Shutong (Tony) Zhang

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Education

University of Toronto Sep 2019 – Jun 2024 (Expected)

Bachelor of Applied Science and Engineering with High Honor

- CGPA: 3.99/4.00, Major GPA: 4.00/4.00, Core Course Average: 93.6 (Top 1%)
- Major in Computer Engineering, minor in Artificial Intelligence

Publications and Papers

[1] **S. Zhang**. NPSim: Nighttime Photorealistic Simulation From Daytime Images With Monocular Inverse Rendering and Ray Tracing. Thesis at ETH Computer Vision Lab (Aiming CVPR 2024). **Link**

[2] **S. Zhang***, Y. Qiao*, G. Zhu*, E. Heiden, D. Turpin, M. Lin, M. Macklin, A. Garg. HandyPriors: Physically Consistent Perception of Hand-Object Interactions with Differentiable Priors.
Short paper accepted by the 2023 Computer Vision and Pattern Recognition Workshop (CVPRW 2023). **Link**
Full paper submitted to the 2024 IEEE International Conference on Robotics and Automation (ICRA 2024)

[3] D. Turpin, T. Zhong, **S. Zhang**, G. Zhu, E. Heiden, M. Macklin, S. Tsogkas, S. Dickinson, A. Garg. Fast-Grasp'D: Dexterous Multi-finger Grasp Generation Through Differentiable Simulation.
Accepted by the 2023 IEEE International Conference on Robotics and Automation (ICRA 2023). **Link**

Research Experience

ETH Zürich - Computer Vision Lab Apr 2023 – Present

Research Assistant supervised by Prof. Luc Van Gool and Dr. Christos Sakaridis

- Designed and implemented NPSim: a data generation pipeline that simulates nighttime images from daytime images with monocular inverse rendering and ray tracing.
- Generated synthetic nighttime dataset from daytime images and preserved their semantic annotations. Achieved 11% performance improvement in nighttime image segmentation performance through training pre-existing models on our dataset.

University of Toronto - Forcolab Apr 2022 – Present

Research Assistant supervised by Prof. Shurui Zhou, with Prof. Jinghui Cheng

- Conducted systematic literature review on collaboration between software development engineers (SEDs) and UX designers (UXDs) through 44 papers and identified four collaboration challenges and six potential best practices.
- Investigated the current state of SDEs and UXDs collaboration challenges by mining four online forums and the VScode GitHub project.

University of Toronto - Vector Institute/PAIR Lab Aug 2022 – Apr 2023

Research Assistant supervised by Prof. Animesh Garg, with Prof. Ming C.Lin

Project: Physics-based Hand-object Pose Estimation

- Designed an integrated differentiable rendering and simulation pipeline to estimate the hand-object interaction, achieved 50% lower object error and 25% lower hand error than the state-of-the-art model.
- Generalized the pipeline to robotic hand manipulation and human-object pose estimation in the wild.
- Proposed a lightweight filtering-based tracking pipeline that uses differentiable priors and an Extended Kalman Filter, takes 2D fingertips location as its only feedback supervision, and achieves a speed of 40 frames per second.

Project: Multi-finger Robot Hand Grasp Generation

- Developed a grasp generation pipeline based on differentiable simulation that is 10x faster than the previous grasp generator "Graspit!", with 10x contact area and 2x epsilon quality.
- Generated DexGrasp-1M dataset of one million unique grasps with multi-modal visual input for vision-based multi-finger robotic grasping using Nvidia Replicator Composer.

University of Toronto - Computer Engineering Research Group May 2021 – Sep 2021

Research Assistant supervised by Prof. Paul Chow

- Developed an FPGA-based Intrusion Detection and Prevention System using C++ and System Verilog that achieved 83 Gbps running on a single FPGA-equipped server.
- Proposed to combine shift-or filter and hash table that speed up string matching stage by 40%.
- Generated TCP and UDP testing traffic with speed up to 100Gbps using Cisco TRex traffic generator.

