

CONTACT INFORMATION	Po-An Tsai 2 Technology Park Dr, Westford, MA 01886	poant@nvidia.com https://research.nvidia.com/person/po-an-tsai
RESEARCH INTERESTS	Computer systems and architecture; machine learning and tensor algebra accelerator architectures.	
EDUCATION	Ph.D. in Computer Science , June 2019 <i>Massachusetts Institute of Technology</i> <ul style="list-style-type: none"> Advisor: Professor Daniel Sanchez Thesis: Redesigning the Memory Hierarchy to Exploit Static and Dynamic Application Information S.M. in Computer Science , June 2015 <i>Massachusetts Institute of Technology</i> B.S. in Electrical Engineering , June 2012 <i>National Taiwan University (NTU), Taiwan</i>	
HONORS AND AWARDS	Best Paper Award Nominee , ISCA-51, 2024 Distinguished Artifact Award , MICRO-55, 2022 IEEE Micro Top Picks Award , 2021 Best Paper Award Nominee , HPCA-21, 2015 Best Poster Award , MIT Industry-Academia Partnership Workshop, 2014 Jacobs Presidential Fellowship , MIT, 2013 Valedictorian , NTUEE, 2012 Presidential Award , NTU, 2010, 2011, 2012 Second Prize , NTUEE Undergraduate Research Award, 2012 Star Futures Award , Altera International FPGA Design Contest, 2011	
WORK EXPERIENCE	Sr. Research Scientist , July 2022 – Current Research Scientist , July 2019 – June 2022 <i>Architecture Research Group, NVIDIA</i> Research Assistant , September 2013 – May 2019 <i>Computation Structures Group, MIT</i> Software Engineering Intern , Summer 2015 <i>Distributed Resource Management Team, VMware</i>	
PUBLICATIONS	Mind the Gap: Attainable Data Movement and Operational Intensity Bounds for Tensor Algorithms Qijing (Jenny) Huang, Po-An Tsai , Joel S Emer, Angshuman Parashar The 51st Annual International Symposium on Computer Architecture (ISCA-51), June 2024. Best Paper Award Nominee. Abstracting Sparse DNN Acceleration via Structured Sparse Tensor Decomposition Geonhwa Jeong, Po-An Tsai , Abhimanyu R. Bambhaniya, Stephen W. Keckler, Tushar Krishna arXiv preprint arXiv:2403.07953, March 2024. Symphony: Orchestrating Sparse and Dense Tensors with Hierarchical Heterogeneous Processing Michael Pellauer, Jason Clemons, Vignesh Balaji, Neal Crago, Aamer Jaleel, Donghyuk Lee, Mike O'Connor, Angshuman Parashar, Sean Treichler, Po-An Tsai , Stephen W. Keckler, Joel S. Emer ACM Transactions on Computer Systems, Vol. 41, December 2023. RM-STC: Row-Merge Dataflow Inspired GPU Sparse Tensor Core for Energy-Efficient Sparse Acceleration Guyue Huang, Zhengyang Wang, Po-An Tsai , Chen Zhang, Yufei Ding, Yuan Xie The 56th IEEE/ACM International Symposium on Microarchitecture (MICRO-56), October 2023. HighLight: Efficient and Flexible DNN Acceleration with Hierarchical Structured Sparsity Yannan Nellie Wu, Po-An Tsai , Saurav Muralidharan, Angshuman Parashar, Vivienne Sze, Joel S. Emer The 56th IEEE/ACM International Symposium on Microarchitecture (MICRO-56), October 2023. Accelerating Sparse Data Orchestration via Dynamic Reflexive Tiling Toluwanimi O. Odemuyiwa, Hadi Asghari-Moghaddam, Michael Pellauer, Kartik Hegde, Po-An Tsai , Neal C. Crago, Aamer Jaleel, John D. Owens, Edgar Solomonik, Joel S. Emer, Christopher W. Fletcher The 28th ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS-28), March 2023.	

Demystifying Map Space Exploration for NPUs

Sheng-Chun Kao, Angshuman Parashar, **Po-An Tsai**, Tushar Krishna

2022 IEEE International Symposium on Workload Characterization (IISWC), November 2022.

Sparseloop: An Analytical Approach To Sparse Tensor Accelerator Modeling

Yannan Nellie Wu, **Po-An Tsai**, Angshuman Parashar, Vivienne Sze, Joel S. Emer

The 55th IEEE/ACM International Symposium on Microarchitecture (MICRO-55), October 2022.

Distinguished Artifact Award.

SIMD²: A Generalized Matrix Instruction Set for Accelerating Tensor Computation beyond GEMM

Yunan Zhang, **Po-An Tsai**, Hung-Wei Tseng

The 49th Annual International Symposium on Computer Architecture (ISCA-49), June 2022.

Ruby: Improving Hardware Efficiency for Tensor Algebra Accelerators Through Imperfect Factorization

Mark Horeni, Pooria Taheri, **Po-An Tsai**, Angshuman Parashar, Joel S. Emer, Siddharth Joshi

IEEE International Symposium on Performance Analysis of Systems and Software, May 2022.

Union: A Unified HW-SW Co-Design Ecosystem in MLIR for Evaluating Tensor Operations on Spatial Accelerators

Geonhwa Jeong, Gokcen Kestor, Prasanth Chatarasi, Angshuman Parashar, **Po-An Tsai**, Sivasankaran Rajamanickam, Roberto Gioiosa, and Tushar Krishna

The 30th International Conference on Parallel Architectures and Compilation Techniques (PACT-30), September 2021.

