

PhD Project

I am a PhD Candidate and member of System Energy Efficient Laboratory (SeeLab) at UC San Diego. I am searching for alternative computer architectures to address the memory and computing bottlenecks of current processors by techniques including approximate computing, near-data computing and in-memory processing. I am also working toward machine learning and neuromorphic computing to replace traditional computing systems with smart processors which could work as human brain. To make these designs practical, I am working on the technological (emerging non-volatile memories) and design aspects in collaboration with groups at UC San Diego and UC Berkeley.

Education

- 2014–Present **PhD Candidate**, *University of California San Diego*, La Jolla, CA.
Computer Science and Engineering
- 2011–2014 **Master of Science**, *University of Tehran*, Tehran, Iran.
Electrical and Computer Engineering
- 2007–2011 **Bachelor of Science**, *University of Tehran*, Tehran, Iran.
Electrical and Computer Engineering

Awards and Honors

- 2016 Nominated for Outstanding Graduate Student Award at UCSD.
- 2016 Top ranked paper in International IEEE International Conference on Computer Design (ICCD).
- 2014–present Powell Fellow Student at University of California San Diego, one of the most prestigious fellowship offers at UCSD.
- 2015–present Young Richard Newton Student Fellow in Design Automation Conference, CA.
- 2014 Selected as the Best Teaching Assistant, Electrical and Computer Engineering Department, University of Tehran.
- 2011 Ranked 9th among more than 40,000 participants in Iranian Nationwide University Entrance Exam for M.Sc. degree in Electrical Engineering.
- 2007 Ranked 81st among more than 400,000 participants in Iranian Nationwide University Entrance Exam for B.Sc. degree.

Publications (Journals and Conferences)

- D&T 2017 **M. Imani**, A. Rahimi, J. Hwang, T. Rosing, J. M. Rabaey, “Low-Power Sparse Hyperdimensional Encoder for Language Recognition”, *IEEE Design & Test*, 2017.

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- ISLPED 2017 **M. Imani**, S. Gupta, A. Arredondo, T. Rosing, "Efficient Query Processing in Crossbar Memory", *IEEE/ACM International Symposium on Low Power Electronics and Design (ISLPED)*, 2017.
- DAC 2017 **M. Imani**, S. Gupta, T. Rosing, "Ultra-Efficient Processing In-Memory for Data Intensive Applications", *IEEE/ACM Design Automation Conference (DAC)*, 2017.
- DAC 2017 **M. Imani**, D. Peroni, D. Kong, T. Rosing, J. M. Rabaey, "CFPU: Configurable Floating Point Multiplier for Energy-Efficient Computing", *IEEE/ACM Design Automation Conference (DAC)*, 2017.
- HPCA 2017 **M. Imani**, A. Rahimi, D. Kong, T. Rosing, J. M. Rabaey, "Exploring Hyperdimensional Associative Memory", *International Symposium on High-Performance Computer Architecture*, 2017.
- DATE 2017 **M. Imani**, D. Peroni, Y. Kim, A. Rahimi, T. Rosing, "Efficient Neural Network Acceleration on GPGPU using Content Addressable Memory," *IEEE/ACM Design Automation and Test in Europe Conference*, 2017.
- DATE 2017 M. Samragh, **M. Imani**, F. Koushanfar, T. Rosing, "LookNN: Neural Network with No Multiplication," *IEEE/ACM Design Automation and Test in Europe Conference*, 2017.
- TMSCS 2017 **M. Imani**, M. Imani, A. Rahimi, P. Mercati, T. Rosing, "Multi-stage Tunable Approximate Search in Resistive Associative Memory," *IEEE Transactions on Multi-Scale Computing Systems (TMSCS)*, 2017.
- TETC 2016 **M. Imani**, D. Peroni, A. Rahimi, T. Rosing, "Resistive CAM Acceleration for Tunable Approximate Computing", *IEEE Transaction on Emerging Topics in Computing*, 2017.
- ISQED'17 **M. Imani**, T. Rosing, "CAP: Configurable Resistive Associative Processor for Near-Data Computing," *IEEE International Symposium on Quality Electronic Design (ISQED)*, 2017.
- ASP-DAC 2017 **M. Imani**, Y. Kim, T. Rosing, "MPIM: Multi-Purpose In-Memory Processing using Configurable Resistive Memory", *IEEE Asia and South Pacific Design Automation Conference*, 2017.
- ASP-DAC 2017 **M. Imani**, Y. Kim, T. Rosing, "MPIM: Multi-Purpose In-Memory Processing using Configurable Resistive Memory", *IEEE Asia and South Pacific Design Automation Conference*, 2017.
- NVMW 2017 **M. Imani**, M. Imani, Y. Kim, A. Rahimi, T. Rosing, "In-Memory Processing to Support Search-Based and Bitwise Computation", *Non-Volatile Memory Workshop (NVMW)*, 2017.
- NVMW 2017 **M. Imani**, D. Peroni, A. Rahimi, T. Rosing, "Non-volatile Content Addressable Memory for Computing Acceleration", *Non-Volatile Memory Workshop (NVMW)*, 2017.
- ICCD 2016 **M. Imani**, D. Peroni, A. Rahimi, T. Rosing, "Resistive CAM Acceleration for Tunable Approximate Computing", *IEEE International Conference on Computer Design*, 2016. (Selected as top ranked paper for publishing at *IEEE Transactions on Emerging Topics in Computing*).

