

Xun Jiao

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PROFESSIONAL EXPERIENCE

Assistant Professor 08/2018-present
Electrical and Computer Engineering
Villanova University

EDUCATION

Ph.D., Computer Science and Engineering 09/2013-06/2018
University of California, San Diego

B.S., Telecommunication Engineering and Management 09/2009-06/2013
Joint Program of
Beijing University of Posts and Telecommunications
& Queen Mary University of London

Summary of Highlights

- 2022 IEEE Young Engineer of the Year Award (Philadelphia Section).
- Received 6 Best Paper Awards/Nominations in international conferences such as DATE, EMSOFT.
- Published 50+ Papers in IEEE/ACM transactions or first-tier conferences.
- Invited Presentation at U.S. Congressional House.
- Associate editor and program committee member of top-tier journals and conferences.
- Mentored 30 graduate/undergraduate students in research projects

RESEARCH INTERESTS

My research interests lie in the broad areas of energy-efficient and robust computing, bio-inspired computing, and machine learning, with a focus on designing robust, energy-efficient, and real-time machine intelligence.

- Robust Computing (Hardware, AI/ML, Software)
- Applied AI/ML, Brain-Inspired Computing, ML Hardware
- Edge Computing, Embedded System, Design Automation

AWARDS AND HONORS

- IEEE Young Engineer of the Year Award (Philadelphia Section) (2022)
- Finalist of Facebook Research Award (2022)
- Best Paper Nomination in IEEE/ACM Design, Automation & Test in Europe Conference (2022)
- Best Paper Nomination in ACM International Conference on Embedded Software (2020)
- Outstanding Paper Award in Euromicro Conference on Digital System Design (2020)
- Best Paper Award in IEEE Workshop on Silicon Errors in Logic – System Effects (2020)
- Best Paper Nomination in ACM International Conference on Embedded Software (2019)
- Best Paper Award in IEEE International Conference on Cyber Physical and Social Computing (2019)
- First-class Honor of Bachelor Degree, Queen Mary, University of London (2013)

PUBLICATIONS

Journal Publications:

- J14 Ruixuan Wang, Dongning Ma, and Xun Jiao, “EnHDC: Ensemble Learning for Brain-Inspired Hyper-dimensional Computing”, IEEE Embedded System Letter (**ESL**), 2022.
- J13 Mauro Sanchirico III, Xun Jiao, and C. Nataraj, “AMITE: A Novel Polynomial Expansion for Analyzing Neural Network Nonlinearities”, IEEE Transactions on Neural Networks and Learning Systems (**TNNLS**), 2022.
