enabling Accurate and Practical Online Flash Channel Modeling for Modern MLC NAND Flash Memory." In *IEEE Journal on Selected Areas in Communications (JSAC)*, Vol. 34, No. 9, Sept. 2016.

K. K. Chang, A. Kashyap, H. Hassan, **S. Ghose**, K. Hsieh, D. Lee, T. Li, G. Pekhimenko, S. Khan, and O. Mutlu. "Understanding Latency Variation in Modern DRAM Chips: Experimental Characterization, Analysis, and Optimization." In *ACM SIGMETRICS / IFIP Performance*, Jun. 2016.

Y. Li, D. Wang, **S. Ghose**, J. Liu, S. Govindan, S. James, E. Peterson, J. Siegler, R. Ausavarungnirun, and O. Mutlu. "SizeCap: Coordinating Energy Storage Sizing and Power Capping for Fuel Cell Powered Data Centers." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, Mar. 2016.

K. K. Chang, P. J. Nair, D. Lee, **S. Ghose**, M. Qureshi, and O. Mutlu. "Low-Cost Inter-Linked Subarrays (LISA): Enabling Fast Inter-Subarray Data Migration in DRAM." In *Int'l. Conf. on High-Performance Computer Architecture (HPCA)*, Mar. 2016.

D. Lee, **S. Ghose**, G. Pekhimenko, S. Khan, and O. Mutlu. "Simultaneous Multi-Layer Access: Improving 3D-Stacked Memory Bandwidth at Low Cost." In *ACM Transactions on Architecture and Code Optimization (TACO)*, Vol. 12, No. 4, Dec. 2015.

R. Ausavarungnirun, **S. Ghose**, O. Kayıran, G. H. Loh, C. R. Das, M. T. Kandemir, and O. Mutlu. "Exploiting Inter-Warp Heterogeneity to Improve GPGPU Performance." In *Int'l. Conf. on Parallel Architectures and Compilation Techniques (PACT)*, Oct. 2015.

Y. Cai, Y. Luo, **S. Ghose**, E. F. Haratsch, K. Mai, and O. Mutlu. "Read Disturb Errors in MLC NAND Flash Memory: Characterization and Mitigation." In *Int'l. Conf. on Dependable Systems and Networks (DSN)*, Jun. 2015.

Y. Luo, Y. Cai, **S. Ghose**, J. Choi, and O. Mutlu. "WARM: Improving NAND Flash Memory Lifetime with Write-hotness Aware Refresh Management." In *Int'l. Conf. on Massive Storage Systems and Technology (MSST)*, Jun. 2015.

S. Ghose, H. Lee, and J. F. Martínez. "Improving Memory Scheduling via Processor-Side Load Criticality Information." In *Int'l. Symp. on Computer Architecture (ISCA)*, Jun. 2013.

J. Mukundan, **S. Ghose**, R. Karmazin, E. İpek, and J. F. Martínez. "Overcoming Single-Thread Performance Hurdles in the Core Fusion Reconfigurable Multicore Architecture." In *Int'l. Conf. on Supercomputing (ICS)*, Jun. 2012.

S. Ghose, L. Gilgeous, P. Dudnik, A. Aggarwal, and C. Waxman. "Architectural Support for Low Overhead Detection of Memory Violations." In *Design, Automation, and Test in Europe Conf. (DATE)*, Apr. 2009.

INVITED PAPERS

O. Mutlu, **S. Ghose**, J. Gómez-Luna, and R. Ausavarungnirun. "Enabling Practical Processing in and near Memory for Data-Intensive Computing." In *ACM/IEEE Design Automation Conf. (DAC)*, Jun. 2019.

O. Mutlu, **S. Ghose**, J. Gómez-Luna, and R. Ausavarungnirun. "Processing Data Where It Makes Sense: Enabling In-Memory Computation." In *Microprocessors and Microsystems (MICPRO)*, 2019

BOOK CHAPTERS

S. Ghose, K. Hsieh, A. Boroumand, R. Ausavarungnirun, and O. Mutlu. "Enabling the Adoption of Processing-in-Memory: Challenges, Mechanisms, Future Research Directions." In *Beyond-CMOS Technologies for Next Generation Computer Design*, Springer, 2019.

