

# DONGNING MA

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Department of Electrical and Computer Engineering, Villanova University  
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## EDUCATION

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### Villanova University, PA

Ph.D. Candidate in Computer Engineering

Department of Electrical and Computer Engineering

*January 2019 - May 2025 (Expected)*

Advisor: Dr. Xun Jiao

### University of Science and Technology Beijing, China

Bachelor of Engineering in Automation

School of Advanced Engineering

*September 2014 - June 2018*

Advisor: Dr. Jiyuan Dong

## SHORT BIO

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**Dongning Ma** is currently a Ph.D. candidate in Computer Engineering from Department of Electrical and Computer Engineering at Villanova University under the supervision of Prof. Xun Jiao. He obtained his Bachelor of Engineering degree from University of Science and Technology Beijing (USTB). He has published more than 20 papers in top-tier venues including ASPLOS, SIGIR, DAC, TCAD, with best paper awards/nominations from DSD/SEAA, DATE, and SELSE. He is also an A. Richard Newton Young Student Fellow at DAC and a finalist (7th/2434 teams) at 2021 China National Artificial Intelligence Challenge.

## RESEARCH FOCUS

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**One-liner:** Dongning Ma explores the balance of **efficiency**, **robustness** and **performance** of artificial intelligence and machine learning throughout cross-layer and systematic approaches.

**Keywords:** Approximate Computing, Hyperdimensional Computing, Silent Data Corruption, Fault Injection

## LIST OF PUBLICATIONS

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### Journals

6. Dongning Ma, Meltem Izzetoglu, Roe Holtzer, and Xun Jiao. "Deep Learning Based Walking Tasks Classification in Older Adults using fNIRS". IEEE Transactions on Neural Systems and Rehabilitation Engineering (**TNSRE**), 2023.
5. Dongning Ma, Tajana Šimunić Rosing, and Xun Jiao. "Testing and Enhancing Adversarial Robustness of Hyperdimensional Computing". IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2023.
4. Ruixuan Wang, Dongning Ma, and Xun Jiao. "EnHDC: Ensemble Learning for Brain-Inspired Hyperdimensional Computing." IEEE Embedded Systems Letters (**ESL**), 2022.
3. Dongning Ma, Xinqiao Zhang, Ke Huang, Yu Jiang, Wanli Chang, and 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.
2. Xun Jiao, Dongning Ma, Wanli Chang, and 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.
1. Dongning Ma, and Xun Jiao, "WoMA: An Input-Based Learning Model to Predict Dynamic Workload of Embedded Applications." IEEE Embedded Systems Letters (**ESL**), 2019.

