

SHENGGKANG (WILLIAM) CHEN

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EDUCATION

Georgia Institute of Technology
Robotics Ph.D. student (ECE)

Expected graduation: Spring 2024

University of California, Los Angeles
M.S. in Electrical and Computer Engineering;
18-19 Distinguished Master's Thesis in Circuits & Embedded Systems Award
Area of focus: Robotics

June 2019

University of California, Los Angeles
B.S. in Electrical Engineering;
Honor Cum Laude, Member of Eta Kappa Nu, Dean's List

June 2017

SKILLS

Programming Language	Python, C++, Matlab
Data Sciences	SQL, Pandas
Machine Learning & Deep Learning	PyTorch, TensorFlow, GNN, Reinforcement Learning

RESEARCH

Game-theoretical Approach to Multi-robot Task Allocation October 2022 - Present
Georgia Tech System Research Lab (GTSR) *Dr. Fumin Zhang*

- Developing a multi-robot task allocation approach for self-interested robots.
- Proposed a distributed decision-making framework with a consensus-based communication module and a bio-inspired optimization strategy for task selection.
- Robots can reach a Nash equilibrium under various communication topologies.

Hybrid SUSD-based Multi-robot Task Allocation August 2021 - October 2022
Georgia Tech System Research Lab (GTSR) *Dr. Fumin Zhang*

- Developed a hybrid task allocation algorithm combining a market-based approach with an optimization method.
- Applied the Speeding-up and Slowing-down (SUSD) strategy, a derivative-free optimization method, to significantly improve the results of the market-based approach.
- The algorithm Outperformed current state-of-the-art task allocation algorithms in terms of total utility.

Robot Ethics Architecture with Alternative Ethical Frameworks Fall 2021 - Present
Georgia Tech Mobile Robot Lab (GaTech MRL) *Dr. Ronald C. Arkin*

- Developed a case-based robotic architecture to create ethical behaviors in human-robot interaction scenarios.
- Equipped the architecture with various ethical framework to produce appropriate behaviors based on the situation.
- Conducted survey studies on the appropriate robotic behaviors in different human-robot interaction scenarios.

Multi-Robot Coordination with Human Supervisions July 2020 - September 2021
DARPA Subterranean (SubT) Challenge *Team CSIRO Data61*

- Deployed a multi-robot team to complex underground environments for time-critical missions.
- Developed a task-allocation framework (ROS) for robots to coordinate autonomously while guided by a human operator from a remote base station.
- Developed a multi-modal user interface (ROS and RVIZ) that can provide the human operator with continuous situational awareness and multiple levels of control to guide a multi-robot team.
- Our team tied for the top score and won second in the final challenge.

- Studied misdirection and counter-misdirection strategies for multi-robot teams.
- Developed a behavior-based counter-misdirection strategy to stop threshold-based misdirected robots.
- Implemented counter-misdirection behaviors on MissionLab developed by MRL to study the strategic effectiveness.

Counter-misdirection in Multi-robot Systems

September 2016 - June 2019

*Laboratory for Embedded Machines and Ubiquitous Robots (UCLA LEMUR)**Dr. Ankur Mehta*

- A complete and easy-to-use open-source evaluation system for multi-robot cooperative localization algorithms.
- CoLo includes a physical testbed with robots (ROS and iRobot Create) for data collection, a modularized software analysis tool (Python), and a database containing real-world datasets and baseline algorithms.
- Link: <https://git.uclalemur.com/billyskc/CoLo>

PUBLICATIONS

(Forthcoming) **Shengkang Chen**, Tony X. Lin, and Fumin Zhang. "Game-Theoretical Approach to Multi-Robot Task Allocation Using a Bio-Inspired Optimization Strategy". 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

Shengkang Chen, Tony X. Lin, Ronald C. Arkin, and Fumin Zhang. "Hybrid SUSD-Based Task Allocation for Heterogeneous Multi-Robot Teams." 2023 IEEE International Conference on Robotics and Automation (ICRA), pp. 1400–1406. IEEE, 2023.

Navinda Kottege, Jason Williams, et al. "Heterogeneous robot teams with unified perception and autonomy: How Team CSIRO Data61 tied for the top score at the DARPA Subterranean Challenge." 2023.

Shengkang Chen, Matthew J. O'Brien, Fletcher Talbot, Jason Williams, Brendan Tidd, Alex Pitt, and Ronald C. Arkin. "Multi-modal User Interface for Multi-robot Control in Underground Environments." In 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 9995-10002. IEEE, 2022.

Shengkang Chen, Vidullan Surendran, Alan R. Wagner, Jason Borenstein, and Ronald C. Arkin. "Toward Ethical Robotic Behavior in Human-Robot Interaction Scenarios." In TRAILS Workshop Proceedings (arXiv:2206.08270) held in conjunction with Companion of the 2022 ACM/IEEE International Conference on Human-Robot Interaction, pp. 1284-1286. 2022.

Shengkang Chen, Ronald C. Arkin, Jason Borenstein, and Alan R. Wagner. "Case-based Robotic Architecture with Multiple Underlying Ethical Frameworks for Human-Robot Interaction." In 7th International Conference on Robot Ethics and Standards. 2022.

Vidullan Surendran, Arthur Melo Cruz, Alan R. Wagner, Jason Borenstein, Ronald C. Arkin, and **Shengkang Chen**. "Informing a Robot Ethics Architecture through Folk and Expert Morality." In 7th International Conference on Robot Ethics and Standards. 2022.

Nicolas Hudson, Fletcher Talbot, et al. "Heterogeneous ground and air platforms, homogeneous sensing: Team CSIRO Data61's approach to the DARPA subterranean challenge." Field Robotics, Volume 2, pp 595-636. 2022

Shengkang Chen, and Ronald C. Arkin. "Counter-misdirection in behavior-based multi-robot teams." In 2021 IEEE International Conference on Intelligence and Safety for Robotics (ISR), pp. 268-275. IEEE, 2021.

Shengkang Chen, and Ankur Mehta. "CoLo: A performance evaluation system for multi-robot cooperative localization algorithms." In 2019 International Conference on Robotics and Automation (ICRA), pp. 1458-1464. IEEE, 2019.

Tsang-Kai Chang, **Shengkang Chen**, and Ankur Mehta. "Localization algorithm with circular representation in 2d and its similarity to mammalian brains." arXiv preprint arXiv:1809.02910 (2018).

Tsang-Kai Chang, **Shengkang Chen**, and Ankur Mehta. "Multirobot cooperative localization algorithm with explicit communication and its topology analysis." The 18th International Symposium In Robotics Research (ISRR), pp. 643-659. Springer International Publishing, 2020.

PROJECT

Graph Neural Network on Multi-Robot Scheduling

Multi-disciplinary Research Project

May