

Benjamin C. Lee

Curriculum Vitae – September 2020

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Nationality: United States
Place of Birth: California

School of Engineering and Applied Science
University of Pennsylvania
220 South 33rd Street
Philadelphia, PA 19104

Interests

Computer architecture – processor and memory design, power efficiency, security.
Datacenter systems – server architecture, resource management, simulation methods.
Systems modeling – performance and power analysis, statistical machine learning.
Algorithmic economics – allocation and scheduling, multi-agent markets, game theory.
Technology policy – technology, economics, policy for environmentally sustainable IT.

Education

Harvard University

Ph.D., Computer Science, 2008
S.M., Computer Science, 2006
Minor, Statistics

University of California, Berkeley

B.S., Electrical Engineering and Computer Science, 2004
Minor, Business Administration

Academic Experience

University of Pennsylvania, Philadelphia PA

Professor, Electrical & Systems Engineering, Computer & Information Science, 2020-.

Duke University, Durham NC

Co-Director, Center for Alternative Sustainable and Intelligent Computing, 2018-20
Associate Professor, Electrical & Computer Engineering, Computer Science, 2015-20
Assistant Professor, Electrical & Computer Engineering, Computer Science, 2010-15

Stanford University, Stanford CA

NSF Computing Innovation Fellow, Electrical Engineering, 2009-10

Harvard University, Cambridge MA

Graduate Researcher, Engineering and Applied Sciences, 2004-08

University of California, Berkeley CA

Undergraduate Researcher, Computer Science, 2002-04

Industrial Experience

Microsoft Research, Redmond WA

Post-doctoral Researcher, Systems and Networking, 2008-09

Intel Corporation, Santa Clara CA

Intern Researcher, Microarchitecture Research, 2007

Lawrence Livermore National Laboratory, Livermore CA

Intern Researcher, Applied Scientific Computing, 2006

Charles M. Salter Associates, San Francisco CA

Intern Engineer, Transportation and Airport Acoustics, 2000

**Academic
Honors**

ACM Distinguished Scientist, 2019
IEEE Senior Member, 2019
Dean's Award for Excellence in Mentoring Nominee, Duke University, 2018
Celebrating Mentors Honoree, Duke University, 2018
Hall of Fame, Int'l Symp. High-Perf. Computer Architecture (HPCA), 2018
Nortel Networks Assistant Professorship, Duke University, 2013-15
CAREER Award, National Science Foundation, 2012
Faculty Research Award, Google, 2011
Computing Innovation Fellowship, National Science Foundation, 2009
Engineering and Applied Sciences Fellowship, Harvard University, 2004
National Merit Scholarship, 2000

**Publication
Awards**

Better I/O through byte-addressable, persistent memory
Persistent impact prize for SOSP 2009 paper, 2020

The computational sprinting game
Research highlight, Communications of the ACM, 2019
Invited paper from ASPLOS, ACM Transactions on Computer Systems, 2017
Honorable mention, IEEE Micro Top Picks, 2016
Best paper, Int'l Conf. Architectural Support... (ASPLOS), 2016

Amdahl's Law in the datacenter era: A market for fair processor allocation
Best paper, Int'l Symp. High-Perf. Computer Architecture (HPCA), 2018

MAPS: Understanding metadata access patterns in secure memory
Best paper, Int'l Symp. Perf. Analysis Systems & Software (ISPASS), 2018

Microeconomic models for managing shared datacenters
Outstanding PhD dissertation award, Duke Electrical & Computer Engineering, 2017

PoisonIvy: Safe speculation for secure memory
Honorable mention, IEEE Micro Top Picks, 2016

Modeling communication costs in blade servers
Invited paper from HotPower, ACM Operating Systems Review, 2015

REF: Resource elasticity fairness with sharing incentives for multiprocessors
IEEE Micro Top Picks, 2014

Mobile processors for energy-efficient web search
Invited paper from ISCA, ACM Transactions on Computer Systems, 2011

Understanding sources of inefficiency in general-purpose chips
Research highlight, Communications of the ACM, 2011

Architecting phase change memory as a scalable DRAM alternative
Research highlight, Communications of the ACM, 2010
IEEE Micro Top Picks, 2009

CPR: Composable performance regression for scalable multiprocessor models
Best paper nominee, Int'l Symp. Microarchitecture (MICRO), 2008

Statistical inference for efficient microarchitectural analysis

Harvard University nominee, ACM Doctoral Dissertation Award, 2008

Corporate social responsibility and the globalization of 'local values'

Invited participant, 38th St. Gallen Symposium, 2008

Flattening the world efficiently: Digital sustainability for the twenty-first century

Invited participant, 37th St. Gallen Symposium, 2007

Statistical inference for efficient microarchitectural and application analysis

First place, Supercomputing (SC) Student Research Competition, 2006

Performance models for evaluation and automatic tuning of symmetric sparse matrix-vector multiply

Best paper, Int'l Conf. Parallel Processing (ICPP), 2004

Performance optimization and bounds for sparse matrix-vector multiply

Best student paper finalist, Supercomputing (SC), 2002

Publications

Journals, Magazines, Books

1. Seyed Majid Zahedi, Benjamin C. Lee. "A win for game theory in the data center," *IEEE Spectrum*, April 2020.
2. Yuhao Li, Dan Sun, Benjamin C. Lee. "Dynamic colocation policies with reinforcement learning," *ACM Transactions on Architecture and Code Optimization (TACO)*, 17(1):1:1-1:25, March 2020.
3. Songchun Fan*, Seyed Majid Zahedi*, Benjamin C. Lee. "Distributed strategies for computational sprints," *Communications of the ACM (CACM), Research Highlight*, 62(2):98-106, February 2019. *Equal Contributions.
4. Rupert Freeman*, Seyed Majid Zahedi*, Vincent Conitzer, Benjamin C. Lee. "Dynamic proportional sharing: A game-theoretic approach." *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, 2(1):3:1-3:36, June 2018. *Equal Contributions.
5. Pengfei Zheng and Benjamin C. Lee "Hound: Causal learning for datacenter-scale straggler diagnosis." *Proc. of the ACM on Measurement and Analysis of Computing Systems (POMACS)*, 2(1):17:1-17:36, June 2018.
6. Seyed Majid Zahedi, Songchun Fan, Benjamin C. Lee. "Managing heterogeneous datacenters with tokens." *ACM Transactions on Architecture and Code Optimization (TACO)*, 15(2):18:1-18:23, June 2018.
7. Seyed Majid Zahedi, Songchun Fan, Matthew Faw, Elijah Cole, Benjamin Lee. "Computational sprinting: Architecture dynamics, and strategies." *ACM Transactions on Computer Systems (TOCS)*, 34(4):12.1-12.26, January 2017.
8. Benjamin C. Lee. "Datacenter design and management: A computer architect's perspective," *Synthesis Lectures on Computer Architecture*, 11(1):1-121, February 2016.
9. Seyed Majid Zahedi, Benjamin C. Lee. "Sharing incentives and fair division for multiprocessors," *IEEE Micro, Top Picks from the Computer Architecture Conferences*, 35(3):92-100, May/June, 2015.