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- ISLPED 2016 **M. Imani**, Y. Kim, A. Rahimi, T. Rosing, "ACAM: Approximate Computing Based on Adaptive Associative Memory with Online Learning" *International Symposium on Low Power Electronics and Design*, 2016.
- NVMSA 2016 **M. Imani**, A. Rahimi, Y. Kim, T. Rosing, "A Low-Power Hybrid Magnetic Cache Architecture Exploiting Narrow-Width Values," *Non-Volatile Memory Systems and Applications Symposium*, 2016.
- TETC 2016 **M. Imani**, S. Patil, T. Rosing, "Approximate Computing using Multiple-Access Single-Charge Associative Memory", *IEEE Transaction on Emerging Topics in Computing*, 2016.
- DATE 2016 **M. Imani**, A. Rahimi, T. Rosing, "Resistive Configurable Associative Memory for Approximate Computing," *IEEE/ACM Design Automation and Test in Europe Conference*, 2016.
- DATE 2016 **M. Imani**, S. Patil, T. Rosing, "MASC: Ultra-Low Energy Multiple-Access Single-Charge TCAM for Approximate Computing," *IEEE/ACM Design Automation and Test in Europe Conference*, 2016.
- MEMSYS 2016 **M. Imani**, T. Rosing, "Processing Acceleration with Resistive Memory-based Computation," *ACM International Symposium on Memory Systems*, 2016.
- ISQED 2016 **M. Imani**, S. Patil, T. Rosing, "Low Power Data-Aware STT-RAM based Hybrid Cache Architecture," *IEEE International Symposium on Quality Electronic Design*, 2016.
- ISQED 2016 **M. Imani**, P. Mercati, T. Rosing, "ReMAM: Low Energy Resistive Multi-Stage Associative Memory for Energy Efficient Computing," *International Symposium on Quality Electronic Design*, 2016.
- DAC 2016 **M. Imani**, Y. Kim, A. Rahimi, T. Rosing, "Associative Memory with Online Learning for Approximate Computing", Poster presentation in *IEEE/ACM Design Automation Conference*, 2016.
- GLSVLSI 2016 P. Mercati, A. Bartolini, F. Paterna, **M. Imani**, L. Benini and T. Rosing, "VarDroid: Online Variability Emulation in Android/Linux Platforms," *ACM Great lakes symposium on VLSI*, 2016.
- GLSVLSI 2016 **M. Imani**, S. Patil, T. Rosing, "DCC: Double Capacity Cache for Narrow-Width Data Values," *ACM Great lakes symposium on VLSI*, 2016.
- Techon 2016 **M. Imani**, B. Aksanli, T. Rosing, "Ultra-Efficient Content Addressable Memory for Tunable GPU Approximation," *Techon SRC Conference*, 2016.
- ICCAD 2015 Y. Kim, **M. Imani**, S. Patil, T. Rosing, "CAUSE: Critical Application Usage-Aware Memory System using Non-volatile Memory for Mobile Devices," *IEEE International Conference On Computer Aided Design*, 2015.
- NANOARCH 2015 **M. Imani**, S. Patil, T. Rosing, "Hierarchical Design of Robust and Low Data Dependent 32KB FinFET Based SRAM Array," *IEEE International Symposium on Nanoscale Architecture*, 2015.
- DAC 2015 **M. Imani**, S. Patil, M. Jafari, T. Rosing, "Ultra-Low Read leakage SRAM Cell Utilizing Independently-Controlled-Gate FinFET," Poster in *IEEE/ACM Design Automation Conference*, 2015.