N. Vijaykumar, K. Hsieh, G. Pekhimenko, S. Khan, **S. Ghose**, A. Shreshtha, A. Jog, P. B. Gibbons, and O. Mutlu. "Decoupling the Programming Model from Resource Management in Throughput Processors." In *Many-Core Computing: Hardware and Software*, IET, 2019.

Y. Cai, **S. Ghose**, E. F. Haratsch, Y. Luo, and O. Mutlu. "Reliability Issues in Flash-Memory-Based Solid-State Drives: Experimental Analysis, Mitigation, Recovery." In *Inside Solid State Drives (SSDs)*, 2nd edition, Springer, 2018.

N. Vijaykumar, G. Pekhimenko, A. Jog, **S. Ghose**, A. Bhowmick, R. Ausavarungnirun, C. Das, M. Kandemir, T. C. Mowry, and O. Mutlu. "A Framework for Accelerating Bottlenecks in GPU Execution with Assist Warps." In *Advances in GPU Research and Practice*, Elsevier, 2016.

EDITORIAL ARTICLES

O. Mutlu, **S. Ghose**, and R. Ausavarungnirun. "Guest Editor Introduction: Recent Advances in DRAM and Flash Memory Architectures." In *IPSI BgD Trans. on Internet Research (TIR)*, Vol. 14, No. 2, Jul. 2018.

O. Mutlu, **S. Ghose**, and R. Ausavarungnirun. "Guest Editor Introduction: Recent Advances in Overcoming Bottlenecks in Memory Systems and Managing Memory Resources in GPU Systems." In *IPSI BgD Trans. on Advanced Research (TAR)*, Vol. 14, No. 2, Jul. 2018.

TECHNICAL REPORTS *(OTHERWISE UNPUBLISHED)*

A. Tavakkol, A. Kolli, S. Novakovic, K. Razavi, J. Gómez-Luna, H. Hassan, C. Barthels, Y. Wang, M. Sadrosadati, **S. Ghose**, A. Singla, P. Subrahmanyam, and Onur Mutlu. "Enabling Efficient RDMA-Based Synchronous Mirroring of Persistent Memory Transactions." arXiv:1810.09360 [cs.DC], Oct. 2018.

Y. Luo, **S. Ghose**, T. Li, S. Govindan, B. Sharma, B. Kelly, A. Boroumand, and O. Mutlu. "Using ECC DRAM to Adaptively Increase Memory Capacity." arXiv:1706.08870 [cs.AR], Jun. 2017.

S. Ghose, S. Srinath, and J. Tse. "Accelerating a PARSEC Benchmark Using Portable Subword SIMD." Dec. 2011.

GRANTS AND RESEARCH FUNDING

- **Co-PI, "Establishing a New Collaborative Research Thrust in Energy-Efficient Computing"** April 2019 – June 2020
  CMU Scott Institute of Energy Research Total Grant: $75,000
- **Co-PI, "Architectural Frameworks to Facilitate Practical, Efficient and Transparent Computation Near Data"** May 2017 – November 2019
  Semiconductor Research Corporation, Task 2719.001 Total Grant: $231,000
- **Co-PI, "High-Performance and Energy-Efficient Single-Level Stores: Efficient Coordinated Management of Storage and Memory"** September 2016 – August 2017
  National Science Foundation, Grant CNS-1320531 Total Grant: $516,000
- **Co-PI, "Enabling GPUs as First-Class Computing Engines"** September 2016 – July 2017
  National Science Foundation, Grant CNS-1409723 Total Grant: $456,652

TEACHING EXPERIENCE

- **Instructor, Carnegie Mellon 15-213/18-213** (Introduction to Computer Systems)
  » Spring 2020
- **Instructor, Carnegie Mellon 18-740** (Modern Computer Architecture and Design)
  » Fall 2019
  2019 Wimmer Faculty Fellow at Carnegie Mellon
- **Instructor, Carnegie Mellon 18-240** (Structure and Design of Digital Systems)
  » Spring 2019: overall teaching rating: 4.62/5, overall course rating: 4.62/5 (82 responses)
  » Spring 2018: overall teaching rating: 4.64/5, overall course rating: 4.63/5 (76 responses)
  » Spring 2017: overall teaching rating: 4.23/5, overall course rating: 4.45/5 (104 responses)
- **Instructor, Carnegie Mellon 18-600** (Foundations of Computer Systems)
  » Fall 2018: overall teaching rating: 4.17/5, overall course rating: 4.29/5 (122 responses)