10. Marisabel Guevara, Benjamin Lubin, Benjamin C. Lee. "Market mechanisms for managing datacenters with heterogeneous microarchitectures," *ACM Transactions on Computer Systems (TOCS)*, 32(1):3.1-3.31, February 2014.
11. Rehan Hameed, Wajahat Qadeer, Megan Wachs, Omid Azizi, Alex Solomatnikov, Benjamin C. Lee, Stephen Richardson, Christos Kozyrakis, Mark Horowitz. "Understanding sources of inefficiency in general-purpose chips," *Communications of the ACM (CACM), Research Highlight*, 54(10):85-93, October 2011.
12. Vijay Janapa Reddi, Benjamin C. Lee, Trishul Chilimbi, Kushagra Vaid. "Mobile processors for energy-efficient web search," *ACM Transactions on Computer Systems (TOCS)*, 29(4):9.1-9.39, August 2011.
13. Ofer Shacham, Omid Azizi, Megan Wachs, Wajahat Qadeer, Zain Asgar, Kyle Kelley, Pete Stevenson, Alex Solomatnikov, Amin Firoozshahian, Benjamin C. Lee, Stephen Richardson, Mark Horowitz. "Why design must change: Rethinking digital design," *IEEE Micro*, 30(6):9-24, November/December, 2010.
14. Benjamin C. Lee, David Brooks. "Applied inference: Case studies in microarchitectural design," *ACM Transactions on Architecture and Code Optimization (TACO)*, 7(2):1-37, October 2010.
15. Benjamin C. Lee, Engin Ipek, Onur Mutlu, Doug Burger. "Phase change memory architecture and the quest for scalability," *Communications of the ACM (CACM), Research Highlight*, 53(7):99-106, July 2010.
16. Benjamin C. Lee, Ping Zhou, Engin Ipek, Onur Mutlu, Jun Yang, Youtao Zhang, Bo Zhao, Doug Burger. "Phase change technology and the future of main memory," *IEEE Micro, Top Picks from the Computer Architecture Conferences*, 30(1):131-141, January/February, 2010.
17. Benjamin C. Lee and D. Brooks. "A tutorial in spatial sampling and regression strategies for microarchitectural analysis," *IEEE Micro, Special Issue on Hot Tutorials*, 27(3):74-93, May/June 2007.

Refereed Proceedings

18. Atefeh Mehrabi, Aninda Manocha, Benjamin C. Lee, Daniel J. Sorin. "Prospector: Synthesizing efficient accelerators via statistical learning." *Proc. Design Automation and Test in Europe (DATE)*, March 2020.
19. Ziqiang Huang, Jose Joao, Alejandro Rico, Andrew D. Hilton, Benjamin C. Lee. "DynaSprint: Microarchitectural sprints with dynamic utility and thermal management." *Proc. International Symposium on Microarchitecture (MICRO)*, October 2019.
20. Songchun Fan, Theodoros Salonidis, Benjamin Lee. "Swing: Swarm computing for mobile sensing." *Proc. International Conference on Distributed Computing Systems (ICDCS)*, July 2018.
21. Rupert Freeman*, Seyed Majid Zahedi*, Vincent Conitzer, Benjamin C. Lee. "Dynamic proportional sharing: A game-theoretic approach." *Proc. International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, June 2018. *Equal Contributions.

22. Pengfei Zheng and Benjamin C. Lee “Hound: Causal learning for datacenter-scale straggler diagnosis.” *Proc. International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, June 2018.
23. Tamara Lehman, Andrew Hilton, Benjamin C. Lee. “MAPS: Understanding metadata access patterns in secure memory.” *Proc. International Symposium on Performance Analysis of Systems and Software (ISPASS)*, April 2018.¹
24. Seyed Majid Zahedi*, Qiuyun Llull*, Benjamin C. Lee. “Amdahl’s Law in the datacenter era: A market for fair processor allocation,” *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2018.² *Equal Contributions.
25. Qiuyun Llull, Songchun Fan, Seyed Majid Zahedi, Benjamin C. Lee. “Cooper: Task colocation with cooperative games,” *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2017.
26. Songchun Fan, Qiuyun Llull, Benjamin C. Lee. “Predicting sensory data and extending battery life for wearable devices,” *Proc. Workshop on Mobile Computing Systems and Applications (HotMobile)*, February 2017.
27. Tamara Silbergleit Lehman, Andrew D. Hilton, Benjamin C. Lee. “PoisonIvy: Safe speculation for secure memory,” *Proc. International Symposium on Microarchitecture (MICRO)*, October 2016.³
28. Songchun Fan, Theodoros Salonidis, Benjamin C. Lee. “A framework for collaborative sensing and processing of mobile data streams: Demo,” *Proc. International Conference on Mobile Computing and Networking (MobiCom)*, October 2016.
29. Ziqiang Huang, Andrew D. Hilton, Benjamin C. Lee. “Decoupling loads for nano-instruction set computers,” *Proc. International Symposium on Computer Architecture (ISCA)*, June 2016.
30. Songchun Fan*, Seyed Majid Zahedi*, Benjamin C. Lee. “The computational sprinting game,” *Proc. International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, April 2016.⁴ *Equal Contributions.
31. Songchun Fan, Benjamin C. Lee. “Evaluating asymmetric multiprocessing for mobile applications,” *Proc. International Symposium on Performance Analysis of Systems and Software (ISPASS)*, April 2016.
32. Benjamin C. Lee. “Applied statistical inference for system design and management,” *Proc. International Conference on Computer Design (ICCD)*, October 2015.
33. Qiuyun Wang, Benjamin C. Lee. “Modeling communication costs in blade servers,” *Proc. Workshop on Power-Aware Computing and Systems (HotPower)*, October 2015.
34. Seyed Majid Zahedi, Benjamin C. Lee. “REF: Resource elasticity fairness with sharing incentives for multiprocessors,” *Proc. International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, March 2014.⁵

¹ Best Paper Award.

