Yutong Zhang

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Education

University of California San Diego — La Jolla, USA
M.S. in Computer Science; ***GPA: 4.00/4.00*** — *Sep. 2022 – Expected Jun. 2024*
B.S. in Computer Science and Mathematics; ***GPA: 3.95/4.00*** — *Sep. 2018 – Jun. 2022*

Research Interest

My current research focuses on applying differentiable physics simulation to deformable object manipulation in robotics. I have a broader interest in autonomous robot manipulation through optimization and computational physics, along with a strong curiosity about integrating data-driven learning techniques for enhanced robustness.

Research Experience

Advanced Robotics and Contorls Lab — La Jolla, USA
Student Researcher, advised by Prof. Michael Yip — *Mar. 2021 – present*

- Developed a visualization program in C++ and OpenGL to visualize threads, ropes and robot arms.
- Implemented modules to synchronize robot joint status from ROS topics to the visualization program.
- Created a differentiable PBD (position based dynamics) simulator for deformable objects in Python & PyTorch.
- Applied the differentiable simulator to autonoumous cloth manipulation. Formulated the task as a trajectory optimization problem constrained by safety thresholds to prevent undesired collision.
- Collaborated on the real-to-sim problem of soft tissue manipulation in robot surgery. Utilized the differentiable simulator for online optimization of physical parameters to better model soft tissue under actuation.

Publications

† equal contribution

[1] **Yutong Zhang**†, Fei Liu†, Xiao Liang, and Michael Yip. Achieving Autonomous Cloth Manipulation with Optimal Control via Differentiable Physics-Aware Regularization and Safety Constraints. *IEEE International Conference on Robotics and Automation (ICRA), 2024.* ***Under Review*** [arXiv], [video].

[2] Fei Liu†, Xiao Liang†, **Yutong Zhang**, Yuelei Li, Shan Lin, and Michael C. Yip. Real-to-Sim Deformable Object Manipulation: Optimizing Physics Models with Residual Mappings for Robotic Surgery. *IEEE International Conference on Robotics and Automation (ICRA), 2024.* ***Under Review*** [arXiv].

Projects

The Meoze Runner — Homepage, Code
Graphics Developer

- Developed a multiplayer 3D game in C++ and OpenGL with 6 fellow teammates.
- Worked on graphics modules to manage mesh data and render with texture mapping.
- Implemented an efficient 2D OBB (oriented bounding box) collision checking utility for the game server.
- Wrote Python scripts to export collision data from level designs done in Blender to the game server.

Monte Carlo Path Tracer — Report
Developer

- Developed a Monte Carlo Path Tracer in C++.
- Wrote vairous BRDFs including Phong model, GGX microfacet model and Disney Principled BRDF.
- Implemented Russian Roulette techniques and MIS (multiple importance sampling) to reduce noises.
- Extended a Photon Mappiong pass to produce better caustics for transparent objects.

Ready Set Cook — Video, Code
Project Manager

- Led a team of 10 students with different backgrounds and skills.
- Developed a smart recipe mobile application using Fierbase and Flutter SDK.
- Followed agile development practice with weekly meetings, code reviews and detailed design documents.

Tutoring Experience

UC San Diego, CSE 167 Computer Graphics *Jan. 2022 – Mar. 2022*

UC San Diego, CSE 105 Theory of Computation *Mar. 2021 – Jun. 2021*

Skills

Programming Languages: ***Experienced in*** C, C++, Python; ***Familiar with*** MATLAB, Java, Scheme

Frameworks & Libraries: CUDA, Eigen, OpenGL, ImGui, Warp, NumPy, SciPy, PyTorch, Open3D, PyVista

Software Tools: Git, ROS, Bash, Linux, CMake, Docker, LaTeX, Blender, Houdini