Qi Wu

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EXPERTISE & RESEARCH FOCUS

My expertise is rooted in the field of scientific visualization and high-performance computing, utilizing parallel hardware such as CUDA, vectorized CPUs, and supercomputers. I am also proficient in managing large-scale data and automating adaptive workflow scheduling. My recent research has focused on the application of implicit neural networks for the representation and compression of scientific data, aiming to facilitate more streamlined interactions with large datasets. Looking ahead, I am excited to further integrate implicit neural networks with other cutting-edge machine learning techniques, such as large language models and Generative AI, to advance scientific visualization and enhance computer graphics pipelines.

EDUCATION

Sept. 2018 – Jun. 2024 **PhD in Computer Science**
University of California – Davis, United States
Advisor: Dr. Kwan-Liu Ma
Thesis: A Programmable Streaming Framework for Extreme Scale Scientific Visualizations

Aug. 2016 – May. 2018 **Master's in Computing, Graphics & Visualization Track**
Scientific Computing and Imaging Institute (SCI), University of Utah, United States
Advisor: Dr. Chuck Hansen
Thesis: VisIt-OSPRay: Toward an Exascale Volume Visualization System

Sept. 2012 – Jun. 2016 **Bachelor of Science in Physics, Physics & Mathematics Track, First Class Honor**
Hong Kong University of Science and Technology (HKUST), China
Advisor: Dr. Michael Wong and Dr. Nian Lin
Thesis: Statistical Neural Decoding for Saccadic Visual Stability

Feb. 2015 – Aug. 2015 **Exchange Undergraduate Student**
Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

EMPLOYMENT

Jul. 2024 – Present **NVIDIA**
Applied Research Scientist - Simulation Technology
- Research on implicit neural representation and 3D reconstruction.

Jul. 2022 – Dec. 2022 **Argonne National Laboratory**
Research Internship, with Dr. Joseph A. Insley, Dr. Silvio Rizzi, and Dr. Victor Mateevitsi
- Develop declarative and reactive programming interface in Ascent for in situ visualization.
- Research on distributed neural representation for large-scale interactive volume rendering.

Jul. 2021 – Sept. 2021 **Intel Corporation**, Graphics Research
Research Internship, with Dr. Michael J. Doyle
- Research on implicit neural representation for real-time rendering, data compression and online training.

Jul. 2020 – Sept. 2020 **Intel Corporation**, Graphics Research
Research Internship, with Dr. Michael J. Doyle
Research on efficient direct storage streaming for large-scale volume data.

Jul. 2019 – Sept. 2019 **Intel Corporation**
Software Engineering for Computer Graphics
- SIMD optimizations of the traversal and the scheduling algorithm for hardware ray tracing.

Jul. 2018 – Sept. 2018 **Argonne National Laboratory**
Graduate Research Internship, with Dr. Joseph A. Insley and Dr. Silvio Rizzi
- Develop a CPU rendering system inside the scalable and interactive parallel volume rendering – VL3.
- Develop remote visualization clients for parallel volume rendering on supercomputer – Theta.

Jun. 2015 – Aug. 2015 **European Organization for Nuclear Research (CERN)**
Undergraduate Research, with Dr. Mathieu Benoit
- Develop an auto-optimization program inside ALLPIX, a simulation software for silicon pixel detector.

PUBLICATIONS

2024 **Distributed Neural Representation for Reactive in situ Visualization**
Qi Wu, Joseph A. Insley, Victor A. Mateevitsi, Silvio Rizzi, Michael E. Papka, and Kwan-Liu Ma
TVCG *IEEE Transactions on Visualization and Computer Graphics*

Beyond ExaBricks: GPU Volume Path Tracing of AMR Data
Stefan Zellmann, **Qi Wu**, Alper Sahistan, Kwan-Liu Ma, and Ingo Wald
EuroVis *Eurographics Conference on Visualization*

2023 **Interactive Volume Visualization via Multi-Resolution Hash Encoding based Neural Representation**
Qi Wu, David Bauer, Michael J. Doyle, and Kwan-Liu Ma
TVCG *IEEE Transactions on Visualization and Computer Graphics*

Photon Field Networks for Dynamic Real-Time Volumetric Global Illumination
David Bauer, **Qi Wu**, and Kwan-Liu Ma
VIS *IEEE Visualization Conference*

