Kai Yan

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Education

University of California, Irvine Jun. 2020 – Present
Ph.D. candidate in Computer Science

- **Advisor**: Shuang Zhao
- **Research**: (Variance-aware/Physically-based) Differentiable Rendering, Generated Rendering, World Models

University of California, Irvine Sep. 2016 – Mar 2020
Bachelor of Science in Computer Science & Computer Game Science | Film and Media (Minor)

- **Fellowship** ICS Honor. Advisor: Shuang Zhao
- **Research**: Computer Graphics, Machine Learning, Computer Vision, Cosmology, Radiology
- **Thesis**: Path-Space Differentiable Renderer (PSDR-CUDA)

Selected Publications

Differentiating Variance for Participating Media ***Submitted***
Kai Yan et al.

Image-Space Adaptive Sampling for Fast Inverse Rendering ***SIGGRAPH 2025***
Kai Yan, Cheng Zhang, Sébastien Speierer, Guangyan Cai, Yufeng Zhu, Zhao Dong, Shuang Zhao

Differentiating Variance for Variance-Aware Inverse Rendering ***SIGGRAPH ASIA 2024***
Kai Yan, Vincent Pegoraro, Marc Droske, Jiří Vorba, Shuang Zhao

PSDR-Room: Single Photo to Scene using Differentiable Rendering ***SIGGRAPH ASIA 2023***
Kai Yan, Fujun Luan, Miloš Hašan, Thibault Groueix, Valentin Deschaintre, Shuang Zhao

Neural-PBIR Reconstruction of Shape, Material, and Illumination ***ICCV 2023***
Cheng Sun, Guangyan Cai, Zhengqin Li, **Kai Yan**, Cheng Zhang, Carl Marshall, Jia-Bin Huang, Shuang Zhao, Zhao Dong

Efficient Estimation of Boundary Integrals for Path-Space Differentiable Rendering ***SIGGRAPH 2022***
Kai Yan, Christoph Lassner, Brian Budge, Zhao Dong, and Shuang Zhao

Physics-Based Inverse Rendering using Combined Implicit and Explicit Geometries ***EGSR 2022***
Guangyan Cai, **Kai Yan**, Zhao Dong, Ioannis Gkioulekas, and Shuang Zhao

Path-Space Differentiable Rendering ***SIGGRAPH 2020***
Cheng Zhang, Bailey Miller, **Kai Yan**, Ioannis Gkioulekas, and Shuang Zhao

Systems

PSDR-JIT (PSDR-CUDA)

- Authors: **Kai Yan**, Shuang Zhao
- https://github.com/andyyankai/psdr-jit
- PSDR-JIT is one of the earliest GPU-based physically-based differentiable renderer that fully supports shape/material reconstruction under global illumination. It has been used in several SIGGRAPH/EGSR/CVPR/ICCV projects and is used internally by several companies.

Experiences

Nvidia Research Jun. 2025 –
Research Intern Redmond, WA

- Collaborators: Lifan Wu, Daqi Lin, Markus Kettunen, Ravi Ramamoorthi, Miloš Hašan, Chris Wyman, Aaron Lefohn
- Topic: Differentiable rendering, Generated AI, and World Models
- Next generation real-time rendering pipeline using generated rendering.
- World Generation with differentiable rendering. (PSDR-ROOM extensions)

Meta Reality Lab Jun. 2024 – Oct. 2024
Research Intern Redmond, WA

- Collaborators: Cheng Zhang, Sébastien Speierer
- Topic: Differentiable Rendering for content creation
- Designed and led a dense-capture pipeline that combines Fourier-domain analysis to acquire highly detailed material data for glossy objects.
- Developed a fast inverse-rendering algorithm, published in **SIGGRAPH 2025**.
- PSDR-JIT related project released in Meta Digital Twin Catalog.

Weta Digital Jul. 2023 – Dec. 2023
Visiting Researcher Wellington, NZ

- Collaborators: Vincent Pegoraro, Marc Droske, Jiří Vorba
- Topic: Differentiable rendering for production @ Rendering Research
- Developed a variance-aware differentiable rendering technique that reduces rendering variance. Published in **SIGGRAPH ASIA 2024**; a follow-up paper is under review for **SIGGRAPH ASIA 2025**.
- Created a finite-difference approach for differentiating parameters within the Manuka renderer.

MiHoYo Feb. 2023 – Jun. 2023
Visiting Researcher Shanghai, CN

- Topic: Differentiable Rendering for AI-Driven Games and Meta-Humans @ Lumi Research & Genshin Impact
- Developed a sparse-view content-creation pipeline that fuses generative AI with differentiable rendering.
- Adapted differentiable rendering and built a production-ready level-of-detail (LOD) system now deployed in multiple released games.

Adobe Research Jun. 2022 – Oct. 2022
Research Intern San Jose, CA

- Collaborators: Miloš Hašan, Fujun Luan, Valentin Deschaintre, Thibault Groueix
- Topic: Scene Digital Twins from a Single Photo via Differentiable Rendering
- PSDR-ROOM published in **SIGGRAPH ASIA 2023**.
- Built a large mesh-and-material dataset and fine-tuned CLIP to power LLM-based mesh/material search.

Meta Reality Lab Jun. 2021 – Feb. 2022
Research Intern Redmond, WA

- Collaborators: Christoph Lassner, Brian Budge, Zhao Dong
- Topic: Differentiable rendering for shape/material reconstruction
- Developed a theory to efficiently estimate derivatives under complex environmental lighting and complex shapes. Published in **SIGGRAPH 2022**.
- Delivered and developed PSDR-JIT (with raw PTX/CUDA) and an inverse rendering pipeline used by various teams.
- The inverse rendering pipeline was featured at Meta Connect 2022 and on CNET.

Professional Activities

Program Committee : Eurographics Symposium on Rendering (EGSR)
Reviewer : ACM SIGGRAPH, ACM SIGGRAPH ASIA, ACM Transactions on Graphics (TOG), Eurographics, Computer Graphics Forum, Computer & Graphics, Pacific Graphics, TVCG, HPG