

ANDREW SANG-JIN CHOI

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Website <https://quantumope.github.io>

Code <https://github.com/QuantuMope>

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EDUCATION

Research Interests: **robotics, sim2real, physical simulation, robot learning & vision**

Doctor of Philosophy, Computer Science

Sept. 2021 – Dec. 2023

Major: Graphics & Vision | Minors: Robotics & Artificial Intelligence

GPA: 4.0/4.0

University of California, Los Angeles

Advisors: M. Khalid Jawed, Jungseock Joo, and Demetri Terzopoulos

Ph.D. Thesis: *Simulation of Deformable Objects for Sim2Real Applications in Robotics*

Master of Science, Computer Science

Sept. 2019 – June 2021

University of California, Los Angeles

GPA: 4.0/4.0

M.S. Thesis: *An Implicit Contact Method for Tying Discrete Elastic Knots*

Bachelor of Science, Mechanical Engineering

Sept. 2014 – June 2018

University of California, Davis

GPA: 3.8/4.0

Senior Design: *Underactuated Shoe Tying Manipulator*

Top 6% in College of Eng.

SUBMITTED & IN-PROGRESS PUBLICATIONS

- RA-L 2023 **A. Choi**, R. Jing, A. Sabelhaus, and M. K. Jawed. “DisMech: A Discrete Differential Geometry-based Physical Simulator for Soft Robots and Structures”, *IEEE Robotics and Automation Letters*, 2023 (**in review and on arXiv**)
- T-ASE 2023 **A. Choi***, D. Tong*, D. Terzopoulos, J. Joo, and M. K. Jawed. “Learning Neural Force Manifolds for Sim2Real Robotic Symmetrical Paper Folding”, *IEEE Transactions on Automation Science and Engineering*, 2023 (**in review and on arXiv**)

PUBLICATIONS

- IJRR 2023 D. Tong, **A. Choi**, W. Huang, L. Qin, J. Joo, and M. K. Jawed. “Sim2Real Neural Controllers for Physics-Based Robotic Deployment of Deformable Linear Objects”, *International Journal of Robotics Research*, 2023
- RA-L 2023 **A. Choi**, D. Tong, B. Park, D. Terzopoulos, J. Joo, and M. K. Jawed. “mBEST: Realtime Deformable Linear Object Detection Through Minimal Bending Energy Skeleton Pixel Traversals”, *IEEE Robotics and Automation Letters*, 2023
- EML 2023 D. Tong*, **A. Choi***, J. Joo, and M. K. Jawed. “A Fully Implicit Method for Robust Frictional Contact Handling in Elastic Rods”, *Extreme Mechanics Letters*, 2023
- JAM 2023 D. Tong, **A. Choi**, J. Joo, A. Borum, and M. K. Jawed. “Snap Buckling in Overhand Knots”, *Journal of Applied Mechanics*, 2022
- ICRA 2022 **A. Choi**, M. K. Jawed, and J. Joo. “Preemptive Motion Planning for Human-to-Robot Indirect Placement Handovers”, *IEEE International Conference on Robotics and Automation (ICRA)*, 2022
- WACV 2022 A. Vepa, **A. Choi**, N. Nakhaei, W. Lee, et al. “Weakly-Supervised Convolutional Neural Networks for Vessel Segmentation in Cerebral Angiography”, *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2022
- JAM 2021 **A. Choi**, D. Tong, M. K. Jawed, and J. Joo. “Implicit Contact Model for Elastic Rods in Knot Tying”, *Journal of Applied Mechanics*, 2021

* **Equal Contribution**

PRESENTATIONS

- APS 2023 **A. Choi**, D. Tong, D. Terzopoulos, J. Joo, and M. K. Jawed. “Deep Learning Force Manifolds from the Physical Simulation of Robotic Paper Folding”, *Bulletin of the American Physical Society*, 2023
- APS 2023 D. Tong, **A. Choi**, J. Joo, and M. K. Jawed. “An Implicit Simulation Framework to Handle Frictional Contact in Elastic Rods”, *Bulletin of the American Physical Society*, 2023

ACADEMIC EXPERIENCES

Graduate Student Researcher

UCLA, Structures-Computer Interaction Lab

Los Angeles, California

Jan. 2020 – Present

Advisors: Mohammad Khalid Jawed & Jungseock Joo & Demetri Terzopoulos, UCLA

- Perform research in the general intersection of robotics, simulations, and learning with a focus on sim2real problems.
- Key research areas include #1) developing physically accurate simulations for deformable materials / soft robots, #2) developing sim2real solutions for robotic manipulation of deformable materials, and #3) developing automated robotic solutions for 3D reconstruction of objects / scenes.

Teaching Assistant for CS32: Introduction to Computer Science II (In-Person)

UCLA, Computer Science Department

Los Angeles, California

Jan. 2023 – March 2023

Instructor: David Smallberg, UCLA

- Taught students how to employ object-oriented programming to build large programs as well as a variety of fundamental data structures and algorithms in C++.
- Held office hours and led discussion sessions consisting of 43 students.
- Received a TA evaluation score of 8.0/9.0 with 19/43 (44.2%) survey participation.