- J12 Dongning Ma, Xinqiao Zhang, Ke Huang, Yu Jiang, Wanli Chang, Xun Jiao, “DEVOT: Dynamic Delay Modeling of Functional Units under Voltage and Temperature Variations”, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2021
- J11 Xun Jiao, Dongning Ma, Wanli Chang, Yu Jiang, “LEVAX: An Input-aware Learning-based Error Model of Voltage-Scaled Functional Units”, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2020
- J10 Jian Gao, Yiwen Xu, Yu Jiang, Zhe Liu, Wanli Chang, Xun Jiao and Jianguang Sun, “EM-Fuzz: Augmented Firmware Fuzzing via Memory Checking Instrumentation”, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2020
- J9 Jing Huang, Renfa Li, Xun Jiao, Yu Jiang and Wanli Chang, “Dynamic DAG Scheduling on Multiprocessor Systems: Reliability, Energy and Makespan”, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2020
- J8 Jeng-Hau Lin, Xun Jiao, Mulong Luo, Zhuowen Tu, Rajesh Gupta, “Vulnerability of Hardware Neural Networks to Dynamic Operation Point Variations”, IEEE Design & Test (**D&T**), 2020
- J7 C. A. K. Kwuimy, Foad Nazari, Xun Jiao, Pejman Rohani, C. Nataraj, “Nonlinear dynamic analysis of an epidemiological model for COVID-19 including public behavior and government action”, Nonlinear Dyn, 2020.
- J6 Jie Liang, Yu Jiang, Mingzhe Wang, Xun Jiao, Yuanliang Chen, Houbing Song, and Kim-Kwang Raymond Choo, “DeepFuzzer: Accelerated Deep Greybox Fuzzing”, IEEE Transactions on Dependable and Secure Computing (**TDSC**), 2019.
- J5 Jian Gao, Yu Jiang, Zhe Liu, Xin Yang, Cong Wang, Xun Jiao, Zijiang Yang, and Jianguang Sun, “Semantic Learning and Emulation Based Cross-platform Binary Vulnerability Seeker”, IEEE Transactions on Software Engineering (**TSE**), 2019.
- J4 Dongning Ma, Xun Jiao, “WoMA: An Input-Based Learning Model to Predict Dynamic Workload of Embedded Applications”, IEEE Embedded Systems Letters (**ESL**), 2019.
- J3 Zhengxiong Luo, Feilong Zuo, Yu Jiang, Jian Gao, Xun Jiao, Jianguang Sun, “Polar: Function Code Aware Fuzz Testing of ICS Protocol”, ACM Transactions on Embedded Computing Systems (**TECS**), 2019.
- J2 Xun Jiao, Abbas Rahimi, Yu Jiang, Jianguo Wang, Hamed Fatemi, Jose Pineda de Gyvez, and Rajesh K. Gupta, “CLIM: A Cross-level Workload-aware Timing Error Prediction Model for Functional Units”, IEEE Transaction on Computers (**TC**), 2018.
- J1 Yu Jiang, Hehua Zhang, Xiaoyu Song, Xun Jiao, William N. N. Hung, and Jianguang Sun, “Bayesian Network Based Reliability Analysis of PLC Systems”, IEEE Transaction on Industry Electronics (**TIE**), 2013.