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- MR 2015 **M. Imani**, M. Jafari, B. Ebrahimi, T. Rosing, "Ultra-low power FinFET based SRAM cell employing sharing current concept" *Microelectronic Reliability Elsevier Journal*, 2015.
- NVMW 2015 **M. Imani**, S. Patil, T. Rosing, "Using STT-RAM Based Buffers in Digital Circuits," *Annual Non-Volatile Memories Workshop*, 2015.
- IJFMR 2015 H. Alimohamadi, **M. Imani**, B. Forouzandeh "Computational Analysis of Transient non-Newtonian Blood Flow in Magnetic Targeting Drug Delivery in Stenosed Carotid Bifurcation Artery," *International Journal of Fluid Mechanics Research, Begell house*, vol. 42, no. 2, pp. 149-169, 2015.
- TETN 2014 M. Jafari, **M. Imani**, M. Fathipour, "Analysis of Power Gating in Different Hierarchical Levels of 2MB Caches, Considering Variation," *International Journal of Electronic, Taylor and Francis*, vol. 105, no. 2, pp. 1594-1608, 2014.
- TETN 2014 G. Passandi, M. Jafari, **M. Imani**, "A New Low-Power 10T SRAM cell with Improved Read SNM," *International Journal of Electronic, Taylor and Francis*, vol. 105, no. 2, pp. 1621-1633, 2014.
- JCMES 2014 H. Alimohamadi, **M. Imani**, "Finite Element Simulation of Two-Dimensional Pulsatile Blood Flow thorough a Stenosed Artery in the Presence of External Magnetic Field," *International Journal for Computational Methods in Engineering Science & Mechanics, Taylor and Francis*, vol. 15, no. 4, pp. 390-400, 2014.
- IJTEEE 2014 **M. Imani**, H. Alimohamadi, "A Low Power And Reliable 12T SRAM Cell Considering Process Variation In 16nm CMOS," *International Journal of Technology Enhancement and Emerging Engineering Research*, vol. 2, no. 8, pp. 60-63, 2014.
- JCMES 2014 H. Alimohamadi, **M. Imani**, "Transient Non-Newtonian Blood Flow under Magnetic Targeting Drug Delivery in an Aneurysm Blood Vessel with Porous Walls," *International Journal for Computational Methods in Engineering Science & Mechanics, Taylor and Francis*, vol. 15, no. 6, pp. 522-533, 2014.
- IJTEEE 2014 M. Jafari, **M. Imani**, M. Fathipour, "Design a New Stable and Low Power Bandgap Reference Circuit Based on Fin-FET Device," *International Journal of Technology Enhancements and Emerging Engineering Research*, vol. 2, no. 9, pp. 41-46, 2014.
- DTIS 2013 M. Jafari, **M. Imani**, M. Fathipour, N. Sehatbakhsh "Bottom-up design of a high performance ultra-low power DFT utilizing multiple-VDD, multiple-Vth and gate sizing," *IEEE Design & Technology of Integrated Systems in Nanoscale Era*, 2013.
- DTIS 2013 M. Jafari, **M. Imani**, M. Ansari, M. Fathipour, N. Sehatbakhsh, "Design of an Ultra-Low Power 32-bit Adder Operating at Subthreshold Voltages in 45-nm FinFET," *IEEE Design & Technology of Integrated Systems in Nanoscale Era*, 2013.
- ICECCO 2013 M. Ansari, **M. Imani**, H. Aghababa, B. Forouzandeh, "Estimation of Joint Probability Density Function of Delay and Power with Variable Skewness," *IEEE International Conference on Electronics Computer and Computation*, 2013.
- ICEEE 2013 M. Jafari, **M. Imani**, M. Fathipour, "Employing Different Modes of Power Gating on ARM Processors by 16nm FinFET," *Iranian Conference on Electrical and Electronics Engineering*, 2013.