Work Experience

Intel Corporation - Engineering intern (Full time) May 2022 – Apr 2023

Quality and Execution Team *Software Engineer & Project Manager*

- Developed an auto-triage tool using Perl and MySQL that automatically analyzes test failures and reduces 95% manual efforts.
- Coordinated the development of the OFS 2022.3 (Open FPGA Software) and resolved 100% major issues before launch.

Customer Happiness and User Experience Team *Front-end Engineer*

- Developed a statistic visualization tool using ReactJS and resolved 32 issues, including bug fixes, new feature implementation and performance optimization.
- Redesigned system-viewer - a kernel events visualizer through Gantt charts using React-based graphics engine.
- Implemented a unit testing infrastructure using Jest that covers 75% of the source code.

Core Datapath Compiler Team *Compiler Engineer*

- Improved oneAPI compiler stability by fixing five E1 (major) bugs and 12 E2/E3 bugs.
- Implemented a Bit Manipulation Pass that performs bit shuffle during integer dot product, reduced dot product execution time by 25%.
- Mitigated oneAPI compiler source code vulnerability by performing a coverity scan and successfully resolving 23 identified issues.

University of Toronto - Teaching Assistant (Contract part-time) Sep 2021 – Present

Supervised by Prof. Natalie Enright Jerger and Prof. Jonathan Rose

- Served as teaching assistant for ECE243 Computer Organization (Winter 2022, Winter 2023) and ECE253 Digital and Computer Systems (Fall 2021, Fall 2022).
- Supervised 15 student teams during their design projects, led lab sessions for groups of up to 30 students, conducted office hours, and graded exams.

Academic Activities

Sub-Reviewer for ASE 2022, ECSE/FSE 2023, ICSE 2024.
Invited Talk at ETH Zurich Computer Vision Lab CVL-seminar series on my work NPSim. **Slides**

Selected Projects

Geographic Information System Software Program | *C++* Jan 2021 – Apr 2021

- Developed large-scale Google-maps inspired UI / backend program using C++, HTML, JavaScript and CSS. The program visualizes 35 major cities all over the world.
- Implemented Dijkstra, A* and Simulated-Annealing based heuristics for an NP-C graphing problem (Travelling salesman problem) that reduced the shortest path by 33% on a greedy algorithm basis.
- The proposed algorithm ranked 1 out of 109 teams in the travelling salesman problem-solving competition.

Color war | *C, Assembly* Mar 2021 – Apr 2021

- Designed a two-player competitive game using C and ARM Assembly on an ARMv7 processor that utilized HEX Display, PS2 Keyboard, Pixel Buffer and Interrupt.
- Implemented a physics engine that simulates real-world acceleration and gravity.
- Selected as top 5% projects and received 1% bonus mark.

Awards and Honors

International Experience Award ($3000) May 2023
University of Toronto Summer Research Exchange Fellowship ($3000) Dec 2022
Edith Grace Buchan Undergraduate Research Fellowship ($5400) Apr 2022
Department of Electrical and Computer Engineering Top Student Award Oct 2021
University of Toronto In-Course Scholarship ($1500) Aug 2021
University of Toronto Scholar Aug 2021
University of Toronto Summer Research Fellowship ($5000) May 2021
Deans Honor List 2019 – 2022
Faculty Of Applied Science & Engineering Admission Scholarship ($5000) Sep 2019

Skills

Programming: Python, C/C++, MatLab, Perl, ReactJS, TypeScript, NodeJS, MySQL, ARM Assembly, VHDL
Research Skills: Pytorch, Tensorflow, Docker, Nvidia Isaac Sim, Graspit!, Git, Linux, Slurm
Softwares and Tools: Microsoft Office Suite, PhotoShop, LaTeX, Figma, Quartus, ModelSim, Wireshark
Language: English (fluent), Mandarin (native)