

# XI HAN

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## EDUCATION

### Ph.D. in Computer Science | Stony Brook University

Aug 2019 – Dec 2025

Dept. of Computer Science, Stony Brook University, New York, United States | GPA: 3.9/4.0

### B.E. in Computer Science and Technology | Tsinghua University

Aug 2015 – Jul 2019

Dept. of Computer Science and Technology, Tsinghua University, Beijing, China | GPA: 3.25/4.0

## SKILLS

- **TL;DR.** C/C++/CUDA/Python; GPU Algorithms; Mamba; PDEs; Computer Graphics; Machine Learning.
- Expert in GPU algorithms for AI/HPC: Customized AI operators, AI model training/inference efficiency optimization. Involved techniques: PyTorch C++/CUDA extensions, GPU kernel profiling, fine-tuning, operator fusing, cache optimization, etc.
- Expert in Computer Graphics and Numerical Analysis: Neural PDE solvers, customized CUDA operators.
- Expert in languages: C/C++ (OOP, STL, Metaprogramming and Concurrency), CMake, CUDA (including PTX) and Python.
- Expert in tools: PyTorch Profiler, CUDA-GDB, Nsight Compute and NVIDIA Compute Sanitizer.
- Expert in frameworks: PyTorch and OpenGL.
- Familiar with: Linux systems and the Qt framework.
- Knows: Bash, Assembly, MATLAB, Java, Objective C/C++ and Swift.

## PUBLICATIONS

- Song-Hai Zhang, Ruilong Li, Xin Dong, Paul Rosin, Zixi Cai, **Xi Han**, Dingcheng Yang, Hao-Zhi Huang and Shi-Min Hu, “Pose2Seg: Detection Free Human Instance Segmentation”, In *Proceedings of 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019.
- **Xi Han**, Fei Hou and Hong Qin, “UGrid: An Efficient-And-Rigorous Neural Multigrid Solver for Linear PDEs”, In *Proceedings of the 41st International Conference on Machine Learning (ICML)*, 2024.
- Jingwei Zhang\*, Anh Tien Nguyen\*, **Xi Han\***, Vincent Quoc-Huy Trinh, Hong Qin, Dimitris Samaras, and Mahdi S. Hosseini, “2DMamba: Efficient State Space Model for Image Representation with Applications on Giga-Pixel Whole Slide Image Classification”, In *Proceedings of 2025 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2025. (\*: **Equal Contribution.**)
- Jingwei Zhang\*, **Xi Han\***, Hong Qin, Mahdi S. Hosseini, and Dimitris Samaras, “LBMamba: Locally Bi-directional Mamba”, *Transactions on Machine Learning Research (TMLR)*, 2025. (\*: **Equal Contribution.**) (To appear.)
- **Xi Han\***, Jingwei Zhang\*, Dimitris Samaras, Fei Hou, and Hong Qin, “GeoMaNO: Geometric Mamba Neural Operator for Partial Differential Equations”, *arXiv preprint arXiv:2505.12020*, 2025. (\*: **Equal Contribution.**) (Under Review.)

## WORK EXPERIENCE

### Research Assistant & Teaching Assistant

Aug 2019 – Dec 2025

Stony Brook University, New York, United States

- Conducted research projects on GPU algorithms, neural PDE solvers, PDE-driven foundation models (e.g., Mamba), and Computer Graphics. Research work is published in top-venue conferences, including ICML and CVPR.
- Extensive project experience on AI training/inference efficiency optimization. Involved techniques: CUDA kernel fusing, performance profiling, and PyTorch CUDA extensions.
- Hosted lectures on OpenGL programming with C++/Python, the implementation details of computer graphics applications and algorithms, and the state-of-the-art research topics on graphics and physics-based modeling.

### Research Assistant

Jan 2017 – Jul 2019

Tsinghua University, Beijing, China

- Deployed a MobileNet module on IOS platform with Apple’s CoreML framework, and delivered an IOS app for a human segmentation (in Swift and Objective C++).
- Optimized the model used in the app (increased accuracy and added key point recognition) and achieved 10x speedup in FPS.

## SELECTED PROJECTS

### 2DMamba: A Hardware-Aware 2D Selective State-Space Model with Applications in Image Processing

- **TL;DR.** 2DMamba employs a geometric-rigorous and hardware-aware 2D SSM formulation, which extends 1D Mamba into 2D while maintaining its modeling capabilities, high parallelism, and memory efficiency.
- Implements a warp-scan based 2D parallel scan routine which supports scanning prefix callbacks for global tiling. Extends 1D Mamba scanning operation into 2D while maintaining its training/inference efficiency. Compared to a naïve implementation,

achieves a throughput of 10x, while the GPU memory consumption is only 10%.

- Involved techniques: Warp shuffle and parallel scans, 2D tiling and caching, HBM access optimization, CUDA kernel and AI model profiling, and PyTorch CUDA extension encapsulation.
- Code available at <https://github.com/AtlasAnalyticsLab/2DMamba>.

#### **UGrid: An Efficient-And-Rigorous Neural Multigrid Solver for Linear PDEs**

- **TL;DR.** UGrid is a neural solver for Partial Differential Equations (PDEs) with convergence guarantee.
- Built upon the combination of the U-Net architecture and the legacy MultiGrid PDE solver, provides users with high speed (up to 20x speedup against legacy solvers), high precision (relative residual as low as  $1e-5$ ), high robustness (against irregular and noisy input), high generalization power (to irregular boundary geometries and topology), and high scalability (without need for retraining).
- Involved techniques: Numerical analysis on convergence, customized AI operators (Python and CUDA based). Implements a customized CUDA convolution module to save computation for specific-shaped convolution kernels used in PDE solvers.
- Code available at <https://github.com/AXIHIXA/UGrid>.

#### **CUDA Baseline Experiments: Performance Profiling and Optimization**

- **TL;DR.** Implements and fine-tunes multiple CUDA baseline algorithms.
- Implemented baselines and their optimizations:
  - ☐ Parallel reduction (with loop unrolling and warp shuffle primitives).
  - ☐ Histogram and Copy-If (with atomic primitives).
  - ☐ Parallel scan (WarpScan and Raking variants).
  - ☐ Fused Biased-Mask-Scale-Add (fp32 and fp16, for fp16, with half precision primitives like `__hadd2`).
  - ☐ SGEMM and GEMV (loop unrolling, SMEM padding, warp tiling and double buffer optimizations, reaching 90% throughput of cuBLAS).
  - ☐ Dropout (with cuRAND APIs).
  - ☐ Fused SoftMax/LayerNorm/RMSNorm, Im2Col, Matrix transpose, etc.
- Code available at <https://github.com/AXIHIXA/CudaDemo>.

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#### **Misc**

- Language Proficiencies:
  - ☐ Chinese (Mandarin): Native speaker.
  - ☐ English: Fluent, near-native proficiency. TOEFL: 106/120; GRE: 324/340 + Writing 3.5.
  - ☐ Japanese: Sufficient for basic working scenarios. JLPT: N1 173/180, N2 169/180.