² Best Paper Award.

³ Top Picks (Honorable Mention) from Computer Architecture Conferences, IEEE Micro.

⁴ Best Paper Award; Top Picks (Honorable Mention) from Computer Architecture Conferences, IEEE Micro; Research Highlight, Communications ACM.

⁵ Top Picks from Computer Architecture Conferences, IEEE Micro.

35. Marisabel Guevara, Benjamin Lubin, Benjamin C. Lee. "Strategies for anticipating risk in heterogeneous system design," *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2014.
36. Emily Bragg, Marisabel Guevara, Benjamin C. Lee. "Understanding query complexity and its implications for energy-efficient web search," *Proc. International Symposium on Low Power Electronics and Design (ISLPED)*, September 2013.
37. Sam Xi, Marisabel Guevara, Jared Nelson, Patrick Pensabene, Benjamin C. Lee. "Understanding the critical path in power state transition latencies," *Proc. International Symposium on Low Power Electronics and Design (ISLPED)*, September 2013.
38. Marisabel Guevara, Benjamin Lubin, Benjamin C. Lee. "Navigating heterogeneous processors with market mechanisms," *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2013.
39. Tae Jun Ham, Bharath K. Chelepalli, Neng Xue, Benjamin C. Lee. "Disintegrated control for power-efficient and heterogeneous memory systems," *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2013.
40. Krishna T. Malladi, Ian Shaeffer, Liji Gopalakrishnan, David Lo, Benjamin C. Lee, Mark Horowitz. "Rethinking DRAM power modes for energy proportionality," *Proc. International Symposium on Microarchitecture (MICRO)*, December 2012.
41. Weidan Wu, Benjamin C. Lee. "Inferred models for dynamic and sparse hardware-software spaces," *Proc. International Symposium on Microarchitecture (MICRO)*, December 2012.
42. Krishna T. Malladi, Karthika Periyathambi, Frank A. Nothaft, Benjamin C. Lee, Christos Kozyrakis, Mark Horowitz. "Towards energy-proportional datacenter memory with mobile DRAMs," *Proc. International Symposium on Computer Architecture (ISCA)*, June 2012.
43. Omid Azizi, Aqeel Mahesri, Benjamin C. Lee, Sanjay J. Patel, Mark Horowitz. "Energy performance tradeoffs in processor architecture and circuit design: A marginal cost analysis," *Proc. International Symposium on Computer Architecture (ISCA)*, June 2010.
44. Rehan Hameed, Wajahat Qadeer, Megan Wachs, Omid Azizi, Alex Solomatnikov, Benjamin C. Lee, Stephen Richardson, Christos Kozyrakis, Mark Horowitz. "Understanding sources of inefficiency in general-purpose chips," *Proc. International Symposium on Computer Architecture (ISCA)*, June 2010.
45. Vijay Janapa Reddi, Benjamin C. Lee, Trishul Chilimbi, Kushagra Vaid. "Web search using mobile cores: Quantifying and mitigating the price of efficiency," *Proc. International Symposium on Computer Architecture (ISCA)*, June 2010.⁶
46. Jeremy Condit, Edmund B. Nightingale, Christopher Frost, Engin Ipek, Benjamin Lee, Doug Burger, Derrick Coetzee. "Better I/O through byte-addressable, persistent memory," *Proc. Symposium on Operating Systems Principles (SOSP)*, October 2009.⁷
47. Xiaoyao Liang, Benjamin C. Lee, Gu-Yeon Wei, David Brooks. "Design and test strategies for microarchitectural post-fabrication tuning," *Proc. International Conference on Computer Design (ICCD)*, October 2009.⁸

⁶ Also Microsoft Technical Report MSR-TR-2009-105, August 2009.

⁷ Persistent Impact Prize, Non-volatile Memories Workshop (NVMW) 2020

⁸ Also Harvard University Computer Science Technical Report TR-06-08, December 2008.

48. Kristen Lovin, Benjamin C. Lee, Xiaoyao Liang, David Brooks, Gu-Yeon Wei. “Empirical performance models for 3T1D memories,” *Proc. International Conference on Computer Design (ICCD)*, October 2009.⁹
49. Benjamin C. Lee, Engin Ipek, Onur Mutlu, Doug Burger. “Architecting phase change memory as a scalable DRAM alternative,” *Proc. International Symposium on Computer Architecture (ISCA)*, June 2009.¹⁰
50. Benjamin C. Lee, Jamison Collins, Hong Wang, David Brooks. “CPR: Composable performance regression for scalable multiprocessor models,” *Proc. International Symposium on Microarchitecture (MICRO)*, November 2008.¹¹
51. Benjamin C. Lee. “Corporate social responsibility and the globalization of ‘local values,’” *St. Gallen Symposium: Global Capitalism – Local Values*, May 2008.
52. Benjamin C. Lee, David Brooks. “Efficiency trends and limits from comprehensive microarchitectural adaptivity,” *Proc. International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, March 2008.
53. Benjamin C. Lee, David Brooks. “Roughness of microarchitectural design topologies and its implications for optimization,” *Proc. International Symposium on High Performance Computer Architecture (HPCA)*, February 2008.
54. Benjamin C. Lee. “Flattening the world efficiently: Digital sustainability for the twenty-first century,” *St. Gallen Symposium: The Power of Natural Resources*, May 2007.
55. Benjamin C. Lee, David Brooks, Bronis de Supinski, Martin Schulz, Karan Singh, Sally McKee. “Methods of inference and learning for performance modeling of parallel applications,” *Proc. Symposium on Principles and Practice of Parallel Programming (PPoPP)*, March 2007.
56. Benjamin C. Lee, David Brooks. “Illustrative design space studies with microarchitectural regression models,” *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2007.
57. Benjamin C. Lee, David Brooks. “Accurate and efficient regression modeling for microarchitectural performance and power prediction,” *Proc. International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, October 2006.
58. Benjamin C. Lee, David Brooks. “Statistically rigorous regression modeling for the microprocessor design space,” *Proc. Workshop on Modeling, Benchmarking, and Simulation (MoBS) in conjunction with ISCA-33*, June 2006.
59. Yingmin Li, Benjamin C. Lee, David Brooks, Zhigang Hu, Kevin Skadron. “Impact of thermal constraints on multi-core architectures,” *Proc. Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronics Systems (ITHERM)*, May 2006.
60. Yingmin Li, Benjamin C. Lee, David Brooks, Zhigang Hu, Kevin Skadron. “CMP design space exploration subject to physical constraints,” *Proc. International Symposium on High-Performance Computer Architecture (HPCA)*, February 2006.

