

# JIAN MENG

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## EDUCATION

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**Arizona State University**

*August 2019 - Present*

**Doctor of Philosophy**

Overall GPA: 3.83/4.0

School of Electrical, Computer and Energy Engineering

**Portland State University**

*September 2016 - June 2019*

**Bachelor of Science** (Received June 2019) Overall GPA: 3.61/4.0; Graduate level GPA: 3.75/4.0

Department of Electrical and Computer Engineering

## RESEARCH EXPERIENCE

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**Seo Lab, Arizona State University**

*August 2019 - Present*

*Advisor: Jae-sun Seo*

- Design a novel dynamic sparsification algorithm for contrastive self-supervised learning. As one of the first studies in this area, the research analyzes different feature sparsification strategies with rigorous experiments. The proposed algorithm skips the uninformative features during contrastive learning without hurting the trainability of the networks.
- Collaborated with Georgia Institute of Technology, focusing on the robustness enhancement of the DNN model with the given analog non-ideality (e.g., thermal variations). The research improves the robust RRAM IMC-based DNN inference where >30% CIFAR-10 accuracy and >60% TinyImageNet accuracy is recovered against temperature variations.
- Designing the hardware-aware algorithm for 28nm DNN training accelerator. The designed algorithm supports sparse features, structured weight sparsity, and backward gradient skipping. Furthermore, the proposed algorithm also employs 8-bit floating-point operations.
- Collaborated with ARM research team, investigated the compact MobileNet model compression along with the on-chip FPGA CNN accelerator design. The research compressed the MobileNets model down to 4-bit along with over 95% element sparsity. The proposed CNN accelerator design achieved 3.01 TOPS throughput with 0.37 ms latency on ImageNet-224 datasets.
- Designed a system-level architecture combining the low precision weight and activation, structured pruning, and RRAM crossbar-based accelerator design. The proposed software-hardware co-design achieved up to  $7\times/6\times$  energy/area reduction with ResNet/VGG models for CIFAR-10 dataset with minimum accuracy degradation.

**Teuscher Lab, Portland State University**

*January 2018 - June 2019*

*Advisor: Christof Teuscher*

- Targeting for a novel neuromorphic computing algorithms, architectures for energy-efficient mobile radiation detection platforms. Employed deep neural network and Unscented Kalman Filter for source localization and radiation pattern recognition. The research project was funded by Defense Threat Reduction Agency (DTRA).

## WORKING EXPERIENCE

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**Teaching Assistant of Neuromorphic Computing Hardware Design**

Jan. 2022 - May 2022

*Arizona State University*

**System Engineer: Kilby Labs**  
*Kilby Lab*

June 2021 - August 2021  
*Texas Instrument*

- Design a Pytorch-based tool for modeling low-precision deep neural networks to the in-memory-computing-based accelerator. Given the pre-trained DNN model, the designed tool can automatically generate the C code for hardware deployment and automatic resource allocation.

**Teaching Assistant & Undergraduate Tutor**  
*ECE Department*

September 2018 - June 2019  
*Portland State University*

- ECE 221/2/3 (Circuit Analysis) and ECE 510 (Mathematical Foundation of Machine Learning)

## SELECTED PUBLICATIONS

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### Conference Publications

[**DATE'22**] Fan Zhang, Li Yang, **Jian Meng**, Jae-sun Seo, Yu Cao and Deliang Fan, XST: A Crossbar Column-wise Sparse Training for Efficient Continual Learning, IEEE Design, Automation & Test in Europe (DATE) [**Best IP (Interactive Presentations) Paper Award**]

- [**CVPR'22**] **Jian Meng**, Li Yang, Jinwoo Shin, Deliang Fan, and Jae-sun Seo, "Contrastive Dual Gating: Learning Sparse Features With Contrastive Learning," Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022.

[**IRPS'22**] **Jian Meng**, Injune Yeo, Wonbo Shim, Li Yang, Deliang Fan, Shimeng Yu, and Jae-sun Seo "Sparse and Robust RRAM-based Efficient In-memory Computing for DNN Inference" (IRPS), 2022.

[**FPT'21**] Han-sok Suh, **Jian Meng**, Ty Nguyen, Shreyas K. Venkataramanaiah, Vijay Kumar, Yu Cao, and Jae-sun Seo, Algorithm-Hardware Co-Optimization for Energy-Efficient Drone Detection on Resource-Constrained FPGA, IEEE International Conference on Field-Programmable Technology (FPT), 2021.

[**FPL'21**] **Jian Meng**, Shreyas Kolala Venkataramanaiah, Chuteng Zhou, Patrick Hansen, Paul Whatmough and Jae-sun Seo, "FixyFPGA: Efficient FPGA Accelerator for Deep Neural Networks with High Element-Wise Sparsity and without External Memory Access", International Conference on Field Programmable Logic and Applications (FPL), 2021.

[**ISCAS'21**] **Jian Meng**, Li Yang, Xiaochen Peng, Shimeng Yu, Deliang Fan, Jae-sun Seo, "Structured Pruning of RRAM Crossbars for Efficient In-Memory Computing Acceleration of Deep Neural Networks", IEEE International Symposium on Circuits and Systems (ISCAS), 2021.

[**IRPS'21**] Wonbo Shim, **Jian Meng**, Xiaochen Peng, Jae-sun Seo, and Shimeng Yu, "Impact of Multilevel Retention Characteristics on RRAM based DNN Inference Engine" (IRPS), 2021

[**DATE'21**] Jyotishman Saikia, Shihui Yin, Bo Zhang, **Jian Meng**, Mingoo Seok and Jae-sun Seo, "Modeling and Optimization of SRAM-based In-Memory Computing Hardware Design," IEEE Design, Automation, and Test in Europe (DATE), 2021.

[**INTER\_SPEECH'20**] Deepak Kadetotad, **Jian Meng**, Visar Berisha, Chaitali Chakrabarti, and Jae-sun Seo, Compressing LSTM Networks with Hierarchical Coarse-Grain Sparsity, INTER\_SPEECH.

### Journal Publications

[**IEEE-MICRO**] **Jian Meng**, Wonbo Shim, Li Yang, Deliang Fan, Shimeng Yu, and Jae-sun Seo, Temperature-Resilient RRAM-based In-Memory Computing for DNN Inference, IEEE Micro, 2021 (accepted) (**Presented in IBM Research AI Hardware Forum**)

[**IEEE JETCAS**] Arnab Neelim Mazumder, **Jian Meng**, Hasib-Al Rashid, Utteja Kallakuri, Xin Zhang, Jae-sun Seo, Tinoosh Mohsenin, "A Survey on the Optimization of Neural Network Accelerators for Micro-AI On-Device Inference", IEEE JETCAS, 2021 (accepted)

[**IEEE TCAS-II**] **Jian Meng**, Li Yang, Xiaochen Peng, Shimeng Yu, Deliang Fan, Jae-sun Seo, "Structured Pruning of RRAM Crossbars for Efficient In-Memory Computing Acceleration of Deep Neural Networks". (accepted for Special Issue on 2021 ISCAS)