ZHENGQI, GAO

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EDUCATION

Massachusetts Institute of Technology   Cambridge, USA

Ph.D. in Electrical Engineering and Computer Science   Sep 2021 – Apr 2026 (Expected)
- GPA: 5.00/5.00 (Rank: NA); work with Prof. Duane S. Boning
- Research interests: statistical metrology, design automation for photonic/electronic integrated circuits, and applied machine learning

Fudan University   Shanghai, China

M.S. in Microelectronics and Solid State Electronics   Sep 2018 – Jun 2021
- GPA: 3.82/4.00 (Rank: NA); worked with Prof. Jun Tao and Prof. Xin Li (Duke Univ.)
- Research interests: electronic design automation (EDA), Bayesian methods, and machine learning

B.E. in Microelectronic Science and Engineering   Sep 2014 – Jun 2018
- GPA: 3.84/4.00 (Rank: 4/71); selected to Elite Engineering Program (top 5%)
- Relevant coursework: Mathematical Analysis, Probability, Mathematical Statistics and Stochastic Process, Signal and System, Data Structure and Algorithm Design, Design of Analog Integrated Circuits

PUBLICATIONS

Machine Learning

1. **K. Zha***, **Z. Gao***, M. Shen, Z-W Hong, D. S. Boning, and D. Katabi, "RL Tango: Reinforcing Generator and Verifier Together for Language Reasoning," *Arxiv Print*, 2025. [PDF] (*indicates equal contribution)

2. **Z. Gao**, K. Zha, T. Zhang, Z. Xue, D. S. Boning, "REG: Rectified Gradient Guidance for Conditional Diffusion Models," *International Conference on Machine Learning* (ICML), 2025. [PDF]

3. S. Zheng*, **Z. Gao***, F.-K. Sun, D. S. Boning, B. Yu, M. Wong, "Improving Neural ODE Training with Temporal Adaptive Batch Normalization," *Conference on Neural Information Processing Systems (Neurips)*, 2024. (* indicates equal contribution)

4. H. Lin, C. Liu, C. Xu, **Z. Gao**, Yanwei Fu, Yuan Yao, "On the Theory of Cross-Modality Distillation with Contrastive Learning," *International Conference on Learning Representations BGPT workshop*, 2024. [PDF]

5. C.-Y. Lai, F.-K. Sun, **Z. Gao**, J. Lang, and D. S. Boning, "Nominality Score Conditioned Time Series Anomaly Detection by Point/Sequential Reconstruction," *Conference on Neural Information Processing Systems (Neurips)*, 2023. [PDF][Code]

6. Z. Xue*, **Z. Gao***, S. Ren*, and H. Zhao, "The Modality Focusing Hypothesis: Towards Understanding Crossmodal Knowledge Distillation," *International Conference on Learning Representations* (*ICLR spotlight/*oral, top 5%), 2023. [PDF] [Code] (* indicates equal contribution)

7. **Z. Gao**, F. Sun, M. Yang, S. Ren, Z. Xiong, M. Engeler, A. Burazer, L. Wildling, L. Daniel, and D. S. Boning "Learning from Multiple Annotator Noisy Labels via Sample-wise Label Fusion," *European Conference on Computer Vision (ECCV)*, 2022. [PDF] [Code]

8. J. Gu, **Z. Gao**, C. Feng, H. Zhu, R. T. Chen, D. S. Boning, and D. Z. Pan, "NeurOLight: A Physics-Agnostic Neural Operator Enabling Parametric Photonic Device Simulation," *Conference on Neural Information Processing Systems (Neurips)*, 2022. [PDF] [Code]

9. **Z. Gao**, S. Ren, Z. Xue, and H. Zhao, "Training-Free Robust Multimodal Learning via Sample-Wise Jacobian Regularization," *Arxiv Preprint*, 2022. [PDF]

10. S. Ren, H Wang, **Z. Gao**, S. He, A. Yuille, Y. Zhou and C. Xie, "A Simple Data Mixing Prior for Improving Self-Supervised Learning," *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (*CVPR*), Jun. 2022. [PDF] [Code]

11. S. Ren, **Z. Gao**, T. Hua, Z. Xue, Y. Tian, S. He and H. Zhao, "Co-Advise: Cross Inductive Bias Distillation," *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (*CVPR*), Jun. 2022. [PDF] [Code]