⁹ Also Harvard University Computer Science Technical Report TR-03-08, October 2008.

¹⁰ Top Picks from Computer Architecture Conferences, IEEE Micro; Research Highlight, Communications ACM.

¹¹ Best Paper Nomination.

61. Benjamin C. Lee, David Brooks. “Effects of pipeline complexity on SMT/CMP power-performance efficiency,” *Proc. Workshop on Complexity Effective Design (WCED) in conjunction with ISCA-32*, June 2005.
62. Benjamin C. Lee, Richard Vuduc, James Demmel, Katherine Yelick. “Performance models for evaluation and automatic tuning of symmetric sparse matrix-vector multiply,” *Proc. International Conference on Parallel Processing (ICPP)*, August 2004.¹²
63. Richard Vuduc, James Demmel, Katherine Yelick, Shoaib Kamil, Rajesh Nishtala, Benjamin C. Lee. “Performance optimizations and bounds for sparse matrix-vector multiply,” *Proc. International Conference for High Performance Computing, Networking, Storage and Analysis (SC)*, November 2002.¹³

Dissertations

64. Benjamin C. Lee. “Statistical inference for efficient microarchitectural analysis,” *Ph.D. Dissertation, Harvard University*, May 2008.¹⁴

Invited Seminars

The computational sprinting game

1. Arm Research Summit Austin, 2019
2. AMD Research, 2019
3. NVIDIA Research, 2019

Management strategies for hyperscale datacenters

4. University of Pennsylvania, 2019

Rethinking the pursuit of datacenter efficiency

5. Yale University, 2018

Datacenters and energy efficiency: A game-theoretic perspective

6. Princeton University, 2018

Hound: Causal learning for datacenter-scale straggler diagnosis

7. Arm Research Summit Cambridge (UK), 2018

Rethinking datacenter management with game theory

8. California Institute of Technology, 2018
9. Princeton University, 2017
10. Carnegie Mellon University, 2017
11. Massachusetts Institute of Technology, 2017
12. Qualcomm Research Raleigh, 2017
13. Arm Research Austin, 2016
14. Arm Research Summit Cambridge (UK), 2016
15. Microsoft Research Redmond, 2016

Collaborative computing for mobile sensing

16. Texas Instruments Dallas, 2016

Economic mechanisms for managing risk in datacenters

17. Samsung Memory Solutions Lab Milpitas, 2015

¹² Best Paper; Also UC Berkeley Technical Report UCB/CSD-03-1297, November 2003.

¹³ Best Student Paper Finalist.

¹⁴ Harvard University Nomination, ACM Doctoral Dissertation Award.

18. Tsinghua University, 2015
19. Chinese Academy of Sciences Beijing, 2015
20. North Carolina State University, 2015
21. University of California, Berkeley, 2015
22. Texas A&M University, 2014
23. University of Illinois Urbana-Champaign, 2014
24. University of Massachusetts Amherst, 2014
25. Georgia Institute of Technology, 2014
26. Google Mountain View, 2014
27. Intel Santa Clara, 2014
28. Microsoft Research Redmond, 2014
29. University of Michigan Ann Arbor, 2014
30. University of Wisconsin Madison, 2014
31. IBM T.J. Watson Research Center, 2014
32. Academia Sinica Taipei, 2014
33. National Taiwan University Taipei, 2014

Statistical methods for hardware-software co-design

34. Oak Ridge National Laboratory, 2014

Coordinated strategies for exascale computing

35. NetApp Research Triangle Park, NC, March, 2012.
36. New Faculty Lecture Series, Duke University, October, 2011.
37. IBM Research Triangle Park, NC, October, 2011.
38. University of North Carolina, Chapel Hill, September 2011.
39. Rambus, Sunnyvale, CA, August 2011.
40. IBM Austin Research Laboratory, April 2011.
41. Princeton University, March 2011.
42. North Carolina State University, March 2011.

Web search using mobile cores

43. University of California, Berkeley, August 2010.
44. Intel Corporation, Santa Clara, CA, July 2010.

Phase change memory: An architecture and systems perspective

45. Intel Corporation, Hudson, MA, August 2010.
46. Harvard University, August 2010.
47. Google, Mountain View, CA, July 2010.
48. Lawrence Livermore National Laboratory, May 2010.

Architectural inference and the pursuit of efficiency

49. Stanford Pervasive Parallelism Lab (PPL) Retreat, Santa Cruz, June 2010.
50. University of California, Los Angeles, April 2010.
51. Princeton University, March 2010.
52. University of Southern California, March 2010.
53. Duke University, March 2010.
54. Stanford University, September 2009.

Statistical inference for tractable architectural analysis

55. University of Texas at Austin, March 2009.
56. Swiss Federal Institute of Technology (ETH) Zurich, March 2009.
57. University of Rochester, March 2009.
58. Rutgers University, March 2009.
59. Northwestern University, March 2009.
60. University of Washington, Seattle, WA, March 2009.
61. AMD Research, Bellevue, WA, March 2009.
62. Microsoft Research, Redmond, WA, April 2008.
63. IBM T.J. Watson Research Center, Yorktown Heights, NY, April 2008.
64. Intel Corporation, Santa Clara, CA, June 2007.
65. Intel Corporation, Folsom, CA, June 2007.