## Conferences

22. Dongning Ma, Xun Jiao, “Memory-Efficient Deep Recommender Systems using Approximate Rotary Compositional Embedding”, The 47th International ACM SIGIR Conference on Research and Development in Information Retrieval (**SIGIR**), Washington D.C., 2024.
21. Dongning Ma, Fred Lin, Alban Desmaison, Joel Coburn, Daniel Moore, Sriram Sankar, Xun Jiao, “Dr. DNA: Combating Silent Data Corruptions in Deep Learning using Distribution of Neuron Activations”, the ACM International Conference on Architectural Support for Programming Languages and Operating Systems (**ASPLOS**), San Diego, California, 2024.
20. Dongning Ma, Cong Hao, Xun Jiao, “Hyperdimensional Computing vs. Neural Networks: Comparing Architecture and Learning Process”, The 25th International Symposium on Quality Electronic Design (**ISQED**), San Francisco, California, 2024
19. Dongning Ma, Pengfei Zhao, Xun Jiao, “PerfHD: Efficient ViT Architecture Performance Ranking using Hyperdimensional Computing”, the Fourth Workshop on Neural Architecture Search, Third Lightweight NAS Challenge at 2023 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (**CVPRW-NAS**), Vancouver, Canada, 2023
18. Sizhe Zhang, Dongning Ma, Song Bian, Lei Yang, Xun Jiao, “On Hyperdimensional Computing-Based Federated Learning: A Case Study”, 2023 International Joint Conference on Neural Networks (**IJCNN**), Queensland, Australia, 2023
17. Dongning Ma, Sizhe Zhang, Xun Jiao, “Robust Hyperdimensional Computing Against Cyber Attacks and Hardware Errors: A Survey”, 28th Asia and South Pacific Design Automation Conference (**ASP-DAC**), Tokyo, Japan, 2023
16. Dongning Ma, Rahul Thapa, Xun Jiao, “MoleHD: Drug Discovery using Brain-Inspired Hyperdimensional Computing”, 2022 IEEE International Conference on Bioinformatics and Biomedicine (**BIBM**), Las Vegas, Nevada, 2022
15. Hussam Amrouch, Mohsen Imani, Xun Jiao, Yiannis Aloimonos, Cornelia Fermuller, Dehao Yuan, Dongning Ma, Hamza Errahmouni, Paul R. Genssler, Peter Sutor. “Brain-Inspired Hyperdimensional Computing for Ultra-Efficient Edge AI”, International Conference on Hardware/Software Codesign and System Synthesis (**CODES+ISSS**), Shanghai, China, 2022
14. Dongning Ma, Xue Qin, Xun Jiao, “AxBy-ViT: Reconfigurable Approximate Computation Bypass for Vision Transformers”, 23rd International Symposium on Quality Electronic Design (**ISQED**), Virtual, California, 2022
13. Sizhe Zhang, Ruixuan Wang, Dongning Ma, Jeff Jun Zhang, Xunzhao Yin, Xun Jiao, “Energy-Efficient Brain-Inspired Hyperdimensional Computing Using Voltage Scaling”. 2022 Design, Automation and Test in Europe Conference (**DATE**), Antwerp, Belgium, 2022 (**Best Paper Award Candidate**)
12. Rahul Thapa, Dongning Ma, Xun Jiao, “HDXplore: Automated Differential Testing of Brain-Inspired Hyperdimensional Computing”. 2021 IEEE Computer Society Annual Symposium on VLSI (**ISVLSI**), Tampa, FL, 2021.
11. Rahul Thapa, Bikal Lamichhane, Dongning Ma, Xun Jiao, “SpamHD: Efficient Text Spam Detection Using Brain-Inspired Hyperdimensional Computing”. 2021 IEEE Computer Society Annual Symposium on VLSI (**ISVLSI**), Tampa, FL, 2021.
10. Dongning Ma, Jianmin Guo, Yu Jiang, Xun Jiao, “HDTest: Differential Fuzz Testing of Brain-Inspired Hyperdimensional Computing”. 58th 2021 ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2021.

9. Dongning Ma, Rahul Thapa, Xingjian Wang, Cong Hao and Xun Jiao, "Workload-Aware Approximate Computing Configuration". 2021 Design, Automation & Test in Europe Conference & Exhibition (**DATE**), Grenoble, France, 2021.
8. Dongning Ma, Xun Jiao, "A Machine Learning-based Error Model of Voltage-Scaled Circuits". 50th IEEE/IFIP International Conference on Dependable Systems and Networks (**DSN**), Valencia, Spain, 2020.
7. Dongning Ma, Xun Jiao, "AxBy: Approximate Computation Bypass for Data-Intensive Applications". 2020 Euromicro Conference on Digital System Design (**Euromicro DSD**), Portorož, Slovenia, 2020. (**Out-standing Paper Award**)
6. Dongning Ma, Xunzhao Yin, Michael Niemier, X. Sharon Hu, Xun Jiao, "AxR-NN: Approximate Computation Reuse for Energy-Efficient Convolutional Neural Networks". 30th ACM Great Lakes Symposium on VLSI (**GLSVLSI**), Beijing, China, 2020.
5. Xun Jiao, Dongning Ma, Wanli Chang, Yu Jiang, "TEVoT: Timing Error Modeling of Functional Units under Dynamic Voltage and Temperature Variations". 57th 2019 ACM/EDAC/IEEE Design Automation Conference (**DAC**), San Francisco, CA, 2020.
4. Dongning Ma, Xun Jiao, "An Input-aware Learning-based Error Model of Voltage-Scaled Functional Units". The 16th IEEE Workshop on Silicon Errors in Logic -- System Effects (**SELSE**), Stanford, CA, 2020. (**Best Paper Award**)
3. 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**), New York, USA, 2019.
2. Dongning Ma, Xun Jiao, "Detecting and Bypassing Trivial Computations in Convolutional Neural Networks", IEEE/ACM International Symposium on Nanoscale Architectures (**NANOARCH**), 2019
1. Dongning Ma, Xun Jiao, "Energy Efficient GPU Applications Through Computation Skip". in Proc. IEEE International Conference on Embedded Software and Systems (**ICESS**), Las Vegas, USA, 2019.