12. Z. Xue, S. Ren, **Z. Gao** and H. Zhao, "Multimodal Knowledge Expansion," *IEEE International Conference on*

Computer Vision (ICCV), Oct. 2021. [PDF] [Code]

Design Automation for Photonic/Electronic Integrated Circuits

1. **Z. Gao**, Z. Zhang, Z. He, J. Gu, D. Z. Pan, and D. S. Boning, "Selecting robust silicon photonic designs after Bayesian optimization without extra simulations," *Optica Express* (*OE*), 2024. (highlighted as an editor's pick) [PDF]

2. **Z. Gao**, F. Sun, R. Rohrer, and D. S. Boning, "KirchhoffNet: A Scalable Ultra Fast Analog Neural Network," *IEEE/ACM International Conference on Computer-Aided Design* (*ICCAD*), Oct. 2024 [PDF][Code]

3. **Z. Gao**, X. Chen, Z. Zhang, U. Chakraborty, W. Bogaerts, and D. S. Boning, "Gradient-Based Power Efficient Functional Synthesis for Programmable Photonic Circuits," *IEEE Journal of Lightwave Technology* (*IEEE JLT*). [PDF]

4. **Z. Gao**, D. Zhang, L. Daniel, and D. S. Boning, "NOFIS: Normalizing Flow for Rare Circuit Failure Analysis," *Design Automation Conference* (*DAC*), 2024. (MARC 2024 Best Pitch Award) [PDF][Code]

5. **Z. Gao**, X. Chen, Z. Zhang, C. Y. Lai, U Chakraborty, W. Bogaerts, and D. S. Boning, "Provable Routing Analysis of Programmable Photonics," *IEEE Journal of Lightwave Technology* (*IEEE JLT*). [PDF]

6. **Z. Gao**, Z. Zhang, and D. S. Boning, "Few-Shot Bayesian Performance Modeling for Silicon Photonic Devices Under Process Variation," *IEEE Journal of Lightwave Technology* (*IEEE JLT*). [PDF]

7. J. Li*, D. Ahsanullah*, **Z. Gao***, and R. Rohrer, "Circuit Theory of Time Domain Adjoint Sensitivity," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (*IEEE TCAD*). [PDF] (* indicates equal contribution)

8. Z. Zhang, M. Notaros, **Z. Gao**, U. Chakraborty, J. Notaros, and D. S. Boning, "Impact of process variations on splitter-tree-based integrated optical phased arrays," *Opica Express* (OE). [PDF]

9. **Z. Gao**, X. Chen, Z. Zhang, U. Chakraborty, W. Bogaerts, and D. S. Boning, "Automatic Synthesis of Light Processing Functions for Programmable Photonics: Theory and Realization," *Photonics Research* (highlighted as an editor's pick). [PDF] [Code]

10. C. Li, C. An, **Z. Gao**, F. Yang, Y. Su and X. Zeng, "Unleashing the Power of Graph Spectral Sparsification for Power Grid Analysis via Incomplete Cholesky Factorization," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (*IEEE TCAD*). [PDF]

11. **Z. Gao**, X. Chen, Z. Zhang, U. Chakraborty, W. Bogaerts, and D. S. Boning "Automatic Synthesis of Light Processing Functions for Programmable Photonics," *IEEE Photonics Conference (IEEE IPC)*, 2022. [PDF]

12. **Z. Gao**, Z. Zhang and D. S. Boning, "Automatic Synthesis of Broadband Silicon Photonic Devices via Bayesian Optimization," *IEEE Journal of Lightwave Technology (IEEE JLT)*. [PDF][Code]

13. **Z. Gao**, Z. Zhang and D. S. Boning, "Automatic Design of a Broadband Directional Coupler via Bayesian Optimization," *Conference on Lasers and Electro-Optics (CLEO)*, 2022. [PDF]

14. Z. Liang, H. Wang, J. Cheng, Y. Ding, H. Ren, **Z. Gao**, Z. Hu, D. S. Boning, X. Qian, S. Han, W. Jiang, and Y. Shi "Variational Quantum Pulse Learning," *IEEE International Conference on Quantum Computing and Engineering (IEEE QCE)*, 2022. [PDF]

15. **Z. Gao** and R. Rohrer, "Efficient Non-Monte-Carlo Yield Estimation," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (*IEEE TCAD*). [PDF]