Composable performance regression for scalable multiprocessor models

66. Intel Corporation, Santa Clara, CA, December 2007.

Regression modeling strategies for parameter space exploration

67. Lawrence Livermore National Laboratory, Livermore, CA, September 2006.

**Meeting
Presentations**

Conferences and Workshops

1. “DynaSprint: Microarchitectural sprints with dynamic utility and thermal management,” *International Symposium on Microarchitecture (MICRO)*, October 2019.
2. “Economic mechanisms for managing risk in datacenters,” *Workshop on Energy Secure Systems Architecture in conjunction with ISCA-41*, June 2014.
3. “Inferred models for dynamic and sparse hardware-software spaces,” *45th IEEE/ACM International Symposium on Microarchitecture (MICRO)*, December 2012.
4. “Web search using mobile cores: Quantifying and mitigating the price of efficiency,” *37th ACM International Symposium on Computer Architecture (ISCA)*, June 2010.
5. “Phase change memory: An architecture and systems perspective,” *Workshop on Emerging Memory Technologies (EMT) in conjunction with ISCA-37*, June 2010.
6. “Architecting phase change memory as a scalable DRAM alternative,” *36th ACM International Symposium on Computer Architecture (ISCA)*, June 2009.
7. “Green – Energy efficient software and principled approximation,” *Microsoft Research Techfest*, February 2009.
8. “CPR: Composable performance regression for scalable multiprocessor models,” *41st IEEE International Symposium on Microarchitecture (MICRO)*, November 2008.
9. “Efficiency trends and limits from comprehensive microarchitectural adaptivity,” *13th ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, March 2008.
10. “Roughness of microarchitectural design topologies and its implications for optimization,” *14th IEEE International Symposium on High Performance Computer Architecture (HPCA)*, February 2008.

11. "Methods of inference and learning for performance modeling of parallel applications," *12th ACM Symposium on Principles and Practice of Parallel Programming (PPoPP)*, March 2007.
12. "Statistical inference for efficient microarchitectural analysis," *Boston Area Architecture Workshop (BARC)*, January 2007.
13. "Illustrative design space studies with microarchitectural regression models," *13th IEEE International Symposium on High Performance Computer Architecture (HPCA)*, February 2007.
14. "Statistical inference for efficient microarchitectural and application analysis," *IEEE/ACM International Conference for High Performance Computing, Networking, Storage and Analysis (SC)*, November 2006.¹⁵
15. "Accurate and efficient regression modeling for microarchitectural performance and power prediction," *12th ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, October 2006.
16. "Statistically rigorous regression modeling for the microprocessor design space," *Workshop on Modeling, Benchmarking, and Simulation (MoBS) in conjunction with ISCA-33*, June 2006.
17. "Efficient design space exploration for chip multiprocessors," *Harvard University, Industrial Partnership Annual Meeting*, October 2005.
18. "Effects of pipeline complexity on SMT/CMP power-performance efficiency," *Workshop on Complexity Effective Design (WCED) in conjunction with ISCA-32*, June 2005.
19. "Performance models for evaluation and automatic tuning of symmetric sparse matrix-vector multiply," *33rd International Conference on Parallel Processing (ICPP)*, August 2004.
20. "Optimizations and bounds for sparse symmetric matrix-vector multiply," *SIAM Conference on Parallel Processing for Scientific Computing*, March 2004.
21. "Poster: Automatic performance tuning of sparse matrix kernels," *SIAM Conference on Computational Science and Engineering*, February 2003.

Technical Panels

22. NSF Workshop on Exploiting Parallelism and Scalability, Arlington, VA, July 2015.
23. DOE Workshop on Modeling and Simulation of Exascale Systems and Applications, University of Washington, Seattle, WA, August 2012.
24. NSF Workshop on a Community Supported Computer Architecture and Design Evaluation Framework, Arlington, VA, June 2012.
25. "Architecting heterogeneous datacenters with algorithmic economics," Informational Futures Group Meeting, Duke University, NC March 2012.
26. "Architecting a balance of power," NSF Workshop on Cross-Layer Power Optimization and Management, University of Southern California, Los Angeles, CA, February 2012.

¹⁵ First Place, ACM Student Research Competition.

27. "Mega-servers vs. micro-blades," *Workshop on Architectural Concerns in Large Data Centers (ACLD) in conjunction with ISCA-37*, June 2010.
28. "Emerging technologies," *International Symposium on Nanoscale Architectures (NANOARCH) in conjunction with DAC-47*, July 2009.
29. "New memory technology," *36th ACM International Symposium on Computer Architecture (ISCA)*, June 2009.

Artifacts

1. Duke Hound: Statistical machine learning for diagnosing performance stragglers from datacenter traces. Analysis is implemented atop Spark for distributed computation. Analysis is demonstrated for production Google datacenter and Lenovo experimental system. (<https://www.seas.upenn.edu/~leebcc/software.html>)
2. Duke ActionBench: ActionBench provides mobile benchmarks for user-phone interaction. APK files can be placed in a mounted Gem5 image and installed within simulation. The repository includes benchmark source code, written in Java and Gem5 simulation scripts. (<https://www.seas.upenn.edu/~leebcc/software.html>)
3. Harvard CORE: Comprehensive Optimization via Regression Estimates (CORE) is a collection of example R scripts that construct microarchitectural performance, power regression models with correlation, association, significance analyses. (<https://www.seas.upenn.edu/~leebcc/software.html>)
4. Berkeley OSKI: The Optimized Sparse Kernel Interface is a collection of low-level C primitives that provide automatically tuned computational kernels on sparse matrix solves for use in solver libraries and applications. (<http://bebop.cs.berkeley.edu/oski/>)

Patents

1. Jeremy Condit, Edmund Nightingale, Benjamin C. Lee, Engin Ipek, Christopher Frost, Doug Burger. "Hardware and operating system support for persistent memory on a memory bus," United States Patent #US8533404. Granted September 2013.
2. Jeremy Condit, Edmund Nightingale, Benjamin C. Lee, Engin Ipek, Christopher Frost, Doug Burger. "Hardware and operating system support for persistent memory on a memory bus," United States Patent #US8219741. Granted July 2012.

Grants

1. "Automated rapid certification of software (ARCOS)," Duke Principal Investigator with Johns Hopkins University, Applied Physics Laboratory (Prime), Defense Advanced Research Projects Agency, \$600K, 2020-2024.
2. "Defense logistics agency (DLA)," Sr. Personnel with Vahid Tarokh (Duke PI) and with Raytheon Technologies (Prime), Defense Advanced Research Projects Agency, \$200K, 2020.
3. "Server architectures for distributed shared memory," Principal Investigator, Samsung Research via NSF IUCRC, \$50K, 2020.
4. "Statistical machine learning for systems management," Principal Investigator, Lenovo Research via NSF IUCRC, \$200K, 2019-20.
5. "IUCRC: Center for alternative sustainable and intelligent computing (ASIC)," Co-Director with Yiran Chen (Director) and Hai Li, National Science Foundation, \$750K, 2018-2023.