- ICEEE 2013 M. Jafari, **M. Imani**, M. Fathipour, "An Adaptive Current Mirror Feedback in SRAM Cells for Suppressing NBTI Degradation," *Iranian Conference on Electrical and Electronics Engineering*, 2013.
- IJET 2013 H. Alimohamadi, **M. Imani**, "Computational Analysis of Synovial Fluid in Actual Three Dimensional Modeling of Human Knee Joint under the Action of Magnetic Field," *International Journal of Energy and Technology*, vol. 5, no. 24, pp. 1-8, 2013.
- IJAAS 2013 H. Alimohamadi, **M. Imani**, M. Shojaee-Zadeh, "Computational Analysis of Pulsatile Biofluid in Locally Expanded Vessel under the Action of Magnetic Field," *Advances in Applied Science Research Journal*, vol. 4, no. 6, pp. 96-103, 2013.
- ICEEE 2012 M. Jafari, **M. Imani**, M. Fathipour, "Design of a Switched-Capacitor Sample & Hold Circuit Using a Two-Stage OTA with 13 ENOB and 40MS/s in CMOS 0.18," *Iranian Conference on Electrical and Electronics Engineering*, 2012.

Talks and Presentations

- Oct. 2016 Talk in Center of Center for Networked Systems (CNS), La Jolla.
- Oct. 2016 Talk in International Symposium on Memory Systems (MEMSYS), Washington DC.
- Sept. 2016 Presentation talk in Semiconductor Research Corporation TECHON conference, Austin.
- Aug. 2016 Talk in International Symposium on Low Power Electronics and Design (ISLPED), San Francisco.
- June 2016 Talk in Design Automation Conference (DAC), Austin.
- May 2016 Talk in Great Lakes Symposium on VLSI (GLSVLSI), Boston.
- April 2016 Poster presentation in Research Expo'16, UCSD, La Jolla.
- March 2015 Talk in International Symposium on Quality Electronic Design (ISQED), Santa Clara.
- Jan. 2016 Talk in UCSD CSE291 seminar "From non-volatile memory to approximate computing"
- Nov. 2015. Talk in International Conference On Computer Aided Design (ICCAD), Austin.
- July 2015 Talk in Nanoarchitecture conference (NANOARCH) Conference, Boston
- June 2015 Talk in Design Automation Conference (DAC), San Francisco.
- May 2015 Invited talk in Graduate Student Association, UCSD, La Jolla.
- April 2015. Poster Presentation in Research Expo'15, UCSD, La Jolla
- March 2015 Poster Presentation in Non-Volatile Memory Workshop (NVMW), La Jolla.

Professional Associations

- Semiconductor Research Cooperation (SRC)
- Center for Networked Systems (CNS)
- TerraSwarm Research Center
- Association for Computing Machinery (ACM)
- International Association of Computer Science and Information Technology (IACSIT)

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Teaching Experience

- Fall 2015 **Digital Logic Design**, *UC San Diego, CSE Department.*
Instructor: Prof. Tajana Rosing
- 2012, 2013 **Communications Circuits**, *University of Tehran, ECE Department.*
Instructor: prof. Mahmud Kamarei
- 2013, 2014 **MEMS & NEMS**, *University of Tehran, ECE Department.*
Instructor: Prof. Morteza Fathipur
- 2012, 2014 **Electronic Circuits I**, *University of Tehran, ECE Department.*
Instructor: Prof. Mohammadreza Kolahdouz
- 2010, 2014 **Electronic Circuit II**, *University of Tehran, ECEDepartment.*
Instructor: Prof. Behjat Frouzandeh
- 2011 **Basic Electrical I**, *University of Tehran, ME Department.*
Instructor: Prof. Moosa Ayati
- 2013, 2014 **Basic Electrical II**, *University of Tehran, ME Department.*
Instructor: Prof. Heydar Ramezani-tabar
- 2012 **Linear Control Systems**, *University of Tehran, ME Department.*
Instructor: Prof. Aghil Yousefi-Koma

