

# Assistant Professor John (Jack) Sampson

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## APPOINTMENTS

- **Computer Science and Engineering, Pennsylvania State University** University Park, PA  
Assistant Professor, August 2013–Present
- **Computer Science and Engineering, University of California at San Diego** La Jolla, CA  
Postdoctoral Scholar, September 2010–August 2013

## EDUCATION

- **University of California at San Diego** La Jolla, CA  
Ph.D. in Computer Science (Computer Engineering), September 2010  
Dissertation Advisors: Steven Swanson and Michael Bedford Taylor  
Thesis: *Design and Architecture of Automatically-generated Energy-reducing Coprocessors*
- **University of California at Berkeley** Berkeley, CA  
B.S. in Electrical Engineering and Computer Science, May 2002

## KEY RESEARCH INTERESTS AND SELECTED REPRESENTATIVE PUBLICATIONS

- **Nonvolatile Processors** [C28,C29,C31,C46,C47,C48,C52], [J3,J8,J12,J19]
- **Emerging & Efficient Memories** [C25,C34,C40,C42,C43,C51,C53], [J4,J7,J14,J15,J18,J20,J21]
- **Post-CMOS Alternatives** [C18-20,C27,C30,C32,C33,C39,C41,C45], [J6,J9,J10,J13]
- **Cognitive Visual Architectures** [C17,C24,C26,C35-38,C44,C49,C50,C54,C55], [J5,J11,J16,J17]
- **Architectural Mitigation of Dark Silicon** [C7-12,C14], [J1, J2]

## HONORS AND AWARDS

- **2017** TMSCS Best Paper Award [J6]
- **2017** ASP-DAC 2017 Best Paper Award [C47]
- **2016** Paper selected for IEEE Micro Top Picks [J8]
- **2015** HPCA 2015 Best Paper Award [C28]
- **2013** Dorothy Quiggle Faculty Development Assistant Professorship 2013-2016

## FUNDING

- (*recommended for funding June 2018*), \$900K, NSF, PI: Jack Sampson. Co-PIs: Mahmut Kandemir, Vijaykrishnan Narayanan. "SPX: SOPHIA: Support for Opportunistic Parallelism with Heterogeneous Intermittently-powered Accelerators"
- October 2016, \$600K, NSF/SRC, PI: Saptarshi Das. Co-PIs: Sumeet Gupta, Jack Sampson. "E2CDA: Type II: 2D Electrostrictive FETs for Ultra-Low Power Circuits and Architectures"
- September 2014; 2015; 2016, \$90K (annual×3), Intel Corp. PI: Vijaykrishnan Narayanan. Co-PIs: Jack Sampson. "A Configurable Vision Platform for Cognitive Image Analytics"
- August 2014, \$900K, NSF (After PI institution transfer, \$480K via subcontract with UC Santa Barbara) PI: Yuan Xie, Co-PIs: Jack Sampson, Mary-Jane Irwin. "SHF: Medium: ASKS - Architecture Support for dark Silicon"