6. “Dynamic power allocation and efficient system-on-chip scaling,” Principal Investigator, Semiconductor Research Corporation, \$210K, 2018-2020.
7. “Coalitional game theory for co-locating software on shared hardware,” Principal Investigator with Andrew Hilton (Co-PI), National Science Foundation, \$400K, 2015-2020.
8. “Multi-dimensional scheduling and resource allocation in datacenters,” Co-Principal Investigator with Kamesh Munagala (PI) and Sungjin Im, National Science Foundation, \$959K, 2014-2020.
9. “Allocating heterogeneous datacenter hardware to strategic agents,” Principal Investigator with Vincent Conitzer (Co-PI), National Science Foundation, \$700K, 2013-2019.
10. “Gigapixel cameras for ubiquitous surveying and environmental research,” Co-Principal Investigator with David Brady (PI) et al., Duke University, \$50K, 2016.
11. “AWS research education grant,” Principal Investigator, Amazon Web Services, \$3.5K, 2015-2016.
12. “NSF XPS workshop for exploiting parallelism and scalability,” Co-Principal Investigator with Wuchun Feng (PI), National Science Foundation, \$85K, 2014-2015.
13. “The center for future architectures research,” Duke Principal Investigator with University of Michigan (Prime), Semiconductor Research Corporation and Defense Advanced Research Projects Agency, \$1M to BCL of \$28M award, 2013-2017.
14. “CAREER: Foundations for heterogeneous datacenter design and deployment,” Principal Investigator, National Science Foundation, \$460K, 2012-2016.
15. “Pathfinding for emerging memory technologies,” Principal Investigator, Google Faculty Research Award, \$55K, 2011.
16. “Foundations for heterogeneous datacenter design and development,” Principal Investigator, Duke University Wannamaker Foundation, \$20K, 2011-2012.
17. “An application-driven approach to energy-efficient data centers,” Co-Principal Investigator with Christos Kozyrakis (PI) et al., Google Focused Research Award, \$750K, 2009-2012.
18. “The Computing Innovation Fellows Project: Rethinking digital design,” Fellow with Mark Horowitz (Mentor), National Science Foundation, \$280K, 2009-2010.

**Research Advising
Doctoral**

Current

1. Yuhao Li, Computer Science, 2016-.
2. Atefeh Mehrabi, Electrical and Computer Engineering (with Sorin), 2016-.
3. Dan Sun, Electrical and Computer Engineering, 2018-.
4. Jiali Xing, Computer Science, 2020-.

Alumni

5. Pengfei Zheng, Computer Science, 2020
Artificial intelligence for understanding large and complex datacenters
Postdoctoral Researcher, University of Wisconsin, Madison
6. Ziqiang Huang, Electrical and Computer Engineering, 2019
Coordinating software and hardware design for performance under power constraints
Assistant Research Professor, University of Waterloo

7. Tamara Lehman, Electrical and Computer Engineering, 2019
Design strategies for efficient and secure memory
Assistant Professor, University of Colorado, Boulder
8. Seyed Majid Zahedi, Computer Science, 2018
Managing shared resources in the data center era: Computer architecture meets game theory
Assistant Professor, University of Waterloo
9. Qiuyun Wang, Electrical and Computer Engineering, 2017
Microeconomic models for managing shared datacenters
Software Engineer, Google
10. Songchun Fan, Computer Science, 2016
Towards energy-efficient mobile sensing: Architectures and frameworks for heterogeneous sensing and computing
Software Engineer, Google
11. Marisabel Guevara, Computer Science, 2014
Coordinating the design and management of heterogeneous datacenter resources
Software Engineer, Google
12. Krishna Malladi, Electrical Engineering, Stanford University (with Horowitz), 2013
Energy proportional memory systems
Memory Architect, Samsung Research and Development

**Research Advising
Masters**

Alumni

1. Ankita Nayak, Electrical and Computer Engineering, 2019
Member of Technical Staff, Draper
2. Bryan Prosser, Computer Science, 2019.
3. Keerthana Jetty, Electrical and Computer Engineering, 2017.
Silicon Design Engineer, Microsoft
4. Zhiyu Zhang, Computer Science, 2016-17.
Software Engineer, Google
5. Henri Maxime Demoulin, Computer Science, 2014-16.
PhD Student, University of Pennsylvania
6. Weidan Wu, Electrical and Computer Engineering, 2014.
Software Engineer, Google
7. Xin Zhou, Electrical and Computer Engineering, 2014.
Software Engineer, Amazon Web Services
8. Yifan Zhang, Electrical and Computer Engineering, 2014.
Software Engineer, Cisco

**Research Advising
Undergraduate**

Current

1. Connor Anton, Systems Science and Engineering, 2022

Thesis with Departmental Distinction

2. Calvin Ma, Computer Science, 2018-20.
Time series analysis for straggler prediction
Technology Analyst, Goldman Sachs

3. Jacob Chasan, Computer Science and Economics, 2019.
Re-defining resource allocation in computing systems
Investment Banking Analyst, Goldman Sachs
4. Rahul Swaminathan, Electrical and Computer Engineering, 2016.
Yarn application statistics: Collecting, aggregating and visualizing big data metrics
Software Engineer, Appian
5. Paul Kim, Electrical and Computer Engineering, 2015.
Resource elasticity fairness in scale
Research Assistant, University of Chicago, Booth School of Business
6. Tae Jun Ham, Electrical and Computer Engineering, 2012.
Designing scalable heterogeneous memory for high-performance computing
PhD Student, Princeton University