Peer Reviewed Conference Publications:

- C38 Hussam Amrouch, Mohsen Imani, Xun Jiao, Yiannis Aloimonos, Cornelia Fermuller, Dehao Yuan, Dongning Ma, Hamza Errahmouni, Paul R. Genssler, and Peter Sutor, “Brain-Inspired Hyperdimensional Computing for Ultra-Efficient Edge AI”, International Conference on Hardware/Software Code-sign and System Synthesis (**CODES+ISSS**), Shanghai, China, 2022.

- C37 Ruixuan Wang, Xun Jiao, and X. Sharon Hu, “ODHD: One-Class Hyperdimensional Computing for Outlier Detection”, ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2022.
- C36 Ruixuan Wang, Xun Jiao, “PoisonHD: Poison Attack on Brain-Inspired Hyperdimensional Computing”, IEEE/ACM Design, Automation & Test in Europe Conference (**DATE**), 2022.
- C35 Sizhe Zhang, Ruixuan Wang, Dongning Ma, Jeff Jun Zhang, Xunzhao Yin and Xun Jiao, “Energy-Efficient Brain-Inspired Hyperdimensional Computing Using Voltage Scaling”, IEEE/ACM Design, Automation & Test in Europe Conference (**DATE**), 2022.
- C34 Dongning Ma, Xue Qin, and Xun Jiao, “AxBy-ViT: Reconfigurable Approximate Computation Bypass for Vision Transformers”, International Symposium on Quality Electronic Design (**ISQED**), Virtual, California, 2022.
- C33 Sizhe Zhang, Mohsen Imani, and Xun Jiao, “ScaleHD: Robust Brain-Inspired Hyperdimensional Computing via Adaptive Scaling”, ACM/IEEE International Conference on Computer-Aided Design (**ICCAD**), San Diego, CA, 2022.
- C32 Meltem Izzetoglu, Xun Jiao, Seri Park, “Understanding Driving Behavior Using fNIRS and Machine Learning”, ASCE International Conference on Transportation and Development (**ICTD**), Virtual, 2021.
- C31 Dongning Ma, Jianmin Guo, Yu Jiang, Xun Jiao, “HDTest: Differential Fuzz Testing of Brain-Inspired Hyperdimensional Computing”, ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2021.
- C30 Xiaolong Guo, Song Han, X. Sharon Hu, Xun Jiao, Yier Jin, Fanxin Kong, and Michael Lemmon, “Towards Scalable, Secure, and Smart Mission-Critical IoT Systems: Review and Vision”, International Conference on Embedded Software (**EMSOFT**), 2021.
- C29 Ruixuan Wang, Fanxin Kong, Hasshi Sudler, Xun Jiao, “HDAD: Hyperdimensional Computing-based Anomaly Detection for Automotive Sensor Attacks”, IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Virtual Conference, 2021.
- C28 Dongning Ma, Rahul Thapa, Xingjian Wang, Cong Hao and Xun Jiao, “Workload-Aware Approximate Computing Configuration”, IEEE/ACM Design, Automation & Test in Europe Conference (**DATE**), 2021.
- C27 Rahul Thapa, Dongning Ma, Xun Jiao, “HDXplore: Automated Differential Testing of Brain-Inspired Hyperdimensional Computing”, IEEE Computer Society Annual Symposium on VLSI (**ISVLSI**), 2021.
- C26 Rahul Thapa, Bikal Lamichhane, Dongning Ma, Xun Jiao, “SpamHD: Efficient Text Spam Detection Using Brain-Inspired Hyperdimensional Computing”, IEEE Computer Society Annual Symposium on VLSI (**ISVLSI**), 2021.
- C25 Xun Jiao, Dongning Ma, Wanli Chang, Yu Jiang, “TEVoT: Timing Error Modeling of Functional Units under Dynamic Voltage and Temperature Variations”. ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2020.
- C24 Zhengxiong Luo, Feilong Zuo, Yuheng Shen, Xun Jiao, Wanli Chang, Yu Jiang, “ICS Protocol Fuzzing: Coverage Guided Packet Crack and Generation”, ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2020.
- C23 Jian Gao, Yiwen Xu, Yu Jiang, Zhe Liu, Wanli Chang, Xun Jiao and Jianguang Sun, “EM-Fuzz: Augmented Firmware Fuzzing via Memory Checking Instrumentation”, IEEE/ACM International Conference on Embedded Software (**EMSOFT**), 2020. *Best Paper Nomination*.
- C22 Jing Huang, Renfa Li, Xun Jiao, Yu Jiang and Wanli Chang, “Dynamic DAG Scheduling on Multiprocessor Systems: Reliability, Energy and Makespan”, IEEE/ACM International Conference on Embedded Software (**EMSOFT**), 2010.
- C21 Dongning Ma, Xun Jiao, “AxBy: Approximate Computation Bypass for Data-Intensive Applications”, Euromicro Conference on Digital System Design (**DSD**), *Outstanding Paper Award*.