## SELECTED PUBLICATIONS AND ARTIFACTS

### CONFERENCE PROCEEDINGS:

- [C55] Jinhang Choi, Kevin M Irick, Justin Hardin, Weichao Qiu, Alan Yuille, Jack Sampson, and Vijaykrishnan Narayanan. “Stochastic Functional Verification of DNN Design through Progressive Virtual Dataset Generation”. In: *IEEE International Symposium on Circuits and Systems (ISCAS)*. IEEE. 2018, pp. 1–5.
- [C54] Jinhang Choi, Srivatsa Srinivasa, Yasuki Tanabe, Jack Sampson, and Vijaykrishnan Narayanan. “A Power-efficient Hybrid Architecture Design for Image Recognition using CNNs”. In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. July 2018, pp. 1–6.
- [C53] Nicholas Jao, Akshay Krishna Ramanathan, Srivatsa Srinivasa, Sumitha George, John Sampson, and Vijaykrishnan Narayanan. “Harnessing Emerging Technology for Compute-In-Memory Support”. In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. July 2018, pp. 1–6.
- [C52] Kaisheng Ma, Xueqing Li, Mahmut Taylan Kandemir, Jack Sampson, Vijaykrishnan Narayanan, Jinyang Li, Tongda Wu, Zhibo Wang, Yongpan Liu, and Yuan Xie. “NEOFog: Nonvolatility-Exploiting Optimizations for Fog Computing”. In: *Twenty-Third International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. ACM. 2018, pp. 782–796.
- [C51] Srivatsa Srinivasa, Akshay Ramanathan, Xueqing Li, Wei-Hao Chen, Fu-Kuo Hsueh, Chih-Chao Yang, Chang-Hong Shen, Jia-Min Shieh, Sumeet Gupta, Meng-Fan Chang, Swaroop Ghosh, John Sampson, and Vijaykrishnan Narayanan. “A Monolithic-3D SRAM Design with Enhanced Robustness and In-Memory Computation Support”. In: *ACM/IEEE International Symposium on Low Power Electronics and Design (ISLPED)*. July 2018, pp. 1–6.
- [C50] Peter A Zientara, Jinhang Choi, Jack Sampson, and Vijaykrishnan Narayanan. “Drones as collaborative sensors for image recognition”. In: *IEEE International Conference on Consumer Electronics (ICCE)*. IEEE. 2018, pp. 1–4.
- [C49] Kate D Fischl, Kaitlin Fair, Wei-Yu Tsai, Jack Sampson, and Andreas Andreou. “Path planning on the TrueNorth neurosynaptic system”. In: *IEEE International Symposium on Circuits and Systems (ISCAS)*. IEEE. 2017, pp. 1–4.
- [C48] Kaisheng Ma, Xueqing Li, Jinyang Li, Yongpan Liu, Yuan Xie, Jack Sampson, Mahmut Taylan Kandemir, and Vijaykrishnan Narayanan. “Incidental computing on IoT nonvolatile processors”. In: *50th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*. ACM. 2017, pp. 204–218.
- [C47] Kaisheng Ma, Xueqing Li, Srivatsa Rangachar Srinivasa, Yongpan Liu, John Sampson, Yuan Xie, and Vijaykrishnan Narayanan. “Spendthrift: Machine learning based resource and frequency scaling for ambient energy harvesting nonvolatile processors”. In: *22nd Asia and South Pacific Design Automation Conference (ASP-DAC)*. IEEE. 2017, pp. 678–683.
- [C46] Kaisheng Ma, Minli Julie Liao, Xueqing Li, Zhixuan Huan, and Jack Sampson. “Evaluating tradeoffs in granularity and overheads in supporting nonvolatile execution semantics”. In: *18th International Symposium on Quality Electronic Design (ISQED)*. IEEE. 2017, pp. 39–44.
- [C45] Srivatsa Rangachar Srinivasa, Karthik Mohan, Wei-Hao Chen, Kuo-Hsinag Hsu, Xueqing Li, Meng-Fan Chang, Sumeet Kumar Gupta, John Sampson, and Vijaykrishnan Narayanan. “Improving FPGA Design with Monolithic 3D Integration Using High Dense Inter-Stack Via”. In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. IEEE. 2017, pp. 128–133.
- [C44] Wei-Yu Tsai, Jinhang Choi, Tulika Parija, Priyanka Gomatam, Chita Das, John Sampson, and Vijaykrishnan Narayanan. “Co-training of feature extraction and classification using partitioned convolutional neural networks”. In: *54th ACM/EDAC/IEEE Design Automation Conference (DAC)*. IEEE. 2017, pp. 1–6.
- [C43] Meng-Fan Chang, Ching-Hao Chuang, Yen-Ning Chiang, Shyh-Shyuan Sheu, Chia-Chen Kuo, Hsiang-Yun Cheng, John Sampson, and Mary Jane Irwin. “Designs of emerging memory based non-volatile TCAM for internet-of-things (IoT) and big-data processing: a 5T2R universal cell”. In: *IEEE International Symposium on Circuits and Systems (ISCAS)*. IEEE. 2016, pp. 1142–1145.

