Zhimin Fan

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Educations

Nanjing University — Nanjing, China
M.Eng. in Computer Science and Technology — Advisor: Jie Guo — 2023 - Present

Southeast University — Nanjing, China
B.Eng. in Computer Science and Engineering — GPA: 3.98/4.00, Avg: 93.25/100.00 — 2019 - 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*, Jie Guo, Changqing Zou, Yanwen Guo, and Ling-Qi Yan
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2023) *: Joint first authors

Awards

National Scholarship, Nanjing University	2024
President Scholarship, Southeast University	2021
National Scholarship (Top 1%), 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$_{x4}$), TVCG (2024), EG (2025)

Skills

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

Research experience

Light transport with specular constraints 2022 - 2025

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

Proposed using the specular manifold's continuity to reconstruct continuous importance distributions.
My contributions: the key idea, did most of the implementation and experiments, and co-authored the manuscript.

- **Specular Polynomials**

Introduced a Newton iteration-free solver for specular paths by formulating specular constraints into polynomials.
Reduced dimension with rational coordinate mapping and introduced the hidden variable resultant method.
The first deterministic, complexity-bounded framework for identifying all admissible paths within triangles.
My contributions: the idea, the serial and CUDA code for the main algorithm, most of the results, and the paper draft.

- **Bernstein Bounds for Caustics**

Derived vertex position and irradiance bounds from specular polynomials to reduce the triangle search domain.
Introduced the bounding property of rational functions on the Bernstein basis, extended with remainder variables.
My contributions: the idea, the Python precomputation code, the rendering code, nearly all figures, and the manuscript.

Path guiding under low sample budgets 2023 - 2025

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

Proposed to importance sample path derivatives using a mixture of primal and differential distributions.
Derived optimal mixture weights conditioned on the entire path prefix.
My contributions: the idea, developed the framework for guiding in JIT path tracer, and wrote the manuscript.

- **Multiple Importance Reweighting for Path Guiding**

Presented a path reweighting process that leverages importance distributions from multiple guiding iterations.
Introduce adaptive multiple importance sampling (AMIS) and developed a constant-storage variant.
My contributions: the idea, designed and executed all comparative experiments, and drafted the paper.

Research interests

My research interests lie in realistic image synthesis, with a foundation in physically-based Monte Carlo rendering. A central theme of my previous work is physical principles, such as specular constraints. Looking ahead, I am open to broaden this foundation by exploring generative and data-driven techniques, while ensuring physical plausibility and principled image synthesis.

Invited talks

Light transport with specular constraints: modeling, solving, and bounding 08/2025
Outstanding students forum, CAD/CG 2025, Yantai, China

Advancements in specular light transport 07/2025
Student forum, CSIG Intelligent Graphics Frontiers Seminar 2025, Taiyuan, China

Research experience on path sampling for realistic rendering 05/2025
GAMES Polaris Forum, Online

Work experience

Bytedance Technology Beijing, China
R&D Intern, Graphics develop 07/2022 – 01/2023
Developed several panoramic video display projection algorithms, using OpenGL ES, Metal, and Unity.