Independent Study

7. Ryan Piersma, Electrical and Computer Engineering, 2018-20.
PhD Student, Columbia University
8. Jerry Wang, Electrical and Computer Engineering, 2020.
9. Elizabeth Bartusiak, Computer Science, 2019-20.
10. Anshu Dwibhashi, Electrical and Computer Engineering, 2019-20.
11. Brian Nieves, Computer Science, 2018-19.
12. Vishnu Gottiparthi, Electrical and Computer Engineering, 2017-18.
13. David Tran, Computer Science, 2018.
14. Harry Xie, Computer Science, 2018.
15. Aninda Manocha, Electrical and Computer Engineering, 2017-18.
PhD Student, Princeton University
16. Dan Sun, Electrical and Computer Engineering, 2017-18.
PhD Student, Duke University
17. Hunter Lee, Electrical and Computer Engineering, 2016-17.
18. Elijah Cole, Electrical and Computer Engineering, 2016-17.
PhD Student, California Institute of Technology
19. Matthew Faw, Electrical and Computer Engineering, 2016-17.
PhD Student, University of Texas, Austin
20. Brian Zhou, Electrical and Computer Engineering, 2016-17.
21. Randall Johnson, Electrical and Computer Engineering, 2016.
Software Consultant, Red Hat
22. Stephen Hughes, Electrical and Computer Engineering, 2015.
23. Kevin Delgado, Electrical and Computer Engineering, 2015.
24. Michael Liou, Computer Science, 2015.
25. Justin Wang, Computer Science, 2015.
26. Justine Kim, Electrical and Computer Engineering, 2014-15.
PhD Student, Seoul National University
27. William Chang, Computer Science, 2014.
28. Lance Co Ting Keh, Electrical and Computer Engineering, 2014.
Software Engineer, Box
29. Zachary Michaelov, Electrical and Computer Engineering, 2014.
Software Engineer, TellApart

30. Nazia Tabassum, Electrical and Computer Engineering, 2013-14.
PhD Student, University of Virginia
31. Sam (Likun) Xi, Electrical and Computer Engineering, 2012-13.
PhD Student, Harvard University
32. John Cuffney, Electrical and Computer Engineering, 2012.
Software Engineer, Google
33. Michael Ansel, Electrical and Computer Engineering, 2011.
Systems Architect, NetApp

External Research Experience

34. Cecily Chase, Applied Mathematics, Brown University, 2018.
35. Abhimanyu Yadav, Computer Science and Engineering, IIT Kanpur, 2016.
MS Student, Columbia University
36. Stephanie Morris, Electrical and Electronics Engineering, University of Alabama, 2013.
37. Emily Bragg, Computer Engineering, Georgia Institute of Technology, 2012.
PhD Student, University of Texas, Austin
38. Casey Mackin, Electrical and Computer Engineering, University of Arizona, 2012.
PhD Student, University of California, Berkeley

Thesis Committees

Doctoral Students

Mukesh Agrawal (advisor K. Chakrabarty), Sandeep Agrawal (advisor A. Lebeck), Fan Chen (advisor Y. Chen), Qing Duan (advisor K. Chakrabarty), Mahmoud Elfar (advisor M. Pajic), Rana Elnaggar (advisor K. Chakrabarty), Rahul Ghosh (advisor K. Trivedi), Yuzhang Han (advisor S. Babu), Blake Hechtman (advisor D. Sorin), Kai Hu (advisor K. Chakrabarty), Mohamed Ibrahim (advisor K. Chakrabarty), Mayuresh Kunjir (advisor S. Babu), Adam Jacobvitz (advisor D. Sorin), Ilija Jovanov (advisor M. Pajic), Craig LaBoda (advisor C. Dwyer), Vuk Lesi (advisor M. Pajic), Jiachen Mao (advisor Y. Chen), Opeoluwa Matthws (advisor D. Sorin), Kesari Mishra (advisor K. Trivedi), Mohammed Mottaghi (advisor C. Dwyer), Sean Murray (advisor D. Sorin), Ralph Nathan (advisor D. Sorin), Kent Nixon (advisor Y. Chen), Brandon Noia (advisor K. Chakrabarty), Jun Pang (advisor C. Dwyer), Wubin Pang (advisor D. Brady), Arjun Rallapalli (advisor C. Dwyer), Animesh Srivastava (advisor L. Cox), Chang Song (advisor H. Li), Xin Song (advisor A. Lebeck), Zilong Tan (advisor S. Babu), Vamsidhar Thummala (advisor J. Chase), Viresh Thusu (advisor C. Dwyer), Bing Xie (advisor J. Chase), Bonan Yan (advisor H. Li), Fangming Ye (advisor K. Chakrabarty), Xiaoyan Yin (advisor K. Trivedi), Meng Zhang (advisor D. Sorin), Xiangyu Zhang (advisor A. Lebeck), Tong Zhou (advisor K. Chakrabarty)

Masters Students

Timothy Calloway (advisor L. Cox), Yifei Deng (advisor S. Babu), Fei Dong (advisor S. Babu), Heather Duschl (advisor C. Dwyer) Alexandru Dutu (advisor A. Lebeck), Zhiqiu Kong (advisor L. Cox), Jie Li (advisor S. Babu), Arpan Roy (advisor K. Trivedi), Benjamin Stoddard (advisor A. Machanavajjhala), Alfredo Velasco (advisor D. Sorin)

Teaching

Duke University, Durham NC

Professor, Electrical and Computer Engineering, 2010-20.

- Computer Architecture (ECE/CS 250): F19, F18, S18, F15, S14, S13.
- Advanced Computer Architecture I (ECE/CS 552): F17, F16, F12, F11
- Energy-Efficient Computer Systems (ECE/CS 590): F14, S12, F10
- Datacenter Architecture (ECE/CS 590): S20, S16, F13

Stanford University, Stanford CA

Guest Instructor, Electrical Engineering, 2009

- Autumn 2009: Advanced Processor Architecture (EE282a).
- Autumn 2009: Digital Systems (EE108b).

Harvard University, Cambridge MA

Teaching Fellow, Engineering and Applied Sciences, 2005 – 2008

- Spring 2008: Guest lecture on power modeling, digital sustainability (CS246).
- Fall 2006: Management of innovation in science, engineering (ES139/239).
- Spring 2006: Advanced architecture, power-aware systems (CS246).
- Fall 2005: Introductory computer architecture (CS146), digital logic design (CS141).

Tutorial: Datacenter system design and management

Presenter

- 11th HiPEAC International Summer School on Advanced Computer Architecture and Compilation for High-Performance and Embedded Systems (ACACES), July 2015.

Tutorial: Datacenter simulation methodologies

Presenter and Co-Organizer

- International Symposium on Computer Architecture (ISCA), June 2015.
- International Symposium on Microarchitecture (MICRO), December 2014.
- With Tamara S. Lehman, Qiuyun Wang, Seyed Majid Zahedi.