Teaching Assistant for CS31: Introduction to Computer Science I (Online)

UCLA, Computer Science Department

Los Angeles, California

Summer of 2022

Instructor: Howard Stahl, UCLA

- Taught students fundamental concepts and principles of CS as well as general programming principles in C++.
- Held office hours and led discussion sessions consisting of 85 students.
- Received a TA evaluation score of 8.6/9.0 with 9/85 (10.6%) survey participation.

Robotics Senior Design Presentation

Meijo University, Robotics Department

Nagoya, Japan

Summer of 2018

Advisor: Jason K. Moore, UC Davis (now at TU Delft)

- Fully funded trip to present the design theory and findings of underactuated shot tying robot manipulator to robotics students and professors of Meijo University.
- Acted as a mentor to students completing their own robotics senior design projects. Provided technical guidance and feedback and partook in culture exchange programs.

Undergraduate Researcher

UC Davis, Green Technology Lab

Davis, California

April 2017 – June 2018

Advisor: Masoud Rahman, UC Davis

- Performed economic analysis on different energy management techniques for various battery systems.
- Modeled the energy parameters of residential and commercial communities using behavioral survey data, load data, PV generation data, etc. to calculate optimal battery sizing.

INDUSTRY EXPERIENCES

Graduate Robotic Software Intern

Vecna Robotics, Research & Advanced Development Division

Waltham, Massachusetts

Summer of 2021

Advisors: Siddharth Chhaptar & Magnus Snorrason

- Created an end-to-end robotic solution for autonomous refueling of self-driving warehouse vehicles using a 4DOF serial robot manipulator. Achieved a 99.6% success rate for a client specification of 98%.
- Created hydrogen fuel cell nozzle pose estimation and plane segmentation module using Aruco and RANSAC.
- Carried out motion trajectories using velocity control and inverse Jacobian method for the inverse kinematics.
- Designed the control flow pipeline, control & recovery states, and algorithms for the refueling action.
- Created autonomous testing pipeline and GUI for the autonomous refueling framework with the robot arm and mobile vehicle communicating to each other through server connection.
- Researched and implemented an open-source eye-in-hand hand-eye calibration module using dual quaternions for 4DOF manipulators.
- Created URDF models through Xacro for omnidirectional mobile forklift.
- Derived omnidirectional kinematics and created ROS plugin for Gazebo simulations. Solved inverse kinematics using a constraint-based optimization approach.

Control Systems Engineer

Brock Solutions

Los Angeles, California

Nov. 2018 – July 2019

- Programmed and debugged the programmable logic controllers (PLCs) that control the various actuators and sensors of the automated LAX baggage handling systems.
- Maintained human machine interfaces that display live system status in a high-stakes real time environment.
- Interfaced with real-time database applications to manage critical production information for airline clients.

R&D Engineering Intern

World Surf League (Kelly Slater Wave Company)

Advisor: Adam Fincham, USC

Culver City, California

Summer of 2017

- Collected and stored data from test runs that led to the world's first artificial 6-foot barreling surf wave.
- Installed, programmed, and maintained pressure sensors, strain sensors, cameras, drones, and velocimeters.
- Performed force calculations for safety structures and managed the ordering of necessary materials/tools.

HONORS & ACHIEVEMENTS

1. Senior Design Robotics Television Broadcast	CBS/NBC, 2018
2. Meijo University Travel Grant	UC Davis, 2018
3. Magna Cum Laude <i>Top 8% in College of Eng.</i>	UC Davis, 2018
4. UC Davis / Meijo University Annual Robotics Competition Winner	UC Davis, 2018
5. Engineering Dean's List <i>Top 16% in College of Eng. 10 out of 12 quarters</i>	UC Davis, 2014 - 2018
6. H. and G. Smith Undergraduate Scholarship <i>Based on scholastic potential</i>	UC Davis, 2015

SKILLS

Programming Languages	C/C++, Python, Java, MATLAB
Software Tools and Environments	ROS, Linux, Bash, Git/Github, L ^A T _E X, Unity
Libraries	NumPy, OpenCV, MoveIt, SciPy, SymPy, PyTorch, TF2/Keras
Prototyping	Arduino, Beaglebone, Raspberry Pi, 3D Printing, SOLIDWORKS
Spoken Languages	Bilingual English & Korean, Spanish (Limited Working Proficiency)

COURSEWORK

Math & Probability: Linear Algebra, Differential Equations, Probabilistic Systems Analysis

Robotics & Engineering: Electrical Circuits & Systems, Dynamics, Mechanical Design, Automatic Control of Engineering Systems, Simulation & Design of Mechatronic Systems, Measurement Systems, Vehicle Stability, Kinematics of Robotic Systems, Computational Robotics, Deformable Simulations for Soft Robotics

Computer Science & Machine Learning: Data Structures, Software Construction, Computer Organization, Operating Systems Principles, Programming Languages, Computer Network Fundamentals, Algorithms & Complexity, Machine Learning Algorithms, Machine Learning in Genetics, Pattern Recognition, Deformable Models in Computer Vision, Reinforcement Learning, Artificial Life in Computer Graphics & Vision, Human-centered AI