Haojun Qiu

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Education

University of Toronto *Sep 2020 - Jun 2025*
B.Sc. in Computer Science *cGPA 3.98/4.00*
Courseworks: Linear Algebra (MAT240, MAT247), Multivariable Calculus (MAT237), Geometry of Curves and Surfaces (MAT363), Probability (STA347), Statistics (STA261), Numerical Methods (CSC336), Computer Graphics (CSC317), Computer Vision (CSC320), Imaging (CSC2529), Machine Learning (CSC311, CSC412), Deep Learning (CSC413, MAT1510), Enriched Data Structure (CSC265), Algorithm (CSC373)

Research Interest

Diffusion models, generative modeling, inverse problems in vision, video world models, internal learning, computational imaging, 3d geometry, and scene representation.

Publications

H. Qiu, K. N. Kutulakos, D. B. Lindell
"Efficient and Training-Free Single-Image Diffusion Models." Under review, 2025.

Research Experience

Waabi *Toronto, ON*
Researcher, Sensor Simulation & World Model Team *Sep 2025 – Present*
Topics: scene representation, volume rendering, 3d semantics
(1) Extended a voxel-based volumetric scene representation by adding a semantic 3d field storing per-voxel logits for multiple semantic classes, and implemented its volume-rendering for image space semantic supervision.
(2) Explored design and training variants for less noisy 3d semantic representation, including piece-wise constant fields for robustness under incomplete supervision, geometry-adaptive querying to reduce noise, and opacity-based filtering to remove floaters.
(3) Improved scene completeness and cross-view consistency by incorporating multi-camera supervision across truck-mounted sensors.

University of Toronto, Toronto Computational Imaging Group Toronto, ON
Advisors: Prof. David Lindell & Prof. Kyros Kutulakos *Sep 2024 - Nov 2025*
Topics: *closed-form diffusion models, internal learning*
(1) Led a project on a training-free single-image diffusion model using a closed-form patch-based denoiser, enabling high-quality outputs within ~1 second per sample.
(2) Applied the method to text-guided style transfer, structural analogy, image symmetrization, and image retargeting.
(3) Paper under review.

MIT Summer Geometry Initiative *Remote*
Advisors: Prof. Justin Solomon, Dr. Bailey Miller, Dr. Sina Nabizadeh *Jul 2025 – Aug 2025*
Topics: monte carlo geometry processing, heat diffusion, fluid simulation
(1) Developed harmonic-function mixture control variates for Monte Carlo geometry processing, achieving ~40% variance reduction with minimal runtime overhead. See 🔗 blog post
(2) Implemented and analyzed a numerically stable log-space heat diffusion ODE for geodesic-distance computation on meshes. See 🔗 blog post.
(3) Built divergence-free Gaussian-mixture velocity fields for fluid simulation. See 🔗 blog post.

Stanford University, CogAI Group Stanford, CA
Advisors: Prof. Jiajun Wu & Dr. Elliott Wu *Jun 2024 - Aug 2024*
Topics: *video diffusion models, motion generation, score distillation sampling*
(1) Fine-tuned the OpenSora video diffusion model on synthetic datasets, implemented differentiable 2d/3d renderers in PyTorch3D, implemented score distillation sampling for VDM by extending on three-studio.
(2) Designed an incremental optimization scheme that mitigates the vanishing gradient-issue for large translations.

University of Toronto, Toronto Computational Imaging Group Toronto, ON
Advisors: Prof. Kyros Kutulakos & Prof. David Lindell *May 2022 - May 2024*
Topics: *internal learning, diffusion models, inverse problems in imaging*
(1) Modeled neighboring patch and their spatial relationship (e.g., scale and displacement) from a single image with regression approach for image denoising, and super-resolution (see 🔗 report).
(2) Modeled the same mappings as conditional distributions using diffusion models (see 🔗 slides).
(3) Discovered the equivalence between Gaussian kernel regression & conditional generative modeling trained by Gaussian noised conditioning during memorization stage (see 🔗 slides).

Projects

Fast Textual Inversion with Supreme Intialization (see 🔗 report) *Winter 2023*
Improved the convergence speed of Textual Inversion through multi-tokens initialization and better token initialization by out-of-shelf captioning model.

Technical Skills

Programming: Python, C, C++, Bash
Machine Learning: PyTorch, diffusers, FAISS, PyTorch3D, scikit-learn, Lightning
Tools: Git, Linux, SLURM, FFmpeg, `wandb`, Gradio
Other: LaTeX, Markdown, VSCode, Jupyter, Conda, YAML

TA Experience

CSC320: Introduction to Visual Computing, University of Toronto *Winter 2024*
Teaching Assistant for Prof. Kyros Kutulakos. Graded assignments/exams and ran tutorials.

Honors and Awards

The Dorothy Walters Scholarship *2025*
Woodsworth College, University of Toronto — awarded $1,000 for academic excellence.

Nora Kathleen Gillies Scholarship *2023*
Woodsworth College, University of Toronto — awarded $300 for academic excellence.

Alexander T. Fulton Scholarship in Computer Science *2022*
Faculty of Arts and Science, University of Toronto — awarded $400 for academic excellence.

Dean's List Scholar *2021–2023, 2025*