Jeffrey Liu

jliu179@illinois.edu | linkedin.com/in/jeffrey-liu-604/ | jebbly.github.io/

Education

University of Illinois Urbana-Champaign May 2025

Bachelor of Science in Mathematics and Computer Science, Minor in Physics *GPA: 4.00*

- Relevant Coursework: Probability Theory, Computational Photography, Interactive Computer Graphics (A+), Deep Learning for Computer Vision, Machine Perception (A+), Applied Parallel Programming, Numerical Analysis (A+), Computer System Organization, Electromagnetic Fields (A+), Light Lab (A+)

Research Experience

UCI Physics-Based Graphics Lab Aug. 2024 – Present

Visiting Undergraduate Researcher (Advisor: Shuang Zhao) *Irvine, CA*

- Extending path-space differentiable rendering to differentiate ReSTIR / RIS variance with respect to scene and sampling parameters

NVIDIA Research (Real-Time Rendering) May. 2024 – Aug. 2024

Research Intern (Advisor: Chris Wyman) *Redmond, WA*

- Evaluating ReSTIR for integration over a shutter speed time domain to achieve one sample-per-pixel motion blur
- Developing faster and more robust temporal reuse for one sample-per-pixel anti-aliasing
- Experimenting with scatter-based reuse mechanisms to enable more effective shift mappings

ILLIXR Lab Mar. 2022 – Present

Undergraduate Researcher (Advisor: Sarita Adve) *Champaign, IL*

- Researching performance tradeoffs between accuracy of eye-tracking and intensity of foveated rendering
- Experimenting with custom late-stage asynchronous reprojection techniques to reduce motion-to-photon latency
- Conducting user studies to evaluate latency compensation under various network conditions for offloaded rendering

Illinois Mathematics Lab Aug. 2023 – Dec. 2023

Undergraduate Researcher (Advisor: Joseph Rosenblatt) *Champaign, IL*

- Evaluated the quality of low-degree spherical harmonic terms for function reconstruction
- Investigated the relation between spherical harmonics, Fourier series, and their completeness as eigenfunctions

Publications

1. Russel Arbore, **Jeffrey Liu**, Aidan Wefel, Steven Gao, Eric Shaffer, "*Hybrid Voxel Formats for Efficient Ray Tracing*", 2024 International Symposium on Visual Computing (Paper)
2. Russel Arbore, **Jeffrey Liu**, Aidan Wefel, Steven Gao, Eric Shaffer, "*Real-time Ray Tracing of Large Voxel Scenes*", GPU Zen 3 (Book Chapter)
3. Rahul Singh, Muhammad Huzaifa, **Jeffrey Liu**, Anjul Patney, Hashim Sharif, Yifan Zhao, Sarita Adve, "*Power, Performance, and Image Quality Tradeoffs in Foveated Rendering*", 2023 IEEE Conference on Virtual Reality and 3D User Interfaces (Paper)

Teaching Experience

University of Illinois Urbana-Champaign Aug. 2021 – May. 2024

CS 415 - Game Development Lead Course Assistant *Champaign, IL*

- Worked for 5 semesters (FA21, SP22, FA22, FA23, SP24) to develop and refine assignments
- Addressed student questions about Unreal Engine 4/5 debugging through CampusWire and in-person office hours
- Consulted 4-6 project teams per semester, evaluating and directing progress towards 3 milestones throughout a course-long project creating a fully featured game
- Mentored individual students catching up on course material or needing specific help

Work Experience

Epic Games Jun. 2023 – Aug. 2023
XR Engineering Intern *Cary, NC*

- Added support for split-screen and stereo rendering of distance field ambient occlusion in Unreal Engine 5
- Investigated infrastructure optimizations for stereoscopic / multi-view rendering to decrease related texture memory usage by $> 50\%$ while maintaining temporal super-resolution stability

Blender (Google Summer of Code) May. 2022 – Sep. 2022
Open Source Contributor *blender.org*

- Implemented "Importance Sampling of Many Lights with Adaptive Tree Splitting" in Blender's production renderer, Cycles (released as part of Blender 3.5)
- Wrote weekly community progress updates along with a technical development log for developers to understand implementation details, totaling over $30,000$ combined views

Glodon USA East Cost Jun. 2021 – Aug. 2021
Software Engineer Consultant *Champaign, IL*

- Developed integration and performance tests by configuring xvfb to support headless testing and parsing NVIDIA Nsight Systems' raw SQL output for CPU/GPU workload, improving coverage by $3\times$ and efficiency by $80\times$

BRL-CAD (Google Code-in) Dec. 2019 – Feb. 2020
Open Source Contributor *brlcad.org*

- Integrated external raytracer with BRL-CAD's custom ray intersection logic
- Documented project set-up instructions, current progress, and future tasks for new contributors to get started

Extracurricular Activities

SIGGRAPH@UIUC Student Chapter Aug. 2021 – Present
Chair *Champaign, IL*

- Planning activities and lectures to teach technical and creative applications of computer graphics, e.g., giving a series of talks about Blender, OpenGL, and ray tracing for beginners
- Leading a project to build Project Northstar's Deck X, an open-source augmented reality headset, as an experience for members to get involved with AR
- Volunteered in person at the SIGGRAPH 2022 (student volunteer) and SIGGRAPH 2023 (team leader) conferences

UIUC Table Tennis Club Jan. 2023 – Present
Executive Officer *Champaign, IL*

- Competing in various regional collegiate tournaments with the A-Team
- Qualified for both teams and singles events in the 2024 NCTTA National Championships
- Promoting participation as the club's social media manager

Technical Skills

Languages: C, C++, Python, CUDA, GLSL/HLSL/Slang, Rust
Frameworks/Engines: Falcor, Blender, Unreal Engine 4/5
Developer Tools: CMake, LaTeX, Git, Perforce
Libraries/APIs: Vulkan, OpenGL, NumPy, PyTorch, OpenCV