Zhimin Fan

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Education

Nanjing University   Nanjing, China
M.Eng. in Computer Science and Technology   Advisor: Jie Guo   09/2023 – Present

Southeast University   Nanjing, China
B.Eng. in Computer Science and Engineering   GPA: 3.98/4.00,   Average: 93.25/100.00   09/2019 – 06/2023

Publications

Double Shrinkage for Combining Biased and Unbiased Monte Carlo Renderings

Chenxi Zhou, Keheng Xu, Mufan Guo, Xianhao Yu, **Zhimin Fan**, Guihuan Feng, Yanwen Guo, Jie Guo
Conditionally accepted to SIGGRAPH Asia 2025 (Journal track)

Bernstein Bounds for Caustics

Zhimin Fan, Chen Wang, Yiming Wang, Boxuan Li, Yuxuan Guo, Ling-Qi Yan, Yanwen Guo, Jie Guo
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2025)

Multiple Importance Reweighting for Path Guiding

Zhimin Fan, Yiming Wang, Chenxi Zhou, Ling-Qi Yan, Yanwen Guo, Jie Guo
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2025)

Specular Polynomials

Zhimin Fan, Jie Guo, Yiming Wang, Tianyu Xiao, Hao Zhang, Chenxi Zhou, Zhenyu Chen, Pengpei Hong, Yanwen Guo, Ling-Qi Yan
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2024)

Conditional Mixture Path Guiding for Differentiable Rendering

Zhimin Fan, Pengcheng Shi, Mufan Guo, Ruoyu Fu, Yanwen Guo, Jie Guo
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2024)

Manifold Path Guiding for Importance Sampling Specular Chains

Zhimin Fan*, Pengpei Hong* (Joint first authors), Jie Guo, Changqing Zou, Yanwen Guo, and Ling-Qi Yan
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2023)

Selected awards

National Scholarship, Nanjing University	2024
President Scholarship, Southeast University	2021
National Scholarship, Southeast University	2020
Gold Medal at International Collegiate Programming Contest (ACM-ICPC) Asia Regional Contest	2020
Provincial First Prize at Chinese Physics Olympiad	2018
Provincial First Prize at National Olympiad in Informatics in Provinces	2016, 2017

Academic services

Technical paper reviewer: SIGGRAPH (2025), SIGGRAPH Asia (2024; $2025_{\times 4}$), TVCG (2024), EG (2025)

Skills

English: TOEFL iBT 104 (R28/L26/S23/W27) | **Tools**: C/C++, Python, CUDA, GLSL, PyTorch, Mitsuba, Maya

Research experience

Light transport with specular constraints   07/2022 – 04/2025

- **Manifold Path Guiding for Importance Sampling Specular Chains**

Proposed leveraging the continuity of specular manifolds to reconstruct importance distributions.

Achieved up to 40x variance reduction over existing unbiased methods.

Contributions: conceived the key idea, implemented most experiments, and co-authored the manuscript.

- **Specular Polynomials**

Developed the first complexity-bounded method to find all admissible paths in triangles.

Reduced dimensionality with rational coordinate mappings and resultant methods.

Contributions: originated the idea, implemented the serial/CUDA code, generated most results, and drafted the paper.

- **Bernstein Bounds for Caustics**

Derived position/irradiance bounds using the Bernstein basis to reduce search domain.

Explored remainder variables, implicit differentials, and degree reductions.

Enabled low-variance sampling of specular triangles with up to an order-of-magnitude speedup.

Contributions: idea conception, the Python precomputation, the rendering code, almost all figures, and the manuscript.

Path guiding under low sample budgets   02/2023 – 04/2025

- **Conditional Mixture Path Guiding for Differentiable Rendering**

Proposed importance sampling path derivatives using an optimal mixture of primal and differential distributions.

Contributions: originated the idea, developed the guiding framework in a JIT path tracer, and wrote the manuscript.

- **Multiple Importance Reweighting for Path Guiding**

Analyzed path-level reweighting using adaptive multiple importance sampling and a constant-storage variant.

Contributions: conceived the idea, designed and executed all comparative experiments, and drafted the paper.

Research interests

My research focuses on realistic image synthesis, emphasizing physically-based rendering and controllable light transport with physical constraints. I am also open to exploring how these principles can inform generative and data-driven methods to enhance controllability in learned image synthesis.

Invited talks

Light transport with specular constraints: modeling, solving, and bounding   08/2025

    Outstanding Students Panel, CAD/CG   Yantai, China

Recent advancements in specular path sampling   07/2025

    Student Forum, CSIG Intelligent Graphics Frontiers Seminar   Taiyuan, China

Research experience on path sampling for realistic rendering   05/2025

    GAMES Polaris Forum   Online

Working experience

Bytedance Technology   Beijing, China

R&D Intern, Graphics development   07/2022 – 01/2023

Implemented several projection algorithms for panoramic video, using OpenGL ES, Metal, and Unity.