

# Yumeng He

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## RESEARCH INTERESTS

My research interests are in computer vision, computer graphics, and robotics, with a focus on image, video, and 3D/3DGS generation and understanding, physics-based simulation, real-to-sim pipelines, and policy learning.

## EDUCATION

### University of Southern California

Master of Science

Aug 2024 – May 2026

Los Angeles, CA, USA

- Cumulative GPA: 3.83/4.0
- Computer Science major
- Selected Coursework: Computer Graphics, Computer Animation and Simulation, 3D Graphics and Rendering

### University of Toronto St. George Campus

Honours Bachelor of Science with High Distinction

Sep 2019 – May 2024

Toronto, ON, Canada

- Cumulative GPA: 3.71/4.0
- Computer Science and Mathematics double major
- Selected Coursework: Calculus I & II, Linear Algebra I & II, Ordinary Differential Equations, Abstract Mathematics, Complex Variables, Number Theory, Machine Learning, Artificial Intelligence

## PUBLICATIONS AND MANUSCRIPTS

- [1] **Yumeng He**, Ying Jiang, Jiayin Lu, Yin Yang, Chenfanfu Jiang. *SPARK: Sim-ready Part-level Articulated Reconstruction with VLM Knowledge*. arXiv, 2025.
- [2] Ying Jiang, Jiayin Lu, Yunuo Chen, **Yumeng He**, Kui Wu, Yin Yang, Chenfanfu Jiang. *Birth of a Painting: Differentiable Brushstroke Reconstruction*. arXiv, 2025.
- [3] Zhenlian Miao, Guangzhu Chen, Xiaojuan Liao, Jiu Dai, **Yumeng He**. *Self-supervised dual-layer 2D normalizing flow method for industrial anomaly detection*. Applied Soft Computing (ASOC), 2024.

## RESEARCH EXPERIENCE

### USC Graphics | Master Thesis

Supervisor: Prof. Jernej Barbic

Aug 2025 – present

Los Angeles, CA, USA

- Enhancing traditional Kirchhoff–Love shell models by introducing a novel elastic energy formulation that accurately captures stretching, compression, and bending, while overcoming KL shells’ inability to reproduce Poisson effects

### UCLA AIVC Lab | Visiting student

Supervisor: Prof. Chenfanfu Jiang

Jun 2025 – present

Los Angeles, CA, USA

- Leading research on end-to-end articulation-aware 3D mesh generation, designing a pipeline that synthesizes multi-part objects from text or image conditions while mitigating over-segmentation via per-part image-guided local attention
- Performing joint optimization post-generation to infer plausible URDFs, enabling deployment in embodied simulation environments and supporting per-part texturing for visual realism and downstream manipulation compatibility

### USC RESL Lab | Research Assistant

Supervisor: Prof. Gaurav S. Sukhatme

Jul 2025 – present

Los Angeles, CA, USA

- Designed a few-shot robotic manipulation task that uses Model Predictive Control to optimize material parameters for physically accurate simulation
- Led the Real2Sim pipeline for this project, building a digital twin from a single RGB D image of a cluttered tabletop scene with object segmentation, mesh reconstruction, and pose, scale, and placement estimation, and importing the reconstructed scene into ManiSkill3 for simulation

### CDUT | Research Assistant

Supervisor: Prof. Guangzhu Chen

May 2023 - Aug 2023

Remote

- Faced with unlabeled industrial defects on MVTec AD and tasked to raise unsupervised detection/localization accuracy, proposed SS-DualFlow: a dual-layer 2D normalizing-flow that maps features to a Gaussian base to curb information loss and inserts an Exponential Space Attention module to focus on anomaly-salient regions. Result: image-level AUROC = 99.38% and pixel-level AUROC = 98.38% on MVTec AD; co-authored the Applied Soft Computing (2024) paper.