- C20 Xiaotian Dai, Shuai Zhao, Yu Jiang, Xun Jiao, X. Sharon Hu and Wanli Chang, “Fixed-Priority Scheduling and Controller Co-Design for Time-Sensitive Networks”, International Conference On Computer Aided Design (**ICCAD**), 2020
- C19 Dongning Ma, Xunzhao Yin, Michael Niemier, X. Sharon Hu, Xun Jiao, “AxR-NN: Approximate Computation Reuse for Energy-Efficient Convolutional Neural Networks”, ACM Great Lakes Symposium on VLSI (**GLSVLSI**), Beijing, China, 2020.
- C18 Dongning Ma, Xun Jiao, “A Machine Learning-based Error Model of Voltage-Scaled Circuits”, IEEE/IFIP International Conference on Dependable Systems and Networks (**DSN**), 2020.
- C17 Dongning Ma, Xun Jiao, “An Input-aware Learning-based Error Model of Voltage-Scaled Functional Units”, IEEE Workshop on Silicon Errors in Logic – System Effects (**SELSE**), 2020. **Best Paper Award**.
- C16 Zhengxiong Luo, Feilong Zuo, Yu Jiang, Jian Gao, Xun Jiao, Jiaguang Sun, “Polar: Function Code Aware Fuzz Testing of ICS Protocol”, IEEE/ACM International Conference on Embedded Software (**EMSOFT**), 2019. **Best Paper Nomination**.
- C15 Dongning Ma, Siyu Shen, Xun Jiao, “Work-in-Progress: DeVos: A Learning-based Delay Model of Voltage-Scaled Circuits”, International Conference on Hardware/Software Codesign and System Synthesis (**CODES+ISSS**), 2019.
- C14 Dongning Ma, Xun Jiao, “Detecting and Bypassing Trivial Computations in Convolutional Neural Networks”, IEEE/ACM International Symposium on Nanoscale Architectures (**NANOARCH**), 2019
- C13 Heyuan Shi, Runzhe Wang, Ying Fu, Mingzhe Wang, Xiaohai Shi, Xun Jiao, Houbing Song, Yu Jiang, Jiaguang Sun, “Industry Practice of Coverage-guided Enterprise Linux Kernel Fuzzing”, ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (**ESEC/FSE**), 2019
- C12 Yu Jiang, Mingzhe Wang, Xun Jiao, Houbing Song, Hui Kong, Rui Wang, Yongxin Liu, Jian Wang, Jiaguang Sun, “Uncertainty Theory Based Reliability-Centric Cyber-Physical System Design”, Proc. IEEE International Conference on Cyber Physical and Social Computing (**CPSCom**), 2019. **Best Paper Award**.
- C11 Yuanliang Chen, Yu Jiang, Fuchen Ma, Jie Liang, Mingzhe Wang, Chijin Zhou, Xun Jiao, Zuo Su, “EnFuzz: Ensemble Fuzzing with Seed Synchronization among Diverse Fuzzers”, Proc. USENIX Security Symposium (**USENIX Security**), 2019.
- C10 Dongning Ma, Xun Jiao, “Energy Efficient GPU Applications Through Computation Skip”, Proc. IEEE International Conference on Embedded Software and Systems (**ICCESS**), 2019.
- C9 Mingzhe Wang, Jie Liang, Yuanliang Chen, Yu Jiang, Xun Jiao, Han Liu, Xibin Zhao, Jiaguang Sun, “SAFL: increasing and accelerating testing coverage with symbolic execution and guided fuzzing”, Proc. International Conference on Software Engineering (**ICSE**), 2018.
- C8 Xun Jiao, Vahideh Akhlaghi, Yu Jiang, and Rajesh K. Gupta, “Energy-Efficient Neural Networks using Approximate Computation Reuse”, Proc. IEEE/ACM Design, Automation, and Test in Europe (**DATE**), 2018.
- C7 Xun Jiao, Mulong Luo, Jeng-Hau Lin, and Rajesh K. Gupta, “An Assessment of Vulnerability of Hardware Neural Networks to Dynamic Voltage and Temperature Variations”, Proc. IEEE/ACM International Conference on Computer-Aided Design (**ICCAD**), 2017.
- C6 Xun Jiao, Yu Jiang, Abbas Rahimi, and Rajesh K. Gupta, “SLoT: A Supervised Learning Model to Predict Dynamic Timing Errors of Functional Units”, Proc. IEEE/ACM Design, Automation, and Test in Europe (**DATE**), 2017.
- C5 Xun Jiao, Vincent Camus, Mattia Cacciotti, Yu Jiang, Christian Enz, and Rajesh K. Gupta, “Combining Structural and Timing Error in Overclocked Inexact Speculative Adders”, Proc. IEEE/ACM Design, Automation, and Test in Europe (**DATE**), 2017.

