# Shutong 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(Top 1%), Major GPA: 4.00/4.00, Core Course Average: 93.6
- Major in Computer Engineering, minor in Artificial Intelligence and Engineering Business
- Core Courses: Computer Organizations, Software Communication and Design, Introduction to Databases, Introduction to Machine Learning, Applied Fundamentals of Machine Learning, Probability and Applications, Algorithms and Data Structures, Computer Networks, Computer Graphics, Deep Learning for Computer Vision(CS231n), Advanced Robotics(CS287), Differentiable Geometry for Computer Science

**ETH Zürich** May 2023 – Aug 2023

*Mobility Student - Dept. of Information Technology and Electrical Engineering*

## Publications

[1] Y. Qiao*, **S. Zhang***, 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). **paper**
Full-paper Under Review at the International Conference on Computer Vision 2023 (ICCV 2023). **project page**
(* equal contribution)

[2] 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). **project page**

## Research Experience

**ETH Zürich - Computer Vision Lab** Apr 2023 – Present

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

- Design and implemented a general neural network and physically-based pipeline utilizing inverse rendering and ray tracing for photorealistic nighttime simulation on single real daytime images.
- Generated synthetic nighttime dataset from a real daytime driving dataset and automatically converted segmentation labels. Achieved 11% performance improvement on nighttime image segmentation by training existing models on our dataset.
- Working on a paper that will submit to **CVPR 2024**.

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

*Research Assistant supervised by Professor Animesh Garg*

***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, the dataset contains RGB image, depth, instance segmentation and 2D/3D bounding box.
- Co-authored a paper that is accepted by **ICRA 2023**.

***Project: Physics-based Hand-object Pose Estimation***

- Designed an integrated differentiable rendering and simulation pipeline to estimate the hand-object interaction, the pipeline achieved 50% lower object error and 25% lower hand error than the state-of-the-art model. Our pipeline can also be generalized to robotic hand manipulation and human-object pose estimation in the wild.
- Proposed a light-weighted filtering-based tracking pipeline that uses differentiable priors and Extended Kalman Filter, the tracking pipeline takes 2D fingertips as only feedback supervision and achieved 40 frames/second.
- Authored a paper that is under review at **ICCV 2023**.

**University of Toronto - Forcolab** Apr 2022 – Aug 2022

*Research Assistant supervised by Professor Shurui Zhou*

- Investigated collaboration challenges between software developers and UX designers through Gitlab and VScode open-source projects.
- Conducted Systematic Literature Review on SE and UX collaboration challenges through 5,000 papers from 5 online digital libraries.
- Working on a paper that will submit to **CSCW 2024**.

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

*Research Assistant supervised by Professor 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, the tool reduced 95% of the manual efforts.
- Managed the development of the OFS 2022.3(Open FPGA Software), resolved 100% major issues before launch.

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

- Developed a compiled independent static analysis tool using Typescript and ReactJS, 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 Data path Compiler team*** *Compiler Engineer*

- Improved oneAPI compiler stability by fixing five major E1 bugs two weeks prior to the code complete date.
- 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 Professor Natalie Enright Jerger and Professor Jonathan Rose*

- ECE243 Computer Organization - Winter 2022, Winter 2023
- ECE253 Digital and Computer System - Fall 2021, Fall 2022

## Academic Service

**Sub-Reviewer** for ASE 2022, ECSE/FSE 2023, ICSE 2024.

## Selected Projects

**Face-mask Detector** | *Python* Oct 2021 – Dec 2021

- Designed a human face detecting and tracking pipeline using OpenCV and Kalman filter.
- Implemented a face mask detection model using VGG-16 Convolutional Neural Network, the model achieved a testing accuracy of 97.7% on real-world data.

**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 over the world.
- Implemented Dijkstra, A* and Simulated-Annealing based heuristics for an NP-C graphing problem(Travelling salesman problem). The algorithm 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, the program utilizes 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.

## Extracurricular

**UTACE - University of Toronto Association of Chinese Engineers** Sep 2020 – Present
*Events Department Leader, Mentor*

- Mentored lower-year students, shared personal experience with them, as well as provided guidance, motivation and emotional support.
- Organized and planned events, including lectures with over 200 audiences, knowledge competitions, workshops and hackathons with club members.
- Managed the events department with 10 members and held bi-weekly meetings, coordinated with the marketing, public relations and human resources department.

## 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 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(Excellent listening, speaking, reading and writing abilities), Mandarin(Native)