Tutorial: Methods of learning and inference for large design and parameter spaces

Presenter and Co-Organizer

- International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), March 2008.
- International Symposium on Computer Architecture (ISCA), June 2007.
- With David Brooks, Bronis de Supinski, Sally McKee, Karan Singh.

Professional Service

Memberships

IEEE, Institute of Electrical and Electronics Engineers.
ACM, Association for Computing Machinery.
SIAM, Society for Industrial and Applied Mathematics.
AAAS, American Association for the Advancement of Science.

Journal Editorial Board

Associate Editor, Communications of the ACM, 2019-.

Journal Reviews

ACM Transactions on Architecture and Code Optimization (TACO).
ACM Transactions on Embedded Computing Systems (TECS).
ACM Transactions on Design Automation of Electronic Systems (TODAES).
IEEE Transactions on Computers (TC).
IEEE Transactions on Computer Aided Design (TCAD).
IEEE Transactions on Parallel and Distributed Systems (TPDS).
IEEE Transactions on Signal Processing (TSP).
IEEE Transactions on Very Large Scale Integration Systems (TVLSI).
IEEE Computer Architecture Letters (CAL).
IEEE Micro Magazine (Micro).

Conference Steering Committee

ISPASS 2017-22, Int'l Symp. Perf. Analysis of Systems & Software.

Conference General Chair

XPS 2015, Workshop on Exploiting Parallelism & Scalability.

ISPASS 2015, Int'l Symp. Perf. Analysis of Systems & Software.

Conference Program Chair

ISPASS 2014, Int'l Symp. Perf. Analysis of Systems & Software.

Conference Program Committees

HPCA 2021, Int'l Symp. High Performance Computer Architecture.

MICRO 2020, Int'l Symp. on Microarchitecture.

ASPLOS 2020, Int'l Conf. Arch. Support for Prog. Lang. & Op. Sys.

ISCA 2019, Int'l Symp. Computer Architecture.

HPCA 2019, Int'l Symp. High Performance Computer Architecture.

IEEE 2019, Micro Top Picks

ISCA 2018, Int'l Symp. Computer Architecture.

HPCA 2018, Int'l Symp. High Performance Computer Architecture.

IEEE 2018, Micro Top Picks

MICRO 2017, Int'l Symp. on Microarchitecture.

ISCA 2017, Int'l Symp. Computer Architecture.

ASPLOS 2017, Int'l Conf. Arch. Support for Prog. Lang. & Op. Sys.

IEEE 2017, Micro Top Picks

DATE 2016, Design Automation and Test Europe

IEEE 2016, Micro Top Picks

MICRO 2015, Int'l Symp. on Microarchitecture.

HPCA 2015, Int'l Symp. High Performance Computer Architecture.

DATE 2015, Design Automation and Test Europe

SIGMETRICS 2014, Int'l Conf. Measurement & Modeling Comp. Sys.

DATE 2014, Design Automation and Test Europe

IISWC 2014, Int'l Symp. Workload Characterization

HotPower 2014, Work. Power-Aware Computing & Systems

HiPEAC 2014, Int'l Conf. High Perf. Embedded Arch. & Compilers

MICRO 2013, Int'l Symp. on Microarchitecture.

HotPower 2013, Work. Power-Aware Computing & Systems

IISWC 2013, Int'l Symp. Workload Characterization

ISPASS 2013, Int'l Symp. Perf. Analysis of Systems & Software

HiPEAC 2013, Int'l Conf. High Perf. Embedded Arch. & Compilers

ICCD 2012, Int'l Conf. Computer Design

ISPASS 2012, Int'l Symp. Perf. Analysis of Systems & Software

IPDPS 2012, Int'l Parallel & Distributed Processing Symposium

HPCA 2012, Int'l Symp. High Performance Computer Architecture.

ICCD 2011, Int'l Conf. Computer Design

ICS 2011, Int'l Conf. Supercomputing

ISPASS 2010, Int'l Symp. Perf. Analysis of Systems & Software

ISPASS 2009, Int'l Symp. Perf. Analysis of Systems & Software

Conference Organizing Committees

MICRO 2012, Int'l Symp. Microarchitecture

ISCA 2012, Int'l Symp. Computer Architecture

ICS 2011, Work. Emerging Supercomputing Technologies

ISPASS 2011, Int'l Symp. Perf. Analysis of Systems & Software

MICRO 2010, Int'l Symp. Microarchitecture
PACT 2010, Int'l Conf. Parallel Arch. & Compilation Techniques

External Review Committees

ASPLOS, Int'l Conf. Arch. Support for Prog. Lang. & Op. Sys.
HPCA, Int'l Symp. High Performance Computer Architecture.
ISCA, Int'l Symp. Computer Architecture.
ISLPED, Int'l Symp. Low Power Electronics and Design.
ISPASS, Int'l Symp. Perf. Analysis of Systems & Software.
MICRO, Int'l Symp. on Microarchitecture.

Grant Reviews

Università della Svizzera Italiana, 2019.
National Science Foundation, Computer & Information Science & Engineering, 2016-17.
Research Foundation Flanders, 2015.
National Science Foundation, Computer & Information Science & Engineering, 2014.
Department of Energy, Office of Science, Early Career Research Program, 2014.
Ministry of Education, Singapore Government, 2013.
National Science Foundation, Computer & Information Science & Engineering, 2013.
Department of Energy, Office of Science, Small Business Innovation Research, 2011-12.
Research Foundation Flanders, 2011.

**Academic
Service**

University Service (Duke)

Provost's Academic Programs Committee, Vice-Chair, 2019-20.
Provost's Academic Programs Committee, 2017-19.
President's Council on Black Affairs, 2016-19.
University Judicial Board, 2016-18.
Faculty Diversity Task Force Implementation Committee, 2015-16.

Department Service (Duke)

Faculty Search Committee, 2019-20.
Faculty Search Committee (Chair), 2017-19.
Faculty Tenure Committee 2017-19.
Computer Engineering Curricular Group (Lead), 2017-18.
Faculty Tenure Committee (Chair), 2015-16.
Faculty Search Committee (Chair), 2015-16.
Graduate Diversity Committee, 2014-16.
Business Manager Search Committee, 2012.
Faculty Search Committee, 2012.