## Honors

- The 47th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2024) NSF Student Travel Award and Volunteer
- 2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) Student Travel Award (NSF and TCCLS) and Volunteer
- **2021 (China) National Artificial Intelligence Challenge Finalist (7th / 2434 Teams)**
- 2021 International Green and Sustainable Computing Conference (IGSC 2021) - Student Support Grant (NSF)
- 2021 ACM/EDAC/IEEE Design Automation Conference (DAC 2021) Young Fellow Program with **Best 2-Minute Research Video** Award
- IEEE Computer Society Annual Symposium on VLSI (ISVLSI 2021) - Student Travel Grant (NSF)
- 2020 ACM/EDAC/IEEE Design Automation Conference (DAC 2020) A. Richard Newton Young Student Fellow
- International Green and Sustainable Computing Conference (IGSC 2020) - Student Support Grant (NSF)
- IEEE VLSI Test Symposium 2020 (VTS'20) - Student Activities Program (NSF)
- International Green and Sustainable Computing Conference (IGSC 2019) - Poster Presentation - Student Travel Grant (NSF)

- Embedded System Week 2019 (ESWEEK'19) ACM SIGBED Student Research Competition - Student Travel Grant (Microsoft)

## OTHER SERVICES

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### Teaching

Teaching Assistant at Villanova University:

- EGR 1261 - Engineering Programming and Application (Spring 2023)
- EGR 1620 - Engineering Programming and Application (Spring 2021)
- EGR 1200 - Engineering Interdisciplinary Project I (Fall 2020, Fall 2021)
- ECE 1620 - Engineering Programming and Application (Spring 2020, Spring 2021, Spring 2022)
- ECE 2045 - Fundamentals of Computer Engineering II Lab (Spring 2020)
- ECE 5400 - Applied Machine Learning (Fall 2019, Spring 2022, Spring 2023)
- ECE 5450 - Microcontrollers and Applications (Fall 2019, Fall 2020, Fall 2021, Fall 2023, Fall 2024)
- ECE 2431 - Embedded Systems I Lab (Spring 2019)

### Professional Services

- Reviewer for: IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), ACM Transactions on Knowledge Discovery from Data (TKDD), The Journal of Supercomputing, IEEE Transactions on Very Large Scale Integration Systems (TVLSI), IEEE Journal of the Electron Devices Society (J-EDS), Discover Internet of Things
- Program Committee of the Euromicro Conference on Digital System Design (DSD) 2022 - Special Session on Design of Cyber-Physical Systems (DCPS)

### Memberships

- Institute of Electrical and Electronics Engineers (IEEE), Graduate Student Member
- Institute of Electrical and Electronics Engineers (IEEE), Computational Intelligence Society, Graduate Student Member
- Association for Computing Machinery (ACM), Student Member
- Association for the Advancement of Artificial Intelligence, Member

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