Matthew Strong

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Education

University of Colorado Boulder Boulder, CO

Bachelor of Science in Computer Science, Chinese Minor, 4.00 GPA *Aug. 2017 – May 2021*

Experience

Undergraduate Researcher - Roboskin January 2020 – Present

HIRO (Human Interaction and RObotics Group) Group, CU Boulder *Boulder, CO*

- Devised a kinematic calibration algorithm estimating the pose of a flexible sensory skin on a robot.
- Outperformed current best methods via a 4x increase in accuracy, and 4x decrease in optimization time.
- Setup the core codebase for robotic manipulator control with Robot Operating System (ROS), both in simulation and on the physical robot.
- Future work: null space control (which concerns the possible space of joints while a robot maintains its desired end-effector trajectory) informed by robotic skin for collaborative robotics, funded by an university research grant.
- **Publications**: Kandai Watanabe, **Matthew Strong**, Mary West, Caleb Escobedo, Ander Aramburu, Krishna Chaitanya, Alessandro Roncone. Self-Contained Kinematic Calibration of a Novel Whole-Body Artificial Skin for Collaborative Robotics, *International Conference on Robotics and Automation 2021.* Under Review.
- Caleb Escobedo*, **Matthew Strong***, Ander Aramburu, Mary West, Alessandro Roncone. Human Informed Robotic Arm Collaborative Control for Safe Human-Robot Interaction, *Robotics: Science and Systems 2021.* In Progress.
- **Mentors**: Caleb Escobedo, Kandai Watanabe, CS PhD students.

Undergraduate Researcher - Efficient Hierarchical Reinforcement Learning Jun. 2020 – Present

HIRO Group, CU Boulder *Boulder, CO*

- Built on top of a state of the art Hierarchical Reinforcement Learning method by improving training time to complete complex locomotion tasks 2-4 times faster.
- Created a Python package for housing the HIRO group's gym-based robotic environments.
- Developed and designed baseline HRL agent in a new RL Pytorch-based framework.
- **Publications**: Kandai Watanabe, **Matthew Strong**, Omer Eldar, Alessandro Roncone. SHIRO (Soft Hierarchical Reinforcement Learning With Off Policy Correction). *Robotics: Science and Systems.* In Preparation.
- **Mentor**: Kandai Watanabe, CS PhD student.

Software Engineer Intern - Journey Optimization using RL May 2020 – August 2020

Microsoft, Customer Experience Platform (CXP) *Remote - Broomfield, CO*

- Worked on the CXP team, deploying a real-time analytics service for retrieving customer data.
- Finished original internship goals in half of the expected time, moving onto the creation of the AI service.
- Designed and developed a feature from scratch called journey optimization, which intelligently guides a customer through the "customer journey", using reinforcement learning.
- Worked with the AI team and researchers on which model to use, and how to integrate it, end-to-end.
- Used C#, .NET, Typescript, Azure DevOps.

Undergraduate Researcher - Franka Panda Cartesian Control September 2019 – December 2019

HIRO Group, CU Boulder *Boulder, CO*

- Developed a ROS package that allows for Cartesian-based control of the Franka Panda, a 7 degree of freedom (DOF) robot arm.
- Integrated a state of the art inverse kinematics solver, Trac-IK (99.88 percent solve rate on the Panda), in C++.
- Devised a novel method for trajectory planning via a double Catmull-Rom Spline, using only joint positions.
- Validated on a real robot.
- **Mentor**: Chi-Ju Wu, MS Student, now at Zoox.

Undergraduate Researcher - Energy Simulation via Machine Learning January 2018 – present

SBS (Sustainable Buildings and Societies) Lab, CU Boulder *Boulder, CO*

- Developed an automatic energy building simulation pipeline for testing energy usage of different building models.
- Integrated ML algorithms to avoid using expensive energy simulations.

- Wrote Ruby code for different measures to apply to simulated buildings.
- **Publications**: Yunyang Ye, Yingli Lou, **Matthew Strong**, Satish Upadhyaya, Wangda Zuo, Gang Wang 2020. "Development of New Baseline Models for US Medium Office Buildings Based on Commercial Buildings Energy Consumption Survey Data." Science and Technology for the Built Environment, pp. 1-19.
- Yunyang Ye, Yingli Lou, **Matthew Strong**, Wangda Zuo, 2020. "GANs for Energy Modeling." Submitted.
- **Mentors**: Yunyang Ye, Yingli Lou, Civil Engineering PhD students.

Undergraduate Researcher - Fast Airflow Simulation Using HPC August 2020 – December 2020
SBS Lab, CU Boulder *Boulder, CO*

- Designed and developed pipeline for testing Indoor Airflow simulations on HPC (high performance computing) within the CU Supercomputer ecosystem.
- Integrated simulation code to work on both GPU-based and CPU-based clusters.
- **Mentor**: Cary Faulkner, Civil Engineering PhD student.

CTO and Co-Founder - Udana Systems February 2018 – May 2020
Udana Systems *Boulder, CO*

- Co-Founded company targeted towards drone delivery for small to medium sized businesses.
- Designed and developed robotics tech stack, using ROS, MavROS, Gazebo, PyTorch, and more.
- Developed machine learning pipeline for computer vision based models.

Software Engineer Intern - Global Search May 2019 – July 2019
Microsoft, Dynamics 365 for Talent *Redmond, WA*

- Designed and developed the Global Search feature for Microsoft Dynamics 365 for Talent.
- Worked with .NET, Angular, and XML in order to successfully deploy an end-to-end feature.

Awards

CRA Outstanding Undergraduate Researchers 2021 – Honorable Mention December 2020

- Received honorable mention for the CRA Outstanding Researchers award, the most prestigious award for CS undergraduate researchers in all of North America.

UROP Research Grant: Null Space Control for Collaborative Robotics August 2020 – Present

- Received $1500 research grant from CU Boulder's Undergraduate Research Opportunities Program (UROP) to perform research on null space control.

Sewall Scholar August 2017 – Present

- The top merit scholarship at CU Boulder.

Engineering Merit Scholarship August 2017 – Present

- Received based on high school academic performance.

BOLD Scholarship August 2017 – Present

- Received diversity scholarship based on high school achievement.

National Merit Scholar August 2017

- Selected to receive National Merit Scholarship on basis of outstanding high school achievement.
- Given to <1% of high school seniors in the US.

Service/Leadership

HackCU August 2018 – Present

- Led HackCU's tech team, organizing the largest hackathon in the Rocky Mountain region.
- Managed whole tech stack during 500+ person hackathon.
- Developed hacker sites and APIs accessed by thousands of people across the nation and globe.
- Handled 1000+ hacker applications.
- Currently serving as technical advisor.

Slingshot Tutor and Engineer June 2020 – Present

- Serving as a mentor for students from top high schools interested in CS at Slingshot, a startup co-founded by students from top tech companies.

- Developed website https://slingshotmentoring.com/) in order to attract students.
- Conducting interviews for top tier high school students.

High School CS Tutor June 2020 – December 2020

- Tutoring a student from Legacy High School on a full-stack web app.
- Supervising the development of a chat app using React and .NET.

Discrete Structures Tutor January 2019 – May 2019

- Mentored student in discrete structures.
- Set homework and test-prep deadlines, and prepared practice problems.

SASE (Society of Asian Scientists and Engineers) Leadership January 2018 – May 2018

- Served as Co-Marketing Director and managed social media pages.

Membership

Colorado Data Science Team August 2019 – Present

SHPE (Society of Hispanic Professional Engineers) August 2019 – Present

SASE (Society of Asian Scientists and Engineers) August 2017 – August 2019