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 - Present
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

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.

IN-PROGRESS FIRST AUTHOR PROJECTS

- Motion planning for robotic knot tying via simulation generated inverse unraveling (*co-first*)
- Active learning for efficient 3D reconstruction via NERF models (*co-first*)

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-progress***)
T-ASE 2023	**A. Choi***, D. Tong*, D. Terzopoulos, J. Joo, and M. K. Jawed. "Deep Learning of Force Manifolds from the Simulated Physics of Robotic Paper Folding", *IEEE Transactions on Automation Science and Engineering*, 2023 (***in revision 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
USNCCM17	G. Wang, D. Tong, **A. Choi**, and M. K. Jawed. "Computer Graphics Inspired Fast Simulation of Knots and Tangles", *17th U.S. National Congress on Computational Mechanics (USNCCM17)*, 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. 2022 - March 2022
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