- [C42] Hsiang-Yun Cheng, Jishen Zhao, Jack Sampson, Mary Jane Irwin, Aamer Jaleel, Yu Lu, and Yuan Xie. "LAP: Loop-Block Aware Inclusion Properties for Energy-Efficient Asymmetric Last Level Caches". In: *ACM/IEEE 43rd International Symposium on Computer Architecture (ISCA)*. IEEE, 2016, pp. 103–114.
- [C41] Sumitha George, Ahmedullah Aziz, Xueqing Li, Moon Seok Kim, Suman Datta, John Sampson, Sumeet Gupta, and Vijaykrishnan Narayanan. "Device Circuit Co Design of FEFET Based Logic for Low Voltage Processors". In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. IEEE, 2016, pp. 649–654.
- [C40] Sumitha George, Kaisheng Ma, Ahmedullah Aziz, Xueqing Li, Asif Khan, Sayeef Salahuddin, Meng-Fan Chang, Suman Datta, John Sampson, Sumeet Gupta, and Vijaykrishnan Narayanan. "Nonvolatile memory design based on ferroelectric FETs". In: *53rd ACM/EDAC/IEEE Design Automation Conference (DAC)*. IEEE. 2016, pp. 1–6.
- [C39] Xueqing Li, Kaisheng Ma, Sumitha George, John Sampson, and Vijaykrishnan Narayanan. "Enabling Internet-of-Things: Opportunities Brought by Emerging Devices, Circuits, and Architectures". In: *IFIP/IEEE International Conference on Very Large Scale Integration (VLSI-SoC)*. IEEE, 2016, pp. 1–6.
- [C38] Wei-Yu Tsai, Davis R Barch, Andrew S Cassidy, Michael V DeBole, Alexander Andreopoulos, Bryan L Jackson, Myron D Flickner, Dharmendra S Modha, Jack Sampson, and Vijaykrishnan Narayanan. "LATTE: Low-power audio transform with truenorth ecosystem". In: *International Joint Conference on Neural Networks (IJCNN)*. IEEE. 2016, pp. 4270–4277.
- [C37] Siddharth Advani, Brigid Smith, Yasuki Tanabe, Kevin Irick, Matthew Cotter, Jack Sampson, and Vijaykrishnan Narayanan. "Visual co-occurrence network: using context for large-scale object recognition in retail". In: *13th IEEE Symposium on Embedded Systems For Real-time Multimedia (ESTIMedia)*. IEEE. 2015, pp. 1–10.
- [C36] Siddharth Advani, Yasuki Tanabe, Kevin Irick, Jack Sampson, and Vijaykrishnan Narayanan. "A scalable architecture for multi-class visual object detection". In: *25th International Conference on Field Programmable Logic and Applications (FPL)*. IEEE. 2015, pp. 1–8.
- [C35] Nandhini Chandramoorthy, Giuseppe Tagliavini, Kevin Irick, Antonio Pullini, Siddharth Advani, Sulaiman Al Habsi, Matthew Cotter, John Sampson, Vijaykrishnan Narayanan, and Luca Benini. "Exploring architectural heterogeneity in intelligent vision systems". In: *IEEE 21st International Symposium on High Performance Computer Architecture (HPCA)*. IEEE. 2015, pp. 1–12.
- [C34] Hsiang-Yun Cheng, Jia Zhan, Jishen Zhao, Yuan Xie, Jack Sampson, and Mary Jane Irwin. "Core vs. Uncore: The Heart of Darkness". In: *52nd ACM/EDAC/IEEE Design Automation Conference (DAC)*. ACM, 2015, pp. 1–6.
- [C33] Sumitha George, Ahmedullah Aziz, Xueqing Li, John Sampson, Suman Datta, Sumeet Gupta, and Vijaykrishnan Narayanan. "NCFET based logic for energy harvesting systems". In: *SRC TECHCON*. SRC. 2015, pp. 1–4.
- [C32] Moon Seok Kim, William Cane-Wissing, Jack Sampson, Suman Datta, Vijaykrishnan Narayanan, and Sumeet K Gupta. "Comparing energy, area, delay tradeoffs in going vertical with CMOS and asymmetric HTFETs". In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. IEEE. 2015, pp. 303–308.
- [C31] Yongpan Liu, Zewei Li, Hehe Li, Yiqun Wang, Xueqing Li, Kaisheng Ma, Shuangchen Li, Meng-Fan Chang, John Sampson, Yuan Xie, Jiwu Shu, and Huazhong Yang. "Ambient energy harvesting nonvolatile processors: from circuit to system". In: *52nd ACM/EDAC/IEEE Design Automation Conference (DAC)*. ACM, 2015, pp. 1–6.
- [C30] Kaisheng Ma, Nandhini Chandramoorthy, Xueqing Li, Sumeet Kumar Gupta, John Sampson, Yuan Xie, and Vijaykrishnan Narayanan. "Using Multiple-Input NEMS for Parallel A/D Conversion and Image Processing". In: *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*. IEEE. 2015, pp. 339–344.

- [C29] Kaisheng Ma, Xueqing Li, Yongpan Liu, John Sampson, Yuan Xie, and Vijaykrishnan Narayanan. “Dynamic machine learning based matching of nonvolatile processor microarchitecture to harvested energy profile”. In: *IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*. IEEE. 2015, pp. 670–675.
- [C28] Kaisheng Ma, Yang Zheng, Shuangchen Li, Karthik Swaminathan, Xueqing Li, Yongpan Liu, Jack Sampson, Yuan Xie, and Vijaykrishnan Narayanan. “Architecture exploration for ambient energy harvesting nonvolatile processors”. In: *IEEE 21st International Symposium on High Performance Computer Architecture (HPCA)*. IEEE. 2015, pp. 526–537.
- [C27] Karthik Swaminathan, Jagadish Kotra, Huichu Liu, Jack Sampson, Mahmut Kandemir, and Vijaykrishnan Narayanan. “Thermal-aware application scheduling on device-heterogeneous embedded architectures”. In: *28th International Conference on VLSI Design (VLSID)*. IEEE. 2015, pp. 221–226.
- [C26] Siddharth Advani, Nandhini Chandramoorthy, Karthik Swaminathan, Kevin Irick, Yong Cheol Peter Cho, Jack Sampson, and Vijaykrishnan Narayanan. “Refresh Enabled Video Analytics (REVA): Implications on Power and Performance of DRAM Supported Embedded Visual Systems”. In: *32nd IEEE International Conference on Computer Design (ICCD)*. 2014, pp. 501–504.
- [C25] Hsiang-Yun Cheng, Matt Poremba, Narges Shahidi, Ivan Stalev, Mary Jane Irwin, Mahmut Kandemir, Jack Sampson, and Yuan Xie. “EECache: Exploiting design choices in energy-efficient last-level caches for chip multiprocessors”. In: *International Symposium on Low Power Electronics and Design (ISLPED)*. ACM. 2014, pp. 303–306.
- [C24] Matthew Cotter, Siddharth Advani, Jack Sampson, Kevin Irick, and Vijaykrishnan Narayanan. “A hardware accelerated multilevel visual classifier for embedded visual-assist systems”. In: *IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*. IEEE. 2014, pp. 96–100.
- [C23] Anshuman Gupta, Jack Sampson, and Michael Bedford Taylor. “Quality Time: A Simple Online Technique for Quantifying Multicore Execution Efficiency”. In: *International Symposium on Performance Analysis of Systems and Software (ISPASS)*. IEEE, 2014, pp. 169–179.
- [C22] Chris S Lee, Kevin M Irick, Jack Sampson, Chuanjun Zhang, and Vijaykrishnan Narayanan. “Exploiting natural redundancy in visual information”. In: *32nd IEEE International Conference on Computer Design (ICCD)*. IEEE. 2014, pp. 505–508.
- [C21] Chris S Lee, Kevin M Irick, John Sampson, and Vijaykrishnan Narayanan. “Data driven adaptation for QoS aware embedded vision systems”. In: *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*. IEEE. 2014, pp. 69–72.
- [C20] Karthik Swaminathan, Moon Seok Kim, Nandhini Chandramoorthy, Behnam Sedighi, Robert Pericone, Jack Sampson, and Vijaykrishnan Narayanan. “Modeling steep slope devices: From circuits to architectures”. In: *Design, Automation and Test in Europe Conference and Exhibition (DATE)*. IEEE. 2014, pp. 1–6.
- [C19] Karthik Swaminathan, Huichu Liu, Xueqing Li, Moon Seok Kim, Jack Sampson, and Vijaykrishnan Narayanan. “Steep slope devices: Enabling new architectural paradigms”. In: *51st ACM/EDAC/IEEE Design Automation Conference (DAC)*. ACM. 2014, pp. 1–6.
- [C18] Karthik Swaminathan, Huichu Liu, Jack Sampson, and Vijaykrishnan Narayanan. “An examination of the architecture and system-level tradeoffs of employing steep slope devices in 3D CMPs”. In: *ACM/IEEE 41st International Symposium on Computer Architecture (ISCA)*. IEEE. 2014, pp. 241–252.
- [C17] Yang Xiao, Kevin Irick, Jack Sampson, Vijaykrishnan Narayanan, and Chuanjun Zhang. “A task-oriented vision system”. In: *24th Great Lakes Symposium on VLSI (GLSVLSI)*. ACM. 2014, pp. 181–186.
- [C16] Anshuman Gupta, Jack Sampson, and Michael Bedford Taylor. “DR-SNUCA: An energy-scalable dynamically partitioned cache”. In: *IEEE 31st International Conference on Computer Design (ICCD)*. IEEE. 2013, pp. 515–518.