Mentorship

I am directly mentoring/supervising several graduate and undergrad students at UCSD:

Joonseop Sim, *PhD Student, ECE Department, UC San Diego.*

Project: Emerging Memory/Circuit Design

Daniel Perioni, *PhD Student, CSE Department, UC San Diego.*

Project: Approximate hardware

Saransh Gupta, *Ms Student, ECE Department, UC San Diego.*

Project: Memory-based computing

Deqian Kong, *BSc student, CSE Department, UC San Diego.*

Project: Brain-inspired computing

Pushen Wang, *Ms student, CSE Department, UC San Diego.*

Project: Supervised learning training acceleration

Harveen Kaur, *Ms student, CSE Department, UC San Diego.*

Project: Deep learning

Sahil Sharma, *Ms student, CSE Department, UC San Diego.*

Project: Map reduce and query processing

Minxuan Zhou, *Ms student, CSE Department, UC San Diego.*

Project: Graph processing

Chihheng Tzang, *Ms student, ECE Department, UC San Diego.*

Project: Approximate logic

Max Masich, *Ms student, CSE Department, UC San Diego.*

Project: Neural Network

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Tarek Nassar, *BSc student, ECE Department, UC San Diego.*

Project: GPU-based deep neural network

Thomas Worley, *BSc student, CSE Department, UC San Diego.*

Project: Classification and clustering acceleration

Seven Wu, *BSc student, CSE Department, UC San Diego.*

Project:Text classification

Shuo Li, *BSc student, CSE Department, UC San Diego.*

Project:Image-like text classification

Jiaxiao Zhou, *BSc student, CSE Department, UC San Diego.*

Project:Self learning in high-dimensional space

Alumni

Atl Arredondo, (*MS CSE*), Data science engineer at slack Inc., Jan 2016 .

Debanjan Chatterjee, (*BSc CSE*), Engineer at Citadel Information Services Inc., Jan 2016.

Yan Cheng, (*BSc CSE*), Graduate student at CSE, UCSD, July 2016.

John F Hwang, (*BSc CSE*), Engineer at Parsons Corporation, Sept 2016.

Moyuan Huang, (*MS CSE*), MS UCSD.

Zhipeng Yan, (*MS CSE*), MS UCSD.

Service

Program Committee Member

34th IEEE SoCC Conference, 2017

13th IEEE PRIME Conference, 2017

Reviewer

IEEE Transactions on Very Large Scale Integration Systems (TVLSI)

IEEE Transactions on Circuits and Systems I (TCAS I)

IEEE Transactions on Circuits and Systems II (TCAS II)

IEEE Transactions on Nanotechnology (TNANO)

IEEE Transactions on Circuits and Systems for Video Technology (TCSVT)

IEEE Transactions on Emerging Topics in Computing (TETC)

IEEE Transactions on Computers (TC)

ACM Journal of Emerging Technologies in Computing Systems (JETC)

Elsevier, Microelectronic Journal

Elsevier, Integration, the VLSI Journal

Elsevier, Computer Methods and Programs in Biomedicine Journal

Elsevier, journal Engineering Science and Technology

Elsevier, Computers in Biology and Medicine

Taylor & Francis, International Journal of Electronic

Taylor & Francis, Brain-Computer Interfaces Journal

Design, Automation and Test in Europe Conference (DATE)

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Computer Skills

Programming C/C++, Java, CodeVisionAVR, Assembly Language, Haskell
EE/CS Multi2sim, GEM5, Pspice, Hspice, Design Compiler, IC Compiler, Prime Time,
Engineering Modelsime, Quartez, Matlab/Simulink, Protel, Proteus, ADS, L-Edit, S-Edit, ISE-
Tools Xilinx, Silvaco, Comsol, Cadence
Hardware System C, Verilog
language

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