- **Instructor, Carnegie Mellon 18-500** (ECE Design Experience)
  - » Fall 2017: overall teaching rating: 4.00/5, overall course rating: 3.53/5 (15 responses)
- **Head Teaching Assistant, Cornell ENGRD 2300** (Digital Logic & Computer Organization)
  - » Spring 2014: overall teaching rating: 4.75/5 (20 responses)
  - » Fall 2012: overall teaching rating: 5.00/5 (29 responses)
    2013 Cornell ECE Director's Ph.D. Teaching Assistant Award
  - » Spring 2012: overall teaching rating: 4.97/5 (29 responses)
    2013 Cornell ECE Director's Ph.D. Teaching Assistant Award
- **Lab Curriculum & Exercise Redevelopment, Cornell ENGRD 2300** Summer 2012 – Fall 2013
  Deployed new six-lab sequence in Fall 2013.
- **Lab Teaching Assistant, Binghamton EECE 252** (Computer Org. & Microcontrollers) Spring 2006
- **Teaching/Course Development, Binghamton UNIV 225** Fall 2004
  (Web Portfolios & University Policy)

STUDENT ADVISING & MENTORING

- **CMU Ph.D. Students**
  Amirali Boroumand (co-advised with Onur Mutlu), Damla Senol Cali (co-advised with Onur Mutlu), Minh Sy Quang Truong (co-advised with L. Richard Carley)
- **CMU Postdoctoral Researcher Training**
  Rachata Ausavarungnirun (2017 – 2019), Yixin Luo (2018), Kevin K. Chang (2017)
- **CMU Master's Research Students**
  Prithvi Cherabuddi, Ashwin Suresh Itagi (2018 – 2019), Kevin Zheng (2018), Naveen Kakarla (2018), Nidhi Bhatia (2018), Mark McElwaine (2018), Abhilasha Jain (2017 – 2018), Diptesh Majumdar (2017), Ashwin Raghavachari (2017), Raghav Gupta (2016 – 2017)
- **CMU Undergraduate Research Students**
  Shivani Prasad, Deanyone Su, William X. Liu, Eric Chen, Ziyue Zhang, Rohini Duvvuri, Aditi Hebbar (2017 – 2019), Adolfo Karim Victoria Higueros (2018 – 2019), Theresa Chan (2018 – 2019), Nicholas Saizan (2018), Adrian Honnold (2018), Samuel Westenberg (2018), Liam Walsh (2018), Kyle Kozlowski (2017 – 2019), Raghav Gupta (2015 – 2016), Kais Kudrolli (2015 – 2016)
- **CMU Ph.D. Student Mentoring**
  Yixin Luo (2014 – 2018), Yang Li (2014 – 2018), Rachata Ausavarungnirun (2014 – 2017), Kevin K. Chang (2014 – 2017), Nandita Vijaykumar (2015 – 2016)
- **CMU Research Intern Mentoring – Visiting Ph.D. Students and M.S. Graduates**
  Nastaran Hajinazar (2016 – 2017), Abdullah Giray Yağlıçkı (2016 – 2017), Xiyue Xiang (2015)
- **CMU Research Intern Mentoring – Visiting B.S. Students**
  Kiran Hombal (2019), Pratik Sampat (2018), Sanjith Athlur (2018), Suyash Mahar (2018), Sumit Kumar Yadav (2018), Ramya Nuggehalli Lakshminarasimha (2017), Tianshi Li (2015 – 2017), Adithya Krishnan Kannan (2017), Vidushi Dadu (2016)
- **CMU Research Intern Mentoring – High School Students**
  Nolan Dickey (2016), Steven Barash (2016)
- **Cornell Master's Project Mentoring**
  Gautam Bhatnagar (2011), Roberto R. Fischer (2011)

- **Cornell Undergraduate Research Mentoring**
  Monica J. Lin (2012 – 2014), Rebant R. Srivastava (2012 – 2014), Brandon S. Eusebio (2013 – 2014), Humna A. Awan (2013), Vinay F. Farias (2013), Kevin Lin (2013), Hyodong Lee (2011 – 2013), Hyun Ryong (Ryan) Lee (2011 – 2012), Sean S. Chen (2009 – 2011), Jiho (Ray) Choi (2007 – 2008), Siu Yu (Cherie) Kwan (2007 – 2008)