Leaking Secrets through Compressed Caches

Po-An Tsai, Andres Sanchez, Christopher W. Fletcher, and Daniel Sanchez.

IEEE Micro's Top Picks from the Computer Architecture Conferences, May/June 2021.

Mind Mappings: Enabling Efficient Algorithm-Accelerator Mapping Space Search

Kartik Hegde, **Po-An Tsai**, Sitao Huang, Vikas Chandram, Angshuman Parashar, and Christopher W. Fletcher.

The 25th International Conference on Architectural Support for Programming Languages and Operating Systems, (ASPLOS-26), April 2021.

Sparseloop: An Analytical, Energy-Focused Design Space Exploration Methodology for Sparse Tensor Accelerators

Yannan Nellie Wu, **Po-An Tsai**, Angshuman Parashar, Vivienne Sze, Joel S. Emer

IEEE International Symposium on Performance Analysis of Systems and Software, March 2021.

Hardware Abstractions for Targeting EDDO Architectures with the Polyhedral Model

Angshuman Parashar, Prasanth Chatarasi, and **Po-An Tsai**.

International Workshop on Polyhedral Compilation Techniques (IMPACT), January 2021.

Safecracker: Leaking Secrets through Compressed Caches

Po-An Tsai, Andres Sanchez, Christopher W. Fletcher, and Daniel Sanchez.

The 25th International Conference on Architectural Support for Programming Languages and Operating Systems, (ASPLOS-25), March 2020.

Compress Objects, Not Cache Lines: An Object-Based Compressed Memory Hierarchy

Po-An Tsai and Daniel Sanchez.

The 24th International Conference on Architectural Support for Programming Languages and Operating Systems, (ASPLOS-24), April 2019.

Rethinking the Memory Hierarchy for Modern Languages

Po-An Tsai, Yee Ling Gan, and Daniel Sanchez.

The 51st International Symposium on Microarchitecture (MICRO-51), October 2018.

Adaptive Scheduling for Systems with Asymmetric Memory Hierarchies

Po-An Tsai, Changping Chen, and Daniel Sanchez.

The 51st International Symposium on Microarchitecture (MICRO-51), October 2018.

KPart: A Hybrid Cache Partitioning-Sharing Technique for Commodity Multicores

Nosayba El-Sayed, Anurag Mukkara, **Po-An Tsai**, Harshad Kasture, Xiaosong Ma, and Daniel Sanchez.

The 24th Intl. Symposium on High Performance Computer Architecture (HPCA-24), February 2018.

Nexus: A New Approach to Replication in Distributed Shared Caches

Po-An Tsai, Nathan Beckmann, and Daniel Sanchez.

The 26th International Conference on Parallel Architectures and Compilation Techniques (PACT-26), September 2017.

Jenga: Software-Defined Cache Hierarchies

Po-An Tsai, Nathan Beckmann, and Daniel Sanchez.

The 44th International Symposium on Computer Architecture (ISCA-44), June 2017.

Scaling Distributed Cache Hierarchies with Computation and Data Co-Scheduling

Nathan Beckmann, **Po-An Tsai**, and Daniel Sanchez.

The 21st International Symposium on High Performance Computer Architecture (HPCA-21), February 2015.

Best Paper Award Nominee.

Hybrid Path-Diversity-Aware Adaptive Routing with Latency Prediction Model in Network-on-Chip Systems

Po-An Tsai, Yu-Hsin Kuo, En-Jui Chang, and An-Yeu Wu.

International Symposium on VLSI Design, Automation & Test, (VLSI-DAT), March 2013.

Path-Diversity-Aware Adaptive Routing in Network-on-Chip Systems

Yu-Hsin Kuo, **Po-An Tsai**, Hao-Ping Ho, En-Jui Chang, Hsien-Kai Hsin, and An-Yeu Wu.

The 6th International Symposium on Embedded Multicore SoCs (MCSoc), September 2012.

PATENT**Resource-Based Virtual Computing Instance Scheduling**

US Patent 15283274

Po-An Tsai, Sahan Gamage, and Rean Griffith.

Flexible Accelerator for a Tensor Workload

US Patent 17343597, 17343582 **Po-An Tsai**, Neal Crago, Angshuman Parashar, Joel Springer Emer, Stephen William Keckler

Pruning and accelerating neural networks with hierarchical fine-grained structured sparsity

US Patent 17681967

Yannan Wu, **Po-An Tsai**, Saurav Muralidharan, Joel Springer Emer

Generating sparse neural networks

US Patent 18222916

Geonhwa Jeong, **Po-An Tsai**, Jeffrey Michael Pool

SERVICE

- Program Committee Member: ISMM'20, HPCA'21, MICRO'22, DAC'24, MICRO'24
- External Review Committee Member: PACT'20, MICRO'20, MICRO'21, ASPLOS'22, ISCA'22, ISCA'23, ISCA'24
- Reviewer: ACM TACO, ACM TCAD, IEEE JSSC, IEEE CAL
- Artifact Evaluation Co-Chair: ISCA'23.
- Workshop/Tutorial Co-Chair: HPCA'21.
- Submissions Co-Chair: MICRO'17
- Organizer: Workshop on Democratizing Domain-Specific Accelerators @ MICRO'22, MICRO'23
- Organizer: Tutorial on Timeloop/Accelergy: Tools for Evaluating Deep Neural Network Accelerator Designs @ MICRO'19, ISCA'20, ISPASS'20.