- C4 Xun Jiao, Yu Jiang, Abbas Rahimi, and Rajesh K. Gupta, “WILD: A Workload-Based Learning Model to Predict Dynamic Delay of Functional Units”, Proc. IEEE International Conference on Computer Design (**ICCD**), 2016.
- C3 Xun Jiao, Abbas Rahimi, Balakrishnan Narayanaswamy, Hamed Fatemi, Jose Pineda de Gyvez, and Rajesh K. Gupta, “Supervised Learning Based Model for Predicting Variability-induced Timing Errors”, Proc. IEEE International NEW Circuits And Systems conference (**NEWCAS**), 2015.
- C2 Yu Jiang, Hehua Zhang, Xun Jiao, Xiaoyu Song, William N. N. Hung, Ming Gu, Jianguang Sun, “Uncertain Model and Algorithm for Hardware/Software Partitioning”, Proc. IEEE Computer Society Annual Symposium on VLSI (**ISVLSI**), 2012.
- C1 Hehua Zhang, Yu Jiang, Xun Jiao, Xiaoyu Song, William N. N. Hung, Ming Gu, “Reliability Analysis of PLC Systems by Bayesian Network”, Proc. International Conference on Software Security and Reliability (**SERE**) 2012.

Research Grants

Principal Investigator (PI): Collaborative Research: Machine Learning-assisted Modeling and Design of Approximate Computing with Generalizability and Interpretability
National Science Foundation (NSF) \$400K 2022-2025

Co-Principal Investigator (co-PI): CAS-Climate: CDS&E: Facilitating Sustainable and Fair Transformation of GSI through AI
National Science Foundation (NSF) \$500K 2022-2025

Principal Investigator (PI): Collaborative Research: PPOSS: Planning: S3-IoT: Design and Deployment of Scalable, Secure, and Smart Mission-Critical IoT Systems
National Science Foundation (NSF) \$50K 2020-2022

Principal Investigator (PI): Machine Learning-based RF Signal Detection and Classification
L3Harris Technologies \$180K 2020-2021

Invited Talks

- 2022, Meta Platforms: “Robust Computing Against Uncertain Operating Conditions and Data Workload”
- 2022, Tsinghua University: “Robust Computing Against Uncertain Operating Conditions and Data Workload”
- 2021, UC San Diego: “Adversarial Behavior of HDC and Applications of HDC in Drug Discovery and Anomaly Detection”
- 2021, Temple University: “Towards Robust Computing Against Uncertain Operating Conditions and Adversarial Data: from Hardware to AI”
- **2020, U.S. Congressional House Energy and Commerce Committee: “Predictive Analysis of Blockchain-based COVID-19 Contact Tracing”**
- 2019, DAC DACPS Workshop, Las Vegas: “Approximate Computing for the Internet of Things: from Circuits to Applications”
- 2018, SUNY Binghamton: “Improved Timing Error Resilience of Computing System using Cross-layer Optimizations ”
- 2018, Villanova University: “Improved Timing Error Resilience of Computing System using Cross-layer Optimizations ”
- 2018, Rochester Institute of Technology: “Improved Timing Error Resilience of Computing System using Cross-layer Optimizations ”

- 2018, University of Kansas: “Improved Timing Error Resilience of Computing System using Cross-layer Optimizations ”

PROFESSIONAL SERVICES

Funding Agency

- National Science Foundation (NSF) Panelist (2021)
- Department of Energy (DoE) Reviewer (2022)

Editorial Board

- Associate Editor: IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**) (2018 - present)
- Associate Editor: ACM SIGDA Newsletter ”What is Column” (2019 - present)
- Lead Guest editor: Special issue on “Brain-Inspired Hyperdimensional Computing: Algorithms, Models, and Architectures” on Frontiers in Neuroscience - Neuromorphic Engineering (2021 - 2022)
- Guest Editor: Special issue on Dependable Cyber Physical Systems in the Journal of Systems Architecture (JSA) (2019)

Conference Committee

- [**DAC 2020 - 2022, track co-chair**] IEEE/ACM Design Automation Conference
- [**ICCAD 2022**] ACM/IEEE International Conference on Computer-Aided Design
- [**ASP-DAC 2022**] ACM/IEEE Asia-Pacific Design Automation Conference
- [**ISVLSI 2022**] IEEE Computer Society Annual Symposium on VLSI
- [**GLSVLSI 2020**] ACM Great Lakes Symposium on VLSI
- [**LCTES 2019**] International Conference on Languages Compilers, Tools and Theory of Embedded Systems
- [**ICESS 2019-2021**] IEEE International Conference on Embedded Software and Systems
- [**COINS 2019**] IEEE International Conference on Omni-layer Intelligent systems

