ANDREW SANG-JIN CHOI

Email asjchoi@cs.ucla.edu   **Code** https://github.com/QuantuMope
Website https://quantumope.github.io   **Google Scholar** https://tinyurl.com/quantumope

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

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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

T-ASE 2024   **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

RA-L 2024   **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*, 2024

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 2024   R. Lahoti, **A. Choi**, and M. K. Jawed. "DiSMech: A Simulator for Soft Robots and Flexible Structures based on Discrete Differential Geometry", *Bulletin of the American Physical Society*, 2024

APS 2024   G. Wang, D. Tong, and **A. Choi**. "Computer Graphics Inspired Fast Simulation of Knots and Tangles", *Bulletin of the American Physical Society*, 2024

| 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 — Los Angeles, California
UCLA, Structures-Computer Interaction Lab — 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) — Los Angeles, California
UCLA, Computer Science Department — 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) — Los Angeles, California
UCLA, Computer Science Department — 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 — Nagoya, Japan
Meijo University, Robotics Department — 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 — Davis, California
UC Davis, Green Technology Lab — 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 — Waltham, Massachusetts
Vecna Robotics, Research & Advanced Development Division — Summer of 2021
Advisors: Siddharth Chhaptar & Magnus Snorrasen

- 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 Los Angeles, California
Brock Solutions 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 Culver City, California
World Surf League (Kelly Slater Wave Company) Summer of 2017
Advisor: Adam Fincham, USC

- 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** *Top 8% in College of Eng.* UC Davis, 2018
4. **UC Davis / Meijo University Annual Robotics Competition Winner** UC Davis, 2018
5. **Engineering Dean's List** *Top 16% in College of Eng. 10 out of 12 quarters* UC Davis, 2014 - 2018
6. **H. and G. Smith Undergraduate Scholarship** *Based on scholastic potential* UC Davis, 2015

SKILLS

Programming Languages	C/C++, Python, Java, MATLAB
Software Tools and Environments	ROS, Linux, Bash, Git/Github, LaTeX, 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