- [C15] Anshuman Gupta, Jack Sampson, and Michael Bedford Taylor. “TimeCube: A Manycore Embedded Processor with Interference-Agnostic Progress Tracking”. In: *International Conference on Embedded Computer Systems: Architectures, Modeling, and Simulation (SAMOS)*. IEEE, 2013, pp. 227–236.
- [C14] Nathan Goulding-Hotta, Jack Sampson, Qiaoshi Zheng, Vikram Bhatt, Joe Auricchio, Steven Swanson, and Michael Bedford Taylor. “GreenDroid: An Architecture for the Dark Silicon Age”. In: *18th Asia and South Pacific Design Automation Conference (ASP-DAC)*. IEEE, 2012, pp. 100–105.
- [C13] Vasileios Kontorinis, Liuyi Eric Zhang, Baris Aksanli, Jack Sampson, Houman Homayoun, Eddie Pettis, Dean M Tullsen, and Tajana Simunic Rosing. “Managing Distributed UPS Energy for Effective Power Capping in Data Centers”. In: *ACM/IEEE 39th Annual International Symposium on Computer Architecture (ISCA)*. ISCA '12. Portland, Oregon: IEEE Computer Society, 2012, pp. 488–499.
- [C12] Manish Arora, Jack Sampson, Nathan Goulding-Hotta, Jonathan Babb, Ganesh Venkatesh, Michael Bedford Taylor, and Steven Swanson. “Reducing the energy cost of irregular code bases in soft processor systems”. In: *IEEE 19th Annual International Symposium on Field-Programmable Custom Computing Machines (FCCM)*. IEEE. 2011, pp. 210–213.
- [C11] Jack Sampson, Manish Arora, Nathan Goulding-Hotta, Ganesh Venkatesh, Jonathan Babb, Vikram Bhatt, Steven Swanson, and Michael Bedford Taylor. “An evaluation of selective depipelining for FPGA-based energy-reducing irregular code coprocessors”. In: *International Conference on Field Programmable Logic and Applications (FPL)*. IEEE. 2011, pp. 24–29.
- [C10] Jack Sampson, Ganesh Venkatesh, Nathan Goulding-Hotta, Saturnino Garcia, Steven Swanson, and Michael Bedford Taylor. “Efficient complex operators for irregular codes”. In: *IEEE 17th International Symposium on High Performance Computer Architecture (HPCA)*. IEEE. 2011, pp. 491–502.
- [C9] Ganesh Venkatesh, Jack Sampson, Nathan Goulding-Hotta, Sravanthi Kota Venkata, Michael Bedford Taylor, and Steven Swanson. “QSCORES: Trading Dark Silicon for Scalable Energy Efficiency with Quasi-Specific Cores”. In: *44th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*. IEEE Computer Society. 2011, pp. 163–174.
- [C8] Nathan Goulding, Jack Sampson, Ganesh Venkatesh, Saturnino Garcia, Joe Auricchio, Jonathan Babb, Michael B Taylor, and Steven Swanson. “GreenDroid: A mobile application processor for a future of dark silicon”. In: *Hot Chips*. 2010.
- [C7] Ganesh Venkatesh, Jack Sampson, Nathan Goulding, Saturnino Garcia, Vladyslav Bryksin, Jose Lugo-Martinez, Steven Swanson, and Michael Bedford Taylor. “Conservation Cores: Reducing the energy of mature computations”. In: *15th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. ASPLOS XV. Pittsburgh, Pennsylvania, USA: ACM, 2010, pp. 205–218.
- [C6] Weihaw Chuang, Satish Narayanasamy, Ganesh Venkatesh, Jack Sampson, Michael Van Biesbrouck, Gilles Pokam, Osvaldo Colavin, and Brad Calder. “Unbounded page-based transactional memory”. In: *12th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. ASPLOS XII. San Jose, California, USA: ACM, 2006, pp. 347–358.
- [C5] Christophe Lemuet, Jack Sampson, Jean Francois, and Norm Jouppi. “The potential energy efficiency of vector acceleration”. In: *Proceedings of the ACM/IEEE SC 2006 Conference (SC)*. IEEE. 2006, pp. 1–10.
- [C4] Erez Perelman, Marzia Polito, J-Y Bouguet, Jack Sampson, Brad Calder, and Carole Dulong. “Detecting phases in parallel applications on shared memory architectures”. In: *20th IEEE International Parallel Distributed Processing Symposium (IPDPS)*. IEEE. 2006, pp. 1–10.
- [C3] Jack Sampson, Ruben Gonzalez, Jean-Francois Collard, Norman P Jouppi, Mike Schlansker, and Brad Calder. “Exploiting fine-grained data parallelism with chip multiprocessors and fast barriers”. In: *39th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO)*. IEEE Computer Society. 2006, pp. 235–246.