Technical Reviewer

- IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS)
- IEEE Design & Test
- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)
- IEEE Transactions on VLSI Systems (TVLSI)
- ACM Transactions on Cyber-physical Systems (TCPS)
- Future Generation Computer Systems (FGCS)
- IET Cyber-Physical Systems: Theory & Applications
- IEEE Transactions on Industrial Informatics (TII)

Media

- 2021 Digital Engineering Magazine: [The Coming of Age of AI and Machine Learning in Design](#)
- 2020 Zippia: [Computer Scientist Trends: Experts Weigh in on What To Expect in 2020](#)
- 2020 Villanova CoE News: [ECE Faculty Lead Blockchain Project to Track Electronic Medical Records in Response to COVID-19](#)

Advised Student Research

Ph.D. Students

- Dongning Ma (Since Spring 2019)
 - DAC Richard Newton Young Fellow 2020, 2021
 - DAC Young Fellow Program Best 2-Minute Research Video Award
 - 16 publications in journals and conferences (TCAD, DAC, DATE, etc)
- Ruixuan Wang (Since Spring 2019)
 - DAC Richard Newton Young Fellow 2021
 - 3 publications in conferences (DAC, DATE, RTAS)
- Sizhe Zhang (Since Spring 2019)
 - DAC Richard Newton Young Fellow 2021
 - 3 publications in conferences (ICCAD, ASAP, DATE)

M.S. Students

- Mauro Sanchirico III (2019 - 2021)
 - **College of Engineering Outstanding Graduate Student Award** (only 1 given annually)
 - Now a Research Manager at Lockheed Martin
 - 1 publication in journal (IEEE Trans. on Neural Networks and Learning Systems)
- Lauren Scalice (Since Summer 2021)
- Sean Lane (Since Summer 2021)
- Bikal Lamichhane (Since Fall 2019)
 - Graduate Summer Research Fellowship at Villanova Computing Science Department
 - 2 publications at conference (ISVLSI)
 - Now at Paypal

Undergraduate Students

- Rahul Thapa (Since Fall 2019)
 - 3 publications in conferences (DATE, ISVLSI)
 - Now at Stanford Medical
- Kennedy Cornish (Since Spring 2021)
 - Clare Boothe Luce Engineering Scholars Program (Support Female STEM students)
- Raymond Ogunjimi (Summer 2019)
 - Hoffman Trailblazer Summer Research Fellowship (Support First-Generation College students)
 - Now at Qualcomm
- Xingjian Wang (Summer 2019)
 - Villanova Undergraduate Research Fellows (VURF)
 - 1 publication in conference (DATE)
 - Now a M.S. student at U Penn
- Duncan Smith (Summer 2021)
 - Villanova Undergraduate Research Fellows (VURF)

- Oluwasola Dugbo (Spring 2021)
 - Villanova Match Research Program for First Year Students
- Andrew Osburn (Spring 2020)
 - Villanova Match Research Program for First Year Students
- Shenda Huang (Spring 2019)
 - Villanova Match Research Program for First Year Students
- Elyse Spinelli, Kevin Zachary, Kefan Han, Hongbo Sun (Capstone Team for 2020-2021)
 - **Brian Anderson Award:** Exploring Hyperdimensional Computing-based Artificial Intelligence
- Ian Birn, Caroline Maclaren, Benjamin Lucas, Andrew Osburn (Summer 2020)
 - L3Harris Innovation Project: NeuroLanguage: Brain-Inspired Computing for Language Recognition)
 - All four students interned at L3Harris afterwards
- Siyu Shen (2018 - 2019)
 - B.S. at Boston University, M.S. at Brown University
 - 1 publication in conference (Codes + ISSS)
 - Now data scientist at Visa Inc.
- Hongbo Sun (2020 - 2021)
 - Now M.S. student at CMU
 - Intern at Meta