## RELEVANT PROJECTS

<b>Incompressible Fluid Simulation: A Comparison</b>   C++, OpenGL	Spring 2025
<ul style="list-style-type: none"> <li>Implemented and benchmarked four 2D incompressible fluid solvers, including Stable Fluids, Smoothed Particle Hydrodynamics (SPH) , Particle In Cell (PIC) and Affine Particle In Cell (APIC) on identical scenarios, reporting performance-vs-accuracy trade-offs.</li> </ul>	
<b>Collision Detection with Penalty Method and IPC</b>   C++	Spring 2025
<ul style="list-style-type: none"> <li>Built a physically accurate 3D jello cube simulator using a mass-spring system with structural, shear, and bend springs to model real-world deformation under force</li> <li>Implemented penalty-based collision detection to handle interactions with static obstacles, including inclined planes and spheres, ensuring realistic response under contact</li> <li>Upgraded basic collision logic with Incremental Potential Contact (IPC), reducing interpenetration to below <math>1e - 4</math> relative gap across 1,000+ simulation steps, effectively achieving zero visible penetration and stable behavior</li> </ul>	
<b>Inverse Kinematics with Skinning</b>   C++	Spring 2025
<ul style="list-style-type: none"> <li>Implemented Linear Blend Skinning and Dual Quaternion Skinning for 3D character deformation with smooth, realistic joint articulation</li> <li>Built an end-to-end FK–IK pipeline, supporting forward kinematics for pose propagation and inverse kinematics under joint constraints</li> <li>Developed and compared multiple IK solvers, including pseudoinverse least squares and damped least squares via Tikhonov regularization, improving numerical stability</li> </ul>	
<b>Motion Capture Interpolation</b>   C++	Spring 2025
<ul style="list-style-type: none"> <li>Implemented four interpolation schemes (incl. linear &amp; Bézier) with both Euler- and quaternion-based rotations to reconstruct and smooth optical mocap, mitigating gimbal lock and interpolation artifacts</li> <li>Generated natural, continuous transitions across keyframes for high-dimensional skeletal animation</li> </ul>	
<b>Ray Tracing</b>   C++, Rendering	Fall 2024
<ul style="list-style-type: none"> <li>Built a modular ray tracer with Phong shading, shadow rays, and recursive reflections, supporting both spheres and triangle meshes</li> <li>Added supersampling, soft shadows via area lights, and Möller–Trumbore intersection, achieving realistic visuals while balancing quality and performance</li> </ul>	

## INDUSTRY EXPERIENCE

<b>Software Developer Intern</b>   Full Time	Aug 2022 – Aug 2023
<i>HCL Canada Inc.</i>	<i>Toronto, ON, Canada</i>
<ul style="list-style-type: none"> <li>Automated build and deployment pipelines using Jenkins, accelerating production releases and minimizing manual errors by eliminating key bottlenecks in CI/CD</li> <li>Containerized microservices for x86_64 (xLinux) and IBM PowerPC (pLinux) architectures, enabling architecture-agnostic builds and consistent, scalable deployments</li> <li>Integrated SonarQube into the pipeline, authored a usage guide and presented it to cross-functional teams, and improved code quality by resolving 3 critical bugs and 308 code smells, including 4 blockers and 41 major issues</li> </ul>	

## COMMUNITY SERVICES

Member of Society of Women Engineers (SWE)	2025 - 2026
Mentor for Viterbi Graduate Mentorship Program	Fall 2025
Mentor for Women in Engineering Mentorship	Fall 2025
Mentor for Viterbi Graduate Mentorship Program	Summer 2025

## INVITED TALKS

<ul style="list-style-type: none"> <li><i>MPC Is All You Need.</i> [Co-presented]. USC SLURM Lab, hosted by Prof. Daniel Seita</li> </ul>	Aug 2025
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## AWARDS & HONORS

Dean’s List Scholar	2020 - 2024
Ranked in the top 25% of contestants in the Galois Contest	2017
Ranked in the top 25% of contestants in the Cayley Contest	2017
Ranked in the top 25% of contestants in the Canadian Intermediate Mathematics	2016

## TECHNICAL SKILLS

<ul style="list-style-type: none"> <li><b>Programming Tools:</b> Linux, Windows, MacOS, C++, Python, HTML, CSS, JavaScript, MySQL, R, OpenGL, GLSL, Eigen, Docker, Jenkins, Gradle, Ant, Shell, Git, Github Actions</li> </ul>	
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