16. **Z. Gao**, J. Tao, Y. Su, D. Zhou, X. Zeng and X. Li, "Fast Statistical Analysis of Rare Failure Events with Truncated Normal Distribution in High-Dimensional Variation Space," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (*IEEE TCAD*). [PDF]

17. **Z. Gao**, Z. Chen, J. Tao, Y. Sun, D. Zhou, and X. Zeng, "Bayesian Inference on Introduced General Region: An Efficient Parametric Yield Estimation Method for Integrated Circuits," *ACM/IEEE Asia and South Pacific Design Automation Conference* (*ASPDAC*), Jan. 2021. [PDF]

18. **Z. Gao**, J. Tao, D. Zhou, X. Zeng and X. Li, "Efficient Rare Failure Analysis over Multiple Corners via Correlated Bayesian Inference," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (*IEEE TCAD*), Oct. 2020. [PDF] [Code]

19. **Z. Gao**, J. Tao, D. Zhou and X. Zeng, "Efficient Parametric Yield Estimation over Multiple Process Corners via Bayesian Inference Based on Bernoulli Distribution," *IEEE Transactions on Computer-Aided Design of*

Integrated Circuits and Systems (*IEEE TCAD*), Oct. 2020. [PDF] [Code]

20. J. Shi, **Z. Gao**, J. Tao, Y. Su, D. Zhou and X. Zeng, "Multi-Corner Parametric Yield Estimation via Bayesian Inference on Bernoulli Distribution with Conjugate Prior," *IEEE International Symposium on Circuits and Systems* (*ISCAS*), Oct. 2020. [PDF]

21. Y. Li, X. Zeng, **Z. Gao**, L. Lin, J. Tao, J. Han, X. Cheng, M. Tahoori and X. Zeng, "Exploring A Bayesian Optimization Framework Compatible with Digital Standard Flow for Soft-Error-Tolerant Circuit," *IEEE/ACM Design Automation Conference* (*DAC*), Jul. 2020. [PDF]

22. **Z. Gao**, J. Tao, Y. Su, D. Zhou and X. Zeng, "Projection Based Active Gaussian Process Regression for Pareto Front Modeling," *Arxiv Preprint*. [PDF]

23. **Z. Gao**, J. Tao, F. Yang, Y. Su, D. Zhou and X. Zeng, "Efficient Performance Trade-Off Modeling for Analog Circuit Based on Bayesian Neural Network," *IEEE/ACM International Conference on Computer Aided Design* (*ICCAD*), Nov. 2019. [PDF]

24. J. Tao, **Z. Gao**, D. Zhou and X. Zeng, "Efficient Statistical Analysis for Correlated Rare Failure Events," *IEEE International Conference on Solid-State and Integrated Circuit Technology* (*ICSICT*), Nov. 2018. [PDF]

RESEARCH EXPERIENCE

Massachusetts Institute of Technology — Cambridge, USA
Research Assistant to Prof. Duane S. Boning — Sep 2021 – Jun 2026 (expected)
- Researched on automatic light processing functions synthesis on programmable photonics
- Optimized silicon photonic devices via Bayesian optimization
- Analyze the error of a photonic-electronic AI chip

Shanghai Qizhi Institute — Shanghai, China
Research Assistant to Prof. Hang Zhao — Mar 2021 – Jun 2021
- Exploited multimodal learning under knowledge distillation
- Developed a method to address adversarial attack by utilizing the multimodal data

Southern Methodist University — Remotely
Research Assistant to Prof. Ron Rohrer — May 2020 – Sep 2021
- Built a power grid DC simulator for the electromigration problem
- Analyzed parametric yield based on the adjoint method

Fudan University (State Key Laboratory of ASIC & System) — Shanghai, China
Research Assistant to Prof. Jun Tao (in collaboration with Prof. Xin Li) — Sep 2016 – Jul 2021
- Improved post-silicon yield estimation with the domain adaptation technique
- Estimated multi-corner failure rate and yield with Bayesian inference
- Modeled performance trade-off of analog circuits based on a Bayesian neural network
- Optimized a time variant analog filter by hierarchical clustering (bachelor thesis)
- Developed an SRAM failure-rate estimation tool in collaboration with Prof. Xuan Zhang (WUSTL) [see here]

TEACHING AND INTERNSHIPS

Apple — Sunnyvale, USA
Hardware Intern — May 2025 – Aug 2025
- Interned in Apple AR/VR display team.