INVITED TALKS & CONFERENCE PRESENTATIONS

"PIM for the Masses: Enabling Technologies for the Widespread Adoption of Processing-in-Memory" *or* "Designing Architectures for a Data-Driven World"
» Samsung (San Jose, CA), 12 Nov. 2019
» Apple (Cupertino, CA), 8 Aug. 2019
» Carnegie Mellon University, ECE Colloquium (Pittsburgh, PA), 14 May 2018
» Cornell University, H.C. Torng Seminar Series (Ithaca, NY), 9 May 2018

"Hot Topics in Academic Flash and NVM Research"
» *Flash Memory Summit* (Santa Clara, CA), 8 Aug. 2019

"Modeling and Mitigating Early Retention Loss and Process Variation in 3D NAND Flash"
» *Flash Memory Summit* (Santa Clara, CA), 7 Aug. 2019

"Demystifying Workload–DRAM Interactions: An Experimental Study"
» *Joint ACM SIGMETRICS / IFIP Performance Conf.* (Phoenix, AZ), 27 Jun. 2019

"Total Recall: Tackling Contemporary Challenges in Memory and Storage Systems"
» Facebook (Menlo Park, CA), 18 Sept. 2018
» Microsoft Research (Redmond, WA), 15 Mar. 2018
» Alibaba Group (Bellevue, WA), 12 Mar. 2018

"MQSim: A Framework for Enabling Realistic Studies of Modern Multi-Queue SSD Devices"
» *Flash Memory Summit* (Santa Clara, CA), 9 Aug. 2018
» *USENIX Conf. on File and Storage Technologies* (Oakland, CA), 13 Feb. 2018

"What Your DRAM Power Models Are Not Telling You: Lessons from a Detailed Experimental Study"
» *ACM SIGMETRICS Conf.* (Irvine, CA), 21 Jun. 2018

"FLIN: Enabling Fairness and Enhancing Performance in Modern NVMe Solid State Drives"
» *Flash Memory Summit* (Santa Clara, CA), 7 Aug. 2019
» *Int'l. Symp. on Computer Architecture* (Los Angeles, CA), 5 Jun. 2018

"How Safe Is Your Storage? A Look at the Reliability and Vulnerability of Modern Solid-State Drives"
» ETH Zürich, Computing Platforms Seminar Series (Zürich, Switzerland), 1 Mar. 2018
» Brown University, Engineering Seminar (Providence, RI), 19 Oct. 2017

"Vulnerabilities in MLC NAND Flash Memory Programming: Experimental Analysis, Exploits, and Mitigation Techniques"
» *Flash Memory Summit* (Santa Clara, CA), 9 Aug. 2017
» *Int'l. Conf. on High-Performance Computer Architecture* (Austin, TX), 6 Feb. 2017

"Design-Induced Latency Variation in Modern DRAM Chips: Characterization, Analysis, and Latency Reduction Mechanisms"
» *ACM SIGMETRICS Conf.* (Urbana-Champaign, IL), 7 Jun. 2017

"Write-hotness Aware Retention Management: Efficient Hot/Cold Data Partitioning for SSDs"
» *Flash Memory Summit* (Santa Clara, CA), 10 Aug. 2016

"Making Memory and Storage Cooperate with Your CPU"
» Carnegie Mellon University, ECE Colloquium (Pittsburgh, PA), 9 Jun. 2016

"Simultaneous Multi-Layer Access: Improving 3D-Stacked Memory Bandwidth at Low Cost"
» *HiPEAC Conf.* (Prague, Czech Republic), 19 Jan. 2016

"Cooperative Memory Systems"
» Intel Labs (Santa Clara, CA), 23 Oct. 2015

"Exploiting Device and Application Behavior to Extend NAND Flash Lifetime"
» Samsung (San Jose, CA), 22 Oct. 2015

"Synergistic Memory Decisions" *or* "Criticality-Aware Memory Systems"
» Princeton University, Martonosi Research Group (Princeton, NJ), 5 Aug. 2014
» Carnegie Mellon University, SAFARI Research Group (Pittsburgh, PA), 18 Jun. 2014

"Improving Memory Scheduling via Processor-Side Load Criticality Information"
» *Int'l. Symp. on Computer Architecture* (Tel Aviv, Israel), 25 Jun. 2013

"Overcoming Single-Thread Performance Hurdles in the Core Fusion Reconfigurable Multicore Architecture"
» *Int'l. Conf. on Supercomputing* (Venice, Italy), 26 Jun. 2012

RELATED PROJECT EXPERIENCE

Big Red Chip Project – Cornell University September 2007 – May 2008
Designed and fabricated a 130 nm, low-power general-purpose processor with custom GPS tracking instructions as part of a student-led team. Main contributions were dual-phase pipeline design, dual-frequency clocking logic for scan chain, instruction decoder design, low-power optimizations.