- [C2] Lieven Eeckhout, John Sampson, and Brad Calder. “Exploiting program microarchitecture independent characteristics and phase behavior for reduced benchmark suite simulation”. In: *IEEE International Symposium on Workload Characterization (IISWC)*. IEEE. 2005, pp. 2–12.
- [C1] Jeremy Lau, Jack Sampson, Erez Perelman, Greg Hamerly, and Brad Calder. “The strong correlation between code signatures and performance”. In: *IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*. IEEE. 2005, pp. 236–247.

**JOURNALS, TRANSACTIONS, AND OTHER PERIODICALS:**

- [J21] Sumitha George, Xueqing Li, Minli Julie Liao, Kaisheng Ma, Srivatsa Srinivasa, Karthik Mohan, Ahmedullah Aziz, John Sampson, Sumeet Kumar Gupta, and Vijaykrishnan Narayanan. “Symmetric 2-D-Memory Access to Multidimensional Data”. In: *IEEE Transactions on Very Large Scale Integration (VLSI) Systems* 26.6 (2018), pp. 1040–1050.
- [J20] Xueqing Li, Sumitha George, Yuhua Liang, Kaisheng Ma, Kai Ni, Ahmedullah Aziz, Sumeet Kumar Gupta, John Sampson, Meng-Fan Chang, Yongpan Liu, Huazhong Yang, Suman Datta, and Vijaykrishnan Narayanan. “Lowering Area Overheads for FeFET-Based Energy-Efficient Non-volatile Flip-Flops”. In: *IEEE Transactions on Electron Devices* 65.6 (2018), pp. 2670–2674.
- [J19] Kaisheng Ma, Jinyang Li, Xueqing Li, Yongpan Liu, Yuan Xie, Mahmut Kandemir, Jack Sampson, and Vijaykrishnan Narayanan. “IAA: Incidental Approximate Architectures for Extremely Energy-Constrained Energy Harvesting Scenarios using IoT Nonvolatile Processors”. In: *IEEE Micro* 38.4 (2018).
- [J18] Srivatsa Srinivasa, Xueqing Li, Meng-Fan Chang, John Sampson, Sumeet Kumar Gupta, and Vijaykrishnan Narayanan. “Compact 3-D-SRAM Memory With Concurrent Row and Column Data Access Capability Using Sequential Monolithic 3-D Integration”. In: *IEEE Transactions on Very Large Scale Integration (VLSI) Systems* 26.4 (2018), pp. 671–683.
- [J17] Siddharth Advani, Peter Zientara, Nikhil Shukla, Ikenna Okafor, Kevin Irick, Jack Sampson, Suman Datta, and Vijaykrishnan Narayanan. “A multitask grocery assist system for the visually impaired: Smart glasses, gloves, and shopping carts provide auditory and tactile feedback”. In: *IEEE Consumer Electronics Magazine* 6.1 (2017), pp. 73–81.
- [J16] KD Fischl, K Fair, W-Y Tsai, J Sampson, and AG Andreou. “Spike propagation path planning on IBM TrueNorth neurosynaptic system”. In: *Electronics Letters* 53.15 (2017), pp. 1023–1025.
- [J15] Xueqing Li, Sumitha George, Kaisheng Ma, Wei-Yu Tsai, Ahmedullah Aziz, John Sampson, Sumeet Kumar Gupta, Meng-Fan Chang, Yongpan Liu, Suman Datta, and Vijaykrishnan Narayanan. “Advancing nonvolatile computing with nonvolatile ncfet latches and flip-flops”. In: *IEEE Transactions on Circuits and Systems I: Regular Papers* 64.11 (2017), pp. 2907–2919.
- [J14] Xueqing Li, Kaisheng Ma, Sumitha George, Win-San Khwa, John Sampson, Sumeet Gupta, Yongpan Liu, Meng-Fan Chang, Suman Datta, and Vijaykrishnan Narayanan. “Design of non-volatile sram with ferroelectric fets for energy-efficient backup and restore”. In: *IEEE Transactions on Electron Devices* 64.7 (2017), pp. 3037–3040.
- [J13] Xueqing Li, John Sampson, Asif Khan, Kaisheng Ma, Sumitha George, Ahmedullah Aziz, Sumeet Kumar Gupta, Sayeef Salahuddin, Meng-Fan Chang, Suman Datta, and Vijaykrishnan Narayanan. “Enabling energy-efficient nonvolatile computing with negative capacitance fet”. In: *IEEE Transactions on Electron Devices* 64.8 (2017), pp. 3452–3458.
- [J12] Kaisheng Ma, Xueqing Li, Huichu Liu, Xiao Sheng, Yiqun Wang, Karthik Swaminathan, Yongpan Liu, Yuan Xie, John Sampson, and Vijaykrishnan Narayanan. “Dynamic power and energy management for energy harvesting nonvolatile processor systems”. In: *ACM Transactions on Embedded Computing Systems (TECS)* 16.4 (May 2017), 107:1–107:23.
- [J11] Wei-Yu Tsai, Davis R Barch, Andrew S Cassidy, Michael V DeBole, Alexander Andreopoulos, Bryan L Jackson, Myron D Flickner, John V Arthur, Dharmendra S Modha, John Sampson, and Vijaykrishnan Narayanan. “Always-on speech recognition using truenorth, a reconfigurable, neurosynaptic processor”. In: *IEEE Transactions on Computers* 66.6 (2017), pp. 996–1007.