Massachusetts Institute of Technology — Cambridge, USA
Teaching Assistant — Feb 2025 – May 2025
- Performed TA duties for 6.3900 Introduction to Machine Learning (~400 students).

Nvidia Corporation — Austin, USA
Research Intern — Jun 2023 – Sep 2023
- Developed deep neural network model for semiconductor lithography (manager: Mark Ren)
- Produced a large-scale image translation model (> 1GB) based on Pixel2Pixel and model compression technique
- Achieved <0.02% MSE error on Nvidia proprietary chip layout dataset containing over 3M images

Fudan University (FDU) and Duke Kunshan University (DKU) — China
Teaching Assistant — Sep 2019 – Mar 2020

- Performed TA duties for Design of Analog Integrated Circuits at FDU (instructor: Prof. Jun Xu) and Introduction to Programming & Data Structure at DKU (instructor: Prof. Dennis Quan [Duke Univ.])

Baidu Inc. Shanghai, China
Quality Assurance (QA) Engineering Intern Jun 2017 – Sep 2017
- Measured the robustness of programs and took charge of the FEEDS project

SELECTED AWARDS AND HONORS

Editor's highlight, Optica Express	2024
ML and Systems Rising Star, MLCommons (41 out of 170)	2024
Best Pitch Award, Microsystem Annual Research Conference (4 out of ~60)	2024
Oral(Spotlight) paper, International Conference on Learning Representations (top 5%)	2023
Editor's highlight, Optica Photonics Research	2023
2nd place, CVPR'23 Ego4d TTM challenge	2023
DAC young fellowship	2023
Outstanding Graduates of Shanghai (top 5%)	2021
Biren Scholarship (3 awardees nationwide)	2020
The Integrated Circuits Scholarship, Chinese Institute of Electronics (44 awardees nationwide)	2020
National Scholarship, Fudan University (top 1%)	2020
Rising Star of Academic, Fudan University (awarded to 11 graduate students majoring in Sci. & Engi.)	2020
Pacemaker to Merit Student, Fudan University (awarded to 15 graduate students)	2019
First Prize Scholarship, Fudan University (top 5%)	2019
National Gold Award, China "Internet+" College Student Innovation & Entrepreneur Competition(top 5%)	2018
National 2nd Prize, China Post-Graduate Mathematical Contest in Modeling (top 15%)	2018
Outstanding Undergraduates of Shanghai (top 5%)	2018
Meritorious Winner, American Mathematical Contest in Modeling (top 13%)	2017
Top 11%, 2017 IEEE Xtreme Global Programming Competition (out of 3,350 teams worldwide)	2017
First Prize Scholarship, Fudan University (top 5%)	2015, 2016, 2017
National 2nd prize, China Mathematical Contest in Modeling (top 15%)	2016

REPRESENTATIVE PROJECTS

***PRML* Solution Manual (GitHub 900+ Stars)** Shanghai, China
An Original Solution Manual for Pattern Recognition and Machine Learning (PRML) Sep 2017 – Present
- Solved nearly all exercises in *PRML* [see here]
- Communicated with people globally via email, helping them solve problems relevant to *PRML*

Auto-Grading System Kunshan, China
An Auto-Grading System Developed at DKU Jan 2020 – Mar 2020
- Led a small TA group to peruse the source code of Submitty
- Developed a fully automatic grading system based on Submitty

"Dr. Stanley's House" (Puzzle Video Game) Written in Haskell Shanghai, China
Final Project for Introduction to Functional Programming: From C/C++ to Haskell Sep 2018 – Jan 2019
- Implemented the game with a complete plot via Haskell [see here]
- Organized the program structure, sorted the logic, and set the schedule as the team leader
- Exploited Haskell libraries (e.g., SDL2, SDL2-ttf, and SDL2-mixer) to add music and animation

ADDITIONAL INFORMATION

Computer and Language Skills
- **Programming languages & Software**: C/C++, MATLAB, Python, Linux, HSPICE, SPECTRE, Lumerical
- **Languages**: Mandarin Chinese (native), English (proficient)

PROFESSIONAL SERVICES

- **Independent reviewer:** IEEE TCAD, CVPR, Neurips, etc.,