BUSIPlus – Online Schedule of Classes Project – SUNY Binghamton March 2005 – September 2011
With a partner, created PHP scripts to parse and store online university class information into a local MySQL database. Used the database to support a new web-based application that provided 5,000 students with a visual, grid-style class schedule builder.

SERVICE

- Undergraduate Advising Committee, Electrical and Computer Engineering Dept., Carnegie Mellon University — August 2019 – present
- Web Chair, 2020 Int'l. Symp. on Computer Architecture (ISCA) — July 2019 – present
- Information Director, Int'l. Symp. on Microarchitecture (MICRO) — April 2018 – present
- University Coordinator, Flash Memory Summit — January 2018 – present
- Web Chair, 2019 Int'l. Symp. on Microarchitecture (MICRO) — January 2019 – November 2019
- Board of Distinguished Reviewers, ACM Transactions on Computer Architecture and Optimization (TACO) — June 2017 – May 2018
- Program Committee member
  » 2019 Young Architect Workshop (YArch)
  » 2018 Int'l. Symp. on Computer Architecture and High Performance Computing (SBAC-PAD)
  » 2018 Int'l. Conf. on Supercomputing (ICS)
  » 2017 Int'l Conf. on Supercomputing (ICS)

- External Review Committee member
  - » 2020 Int'l. Symp. on Computer Architecture (ISCA)
  - » 2019 Int'l. Symp. on Microarchitecture (MICRO)
  - » 2019 Int'l. Conf. on Supercomputing (ICS)
  - » 2016 Int'l. Symp. on High-Performance Computer Architecture (HPCA)
  - » 2015 Int'l. Symp. on Computer Architecture (ISCA)
- Technical reviewer: HPCA 2017, MICRO 2016, ISCA 2016, DSN 2016, DAC 2016, DATE 2016, ASPLOS 2016, DAC 2015, HPCA 2015, SIGMETRICS 2014, HPCA 2014, MICRO 2013, HPCA 2013, ISCA 2012, ISCA 2011, ISCA 2010, IISWC 2009, ISCA 2009, HiPEAC 2008, ACM Transactions on Architecture and Code Optimization (TACO), IEEE Transactions on Computer Aided Design (TCAD), ACM Transactions on Embedded Computing Systems (TECS), ACM Operating Systems Review (OSR), IEEE Computer Architecture Letters (CAL), ACM Computing Surveys (CSUR), IEEE Transactions on Computers (TC), IEEE Journal on Selected Areas of Communication (JSAC), IEEE Transactions on Parallel and Distributed Systems (TPDS), IEEE Transactions on VLSI Systems (TVLSI), ACM Journal of Emerging Technologies in Computing Systems (JETC), IET Computers and Digital Techniques, ACM Transactions on Design Automation of Electronic Systems (TODAES)
- Linux system administration, Computer Systems Lab, Cornell University April 2011 – August 2014
- Meeting organizer, Computer Systems Lab, Cornell University January 2009 – August 2010
- Treasurer, Tau Beta Pi, NY Tau chapter August 2006 – May 2007
  chapter won national Most Improved Award in 2007, Secretary's Commendation in 2007
- Vice President, Eta Kappa Nu, Kappa Epsilon chapter August 2006 – May 2007
- Student Advisory Board, Electrical & Computer Engineering Dept., SUNY Binghamton October 2005 – May 2007
- President, IEEE student branch, SUNY Binghamton August 2005 – May 2007
  branch won regional growth award in 2006, placed 2nd in international web design competition in 2007
- Watson Student Council, SUNY Binghamton August 2005 – May 2007
- Web Portfolio Student Task Force, SUNY Binghamton August 2004 – December 2004

PROFESSIONAL AFFILIATIONS

IEEE, IEEE Computer Society, IEEE TCuARCH, IEEE TCCA, ACM, ACM SIGARCH, ACM SIGMICRO