- [J10] Moon Seok Kim, William Cane-Wissing, Xueqing Li, Jack Sampson, Suman Datta, Sumeet Kumar Gupta, and Vijaykrishnan Narayanan. “Comparative area and parasitics analysis in FinFET and heterojunction vertical TFET standard cells”. In: *ACM Journal on Emerging Technologies in Computing Systems (JETC)* 12.4 (May 2016), 38:1–38:23.
- [J9] Moon Seok Kim, Xueqing Li, Huichu Liu, John Sampson, Suman Datta, and Vijaykrishnan Narayanan. “Exploration of low-power high-SFDR current-steering D/A converter design using steep-slope heterojunction Tunnel FETs”. In: *IEEE Transactions on Very Large Scale Integration (VLSI) Systems* 24.6 (2016), pp. 2299–2309.
- [J8] Kaisheng Ma, Xueqing Li, Karthik Swaminathan, Yang Zheng, Shuangchen Li, Yongpan Liu, Yuan Xie, John Sampson, and Vijaykrishnan Narayanan. “Nonvolatile Processor Architectures: Efficient, Reliable Progress with Unstable Power”. In: *IEEE Micro Magazine* 36.3 (2016), pp. 72–83.
- [J7] Srivatsa Srinivasa, Ahmedullah Aziz, Nikhil Shukla, Xueqing Li, John Sampson, Suman Datta, Jaydeep P Kulkarni, Vijaykrishnan Narayanan, and Sumeet Kumar Gupta. “Correlated material enhanced SRAMs with robust low power operation”. In: *IEEE Transactions on Electron Devices* 63.12 (2016), pp. 4744–4752.
- [J6] Wei-Yu Tsai, Xueqing Li, Matthew Jerry, Baihua Xie, Nikhil Shukla, Huichu Liu, Nandhini Chandramoorthy, Matthew Cotter, Arijit Raychowdhury, Donald M Chiarulli, Steven P Levitan, Suman Datta, John Sampson, Nagarajan Ranganathan, and Vijaykrishnan Narayanan. “Enabling new computation paradigms with HyperFET—an emerging device”. In: *IEEE Transactions on Multi-Scale Computing Systems* 2.1 (2016), pp. 30–48.
- [J5] Yang Xiao, Siddharth Advani, Donghwa Shin, Naehyuck Chang, John Sampson, and Vijaykrishnan Narayanan. “A Saliency-Driven LCD Power Management System”. In: *IEEE Transactions on VLSI* 24.8 (2016), pp. 2689–2702.
- [J4] Hsiang-Yun Cheng, Matt Poremba, Narges Shahidi, Ivan Stalev, Mary Jane Irwin, Mahmut Kandemir, Jack Sampson, and Yuan Xie. “EECache: A Comprehensive Study on the Architectural Design for Energy-Efficient Last-Level Caches in Chip Multiprocessors”. In: *ACM Transactions on Architecture and Code Optimization (TACO)* 12.2 (July 2015), 17:1–17:22.
- [J3] Kaisheng Ma, Xueqing Li, Shuangchen Li, Yongpan Liu, John Jack Sampson, Yuan Xie, and Vijaykrishnan Narayanan. “Nonvolatile processor architecture exploration for energy-harvesting applications”. In: *IEEE Micro* 35.5 (2015), pp. 32–40.
- [J2] Qiaoshi Zheng, Nathan Goulding-Hotta, Scott Ricketts, Steven Swanson, Michael Bedford Taylor, and Jack Sampson. “Exploring Energy Scalability in Coprocessor-Dominated Architectures for Dark Silicon”. In: *ACM Transactions on Embedded Computing Systems (TECS)* 13.4s (Apr. 2014), 130:1–130:24.
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**MISC. (WORKSHOPS, TECH REPORTS, PATENTS, ETC.):**

- [M11] Hsiang-Yun Cheng, Jishen Zhao, Jack Sampson, Mary Jane Irwin, Aamer Jaleel, Yu Lu, and Yuan Xie. *Dswitch: Write-aware dynamic inclusion property switching for emerging asymmetric memory technologies*. Tech. rep. 2016.
- [M10] Hsiang-Yun Cheng, Matt Poremba, Ivan Stalev, Yuan Xie, Jack Sampson, and Mary Jane Irwin. *Energy-Efficient Inclusion Properties for STT-RAM Last-Level Caches*. Non-Volatile Memories Workshop (NVMW). 2015.
- [M9] Kevin M Irick, Peter A Zientara, Jack Sampson, and Vijaykrishnan Narayanan. *Cognitive cameras: Assistive vision systems*. Proceedings of the 2015 International Conference on Compilers, Architecture and Synthesis for Embedded Systems (extended abstract). IEEE Press, 2015.

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- [M7] Vikram Bhatt, Nathan Goulding-Hotta, Qiaoshi Zheng, Jack Sampson, Steven Swanson, and Michael Bedford Taylor. *Sichrome: Mobile web browsing in hardware to save energy*. The 1st Dark Silicon Workshop. 2012.
- [M6] Vasileios Kontorinis, Jack Sampson, Liuyi Eric Zhang, Baris Aksanli, Houman Homayoun, Tajana S Rosing, and Dean Michael Tullsen. *Battery Provisioning and Associated Costs for Data Center Power Capping*. Tech. rep. CS2012-0985. 2012.
- [M5] Ganesh Venkatesh, Jack Sampson, Nathan Goulding, Steven Swanson, and Michael Bedford Taylor. *Quasi-ASICs: Trading Area for Energy by Exploiting Similarity in Synthesized Cores for Irregular Code*. Tech. rep. 2011.
- [M4] John Morgan Sampson. "Design and Architecture of Automatically-generated Energy-reducing Coprocessors". PhD thesis. University of California, San Diego, 2010.
- [M3] Ikkjin Ahn, Nathan Goulding, John Sampson, Ganesh Venkatesh, Michael Taylor, and Steve Swanson. *Scaling the Utilization Wall: The Case for Massively Heterogeneous Multiprocessors*. Tech. rep. 2009.
- [M2] Jean-Francois CP Collard, Norman Paul Jouppi, and John Morgan Sampson. *Program thread synchronization*. US Patent 7,587,555. Sept. 2009.
- [M1] Jack Sampson, Rubén González, Jean-Francois Collard, Norman P Jouppi, and Mike Schlansker. *Fast synchronization for chip multiprocessors*. Workshop on the Design, Architecture, and Simulation of Chip Multiprocessors (dasCMP 2005). 2005.

## TEACHING

### Computer Science and Engineering Department, Pennsylvania State University:

• FA 2018	CMPEN 431: Introduction to Computer Architecture	1 Section	Undergraduate
	CMPEN 111S: First-Year Seminar in Comp. Eng.	3 Sections	Undergraduate
• SP 2018	CMPEN 431: Introduction to Computer Architecture	1 Section	Undergraduate
• FA 2017	CSE 530: Fundamentals of Computer Architecture	1 Section	Graduate
	CMPEN 111S: First-Year Seminar in Comp. Eng.	3 Sections	Undergraduate
• SP 2017	CMPEN 431: Introduction to Computer Architecture	1 Section	Undergraduate
• FA 2016	CSE 530: Fundamentals of Computer Architecture	1 Section	Graduate
	CMPEN 111S: First-Year Seminar in Comp. Eng.	2 Sections(Co-Inst)	Undergraduate
• SP 2016	CSE 530: Fundamentals of Computer Architecture	1 Section	Graduate
• FA 2015	CMPEN 270/1: Digital Design: Theory and Practice	1 Section	Undergraduate
	CMPEN 111S: First-Year Seminar in Comp. Eng.	2 Sections(Co-Inst)	Undergraduate
• SP 2015	CSE 598C: Seminar on Computer Architectures for Emerging Technologies and Applications	1 Section	Graduate
• FA 2014	CMPEN 270/1: Digital Design: Theory and Practice	2 Sections(Co-Inst)	Undergraduate
• SP 2014	CMPEN 431: Introduction to Computer Architecture	1 Section	Undergraduate
• FA 2013	CSE 530: Fundamentals of Computer Architecture	1 Section	Graduate

*Student Ratings of Teaching Effectiveness* for classes(×13) taught through SP 2018:

Graduate: CSE 530(×4): 6.29/7, CSE 598C: N/A (Grad. Seminar)

Undergraduate: CMPEN 431(×3): 5.43/7, CMPEN 27X(×2): 3.98/7, CMPEN 111S(×3): 5.42/7

### Computer Science and Engineering Department, University of California at San Diego:

• FA 2011	CSE 291: Smartphone Processor Design	1 Section(Co-Inst)	Graduate
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### Teaching Assistantships:

- SP 2006, University of California at San Diego, CSE 141/141L
- SU 2000–SP 2003, University of California at Berkeley, CS61B(×3), CS61C, EECS150(×3)



## SERVICE TO THE PROFESSION

- **Track Co-Chair:** ISLPED 2017 Logic and Architecture Track
- **Technical Program Committees:** CASES 2013-2015; ISLPED 2014-2018; IISWC 2014, 2016; HPCA 2015, 2018; DATE 2015-2016; ICS 2015; DAC 2016; MICRO 2017
- **External Review Committees:** ISCA 2014-2017; HPCA 2013, 2016, 2019; MICRO 2013-2014
- **Journal Reviewer:** IEEE TPDS 2011, 2016; IEEE Micro 2013, 2015, 2018; ACM TECS 2013, 2014; IEEE JESSCDC 2015; IEEE TVLSI 2016; ACM TODAES 2016; IEEE TCAD 2016; IEEE CAL 2016, 2017, 2018; IEEE Transactions on Computers 2017
- **Organizing Committees:** DaSi 2012-2013 (Workshop Organizer), ISLPED 2014 (Local Arrangements Co-Chair), HPCA 2015 (Workshops and Tutorials), ISLPED 2018 (Industrial Liaison)
- **Grant Review Panelist:** NSF CPS( $\times 2$ ), NSF E2CDA
- **University Service, Penn State:** Curriculum committee (2014-2015), Graduate committee (2016-present), Faculty Search Committee ( $\times 3$ ), College of Engineering Undergraduate Advising Center program advisor for Computer Engineering (2014), Schreyers Honors College honors advisor for Computer Engineering (2017-present)

## SELECTED INVITED TALKS

- *"Incidental Computing on IoT Nonvolatile Processors."* Non-Volatile Memories Workshop. 2018
- *"Challenges and Opportunities in Translating Emerging Device Innovations into Architectural Benefits."* George Mason University. 2017
- *"Architecture Exploration for Ambient Energy Harvesting Nonvolatile Processors."* Embedded Tutorial at ISLPED. 2016
- *"Hunting for Unicorns: Technology-Driven Computer Architecture Research in an Age of Scaling Slowdowns."* University of Michigan, Ann Arbor, Clarity Lab. 2015
- *"Low(er) Energy Computing: Applications and Devices."* University of California at Santa Barbara, SEAL Lab. 2015
- *"A hardware accelerated multilevel visual classifier for embedded visual-assist systems."* ICCAD. 2014
- *"Scaling Diversity Alongside Dark Silicon with Coprocessor-Dominated Architectures."* Chinese Academy of Sciences, Jisuan Institute of Technology; Beijing Institute of Technology, ASIP Lab; Peking University, Center for Energy-Efficient Computing and Applications; Dark Silicon in EDA Workshop at ICCAD. 2014
- *"Reclaiming Dark Silicon with Conservation Cores."* Pennsylvania State University; Yale; University of California at Santa Cruz. 2013
- *"Conservation Cores: Architectures for a Future of Dark Silicon."* ETH Zurich; University of Pennsylvania; Massachusetts Institute of Technology; University of Washington. 2012

## CURRENT GRADUATE STUDENTS

Saambhavi Baskaran

Zhixuan Huan

Minli Liao

Tulika Parija [co-advised, C. Das]

Philip Shin

Balachandran Swaminathan [co-advised, C. Das]

Peter Zientara [co-advised, V. Narayanan]

## PRIOR GRADUATE STUDENTS

*Kaisheng Ma*, PhD [co-advised, V. Narayanan], 2018. (Assistant Professor, Tsinghua University)

*Wei-Yu Tsai*, PhD [co-advised, V. Narayanan], 2017. (Intel)

*Nandhini Chandramoorthy*, PhD [co-advised, V. Narayanan], 2016. (IBM TJ Watson)

*Siddharth Advani*, PhD, 2016 [co-advised, V. Narayanan]. (Samsung Research America)

*Ivan Stalev*, MS, 2015. (Lyft)

## DOCTORAL COMMITTEE APPOINTMENTS (EXCLUDING ADVISEES)

Amin Jadidi (2018), Orhan Memduh Kislal (2018), Chris Songjin Lee (2016), Moon Seok Kim (2016), Hsiang-Yun Cheng (2016), Matthew Joseph Cotter (2015), Yang Xiao (2015), Karthik Venkataraman Swaminathan (2015)

## RECENT RESEARCH COLLABORATORS

Andreas G. Andreou (Johns Hopkins), Luca Benini (ETHZ), Meng-Fan Chang (National Tsinghua), Nae-hyuck Chang (KAIST), Donald M. Chiarulli (University of Pittsburgh), Chita R. Das (Penn State), Suman Datta (Notre Dame), Sumeet Gupta (Purdue), Kevin Irick (SiliconScapes), Mary Jane Irwin (Penn State), Aamer Jaleel (NVIDIA), Mahmut Kandemir (Penn State), Asif I. Khan (Georgia Tech), Jagadish Kotra (AMD), Steven P. Levitan (University of Pittsburgh), Xueqing Li (Tsinghua), Yongpan Liu (Tsinghua), Dharmendra S. Modha (IBM), Vijaykrishnan Narayanan (Penn State), Arijit Raychowdhury (Georgia Tech), Sayeef Salahuddin (UC Berkeley), Karthik Swaminathan (IBM), Yasuki Tanabe (Toshiba), Yuan Xie (UC Santa Barbara), Jishen Zhao (UC San Diego)