Memory-Efficient GPU Volume Path Tracing of AMR Data Using the Dual Mesh
Stefan Zellmann, **Qi Wu**, Kwan-Liu Ma, and Ingo Wald
EuroVis *Eurographics Conference on Visualization*

HyperINR: A Fast and Predictive Hypernetwork for Implicit Neural Representations via Knowledge Distillation
Qi Wu, David Bauer, Yuyang Chen, and Kwan-Liu Ma
Preprint

2022 **FoVolNet: Fast Volume Rendering using Foveated Deep Neural Networks**
David Bauer, **Qi Wu**, and Kwan-Liu Ma
VIS *IEEE Visualization Conference,* ***Best Paper Honorable Mentions***

A Flexible Data Streaming Design for Interactive Visualization of Large-Scale Volume Data
Qi Wu, Michael J. Doyle, and Kwan-Liu Ma
EGPGV *Eurographics Symposium on Parallel Graphics and Visualization*

Distributed Volumetric Neural Representation for in situ Visualization and Analysis
Qi Wu, Joseph A. Insley, Victor A. Mateevitsi, Silvio Rizzi, and Kwan-Liu Ma
Poster *IEEE Large Scale Data Analysis and Visualization Symposium Poster*

2020 **DIVA: A Declarative and Reactive Language for in situ Visualization**
Qi Wu, Tyson Neuroth, Oleg Igouchkine, Konduri Aditya, Jacqueline H. Chen, and Kwan-Liu Ma
LDAV *IEEE Large Scale Data Analysis and Visualization Symposium*

2019 **Ray Tracing Generalized Tube Primitives: Method and Applications**
Mengjiao Han, Ingo Wald, Will Usher, **Qi Wu**, Feng Wang, Valerio Pascucci, Charles D. Hansen, Chris R. Johnson
EuroVis *Eurographics Conference on Visualization*

2018 **VisIt-OSPRay: Toward an Exascale Volume Visualization System**
Qi Wu, Will Usher, Steve Petruzza, Sidharth Kumar, Feng Wang, Ingo Wald, Valerio Pascucci, and Charles D. Hansen
EGPGV *Eurographics Symposium on Parallel Graphics and Visualization*

CPU Isosurface Ray Tracing of Adaptive Mesh Refinement Data
Feng Wang, Ingo Wald, **Qi Wu**, Will Usher, and Chris R. Johnson
VIS *IEEE Visualization Conference*

Topological data analysis made easy with the Topology ToolKit
Guillaume Favelier, Charles Gueunet, Attila Gyulassy, Julien Kitware, Joshua Levine, Jonas Lukasczyk, Daisuke Sakurai, Maxime Soler, Julien Tierny, Will Usher, and **Qi Wu**
Tutorial *IEEE Visualization Conference Tutorial*

2015 **Thermodynamic versus Kinetic Control in Self-Assembly of Zero, One, Quasi-two and Two Dimensional Metal-Organic Coordination Structures**
Lin, Tao, **Qi Wu**, Jun Liu, Ziliang Shi, Pei Nian Liu, Nian Lin
JCP *Journal of Chemical Physics*

INVITED TALKS & PRESENTATIONS

2023 **Los Alamos National Laboratory**
Invited Talk: “Distributed neural representation for reactive in situ visualization”.

2022 **Ohio State University**
Invited Talk: “Implicit neural representation for interactive volume rendering of large-scale data”.

Stanford University Legion Retreat
Invited Lightning Talk: “Realizing Adaptive in situ Visualization Workflows in Regent”.

US Department of Energy Computer Graphics Forum
Invited Technical Talk: “A Distributed Volumetric Neural Representation for Interactive Visualization of Large-Scale Data”

IEEE Large Scale Data Analysis and Visualization
Early Career Lightning Talk: “Instant Neural Representation for Interactive Volume Rendering”

Intel Innovation Conference
Invited Exhibitor: “Accelerating Instant Neural Representation & FoVolNet with OneAPI”

2018 **Utah Carbon Capture Multidisciplinary Simulation Center Annual Meeting**
Presentation: “VisIt-OSPRay: Toward an Exascale Volume Visualization System”

2017 **Utah Carbon Capture Multidisciplinary Simulation Center Annual Meeting**
Presentation: “Visit-OSPRay: Scalable Volume Rendering on Intel KNL CPUs”

2016 **ACM/IEEE Supercomputing Conference**
University of Utah Booth: “Volume Rendering with VisIt-OSPRay”

2014 **Physical Society of Hong Kong (PSHK) Conference**
Presentation: “Monte Carlo Simulation for 2D Supramolecular Self-Assembly”

Undergraduate Research Opportunities Program, HKUST
Presentation: “The effect of metal atoms in the MOFs self-assembly”

AWARDS

2022 IEEE Visualization Conference Best Paper Honorable Mentions

2016 University of Utah Best Data Visualization Prize Winner

2016 First Honor Classification on Graduation, HKUST

2013 & 2016 Dean's List of HKUST for Academic Excellence, HKUST

2013 – 2016 Ho & Ho Foundation Undergraduate Full Scholarship for 4 Years

2014 Finalist of Mr. Armin & Mrs. Lillian Kitchell Undergraduate Research Award

TEACHING

2023 Fall **Co-Instructor** Computer Graphics (ECS 175), UC Davis
Undergraduate level course instructed by Dr. Kwan-Liu Ma. I contributed to the development and preparation of course materials and assignments. Additionally, I am responsible for delivering 20% of the lecture content.

2023 Winter **Guest Lecture** Computer Graphics (ECS 175), UC Davis
Undergraduate level course instructed by Dr. Kwan-Liu Ma. I was invited to give two guest lectures: “Toward Hardware-Accelerated Interactive Path Tracing” and “Machine Learning in Computer Graphics Research”.

2021 Spring **Teaching Assistant** Advanced Visualization (ECS 277), UC Davis
Graduate level course instructed by Dr. Bernd Hamann. I assisted the design of both course assignments as well as the final project.

2020 Fall **Teaching Assistant** Computer Graphics (ECS 175), UC Davis
Undergraduate level course instructed by Dr. Bernd Hamann. I assisted the design of both course assignments as well as exams.

2020 Winter **Teaching Assistant** Software Development & Object-Oriented Programming in C++ (ECS 36B), UC Davis
Undergraduate level course instructed by Dr. Francois Gygi.

2019 Spring **Teaching Assistant** Introduction to Programming (ECS 32A), UC Davis
Undergraduate level course instructed by Dr. Nathan Hanford.

2019 Winter **Teaching Assistant** Introduction to Programming (ECS 32A), UC Davis
Undergraduate level course instructed by Dr. Nelson Max.

SERVICE AND OUTREACH

Program Committee Member

2023 IEEE Symposium on Large Data Analysis and Visualization (LDAV)

2021 - 2023 ACM/IEEE SC Workshop on In Situ Infrastructures for Enabling Extreme-scale Analysis and Visualization (ISAV)

Paper Reviewer

2024 IEEE PacificVis Full Papers (TVCG/Journal Track), IEEE TVCG

2023 IEEE PacificVis Full Papers, IEEE VIS Full Papers, VIS 2023 Short Papers, IEEE TVCG

2022 IEEE LDAV Posters

2018 IEEE VIS SciVis Short Papers

SELECTED SOFTWARE CONTRIBUTIONS

VisIt, a widely used open source, interactive, scalable, visualization, animation, and analysis tool.
I designed a high-fidelity OSPRay-based distributed volume renderer within VisIt, which continues to be actively utilized and appreciated by its users.

OSPRay, Intel's the open, scalable, and portable ray tracing engine
I collaborated extensively with Intel engineers, making many contributions to OSPRay through the development of numerous features and optimizations.

VL3, a scalable and interactive parallel volume rendering developed by Argonne National Laboratory
I developed a CPU-based distributed volume rendering backend, along with a remote visualization client, specifically designed to enhance the capabilities of VL3.

DIVA, a declarative and reactive programming language for adaptive in situ visualization and analysis.

Ascent, a many-core capable flyweight in situ visualization and analysis infrastructure for multi-physics HPC simulations
I created a declarative and reactive programming interface for Ascent, leveraging the capabilities of the DIVA framework.

TopoVol, a computational topology guided volume rendering tool.
I created the first application to utilize the Topology ToolKit. The application was presented in the 2018 IEEE Visualization conference.

qaRay, a distributed CPU path-tracing engine with a Blender plugin.

TransferFunctionModule, a light weighted ImGui widget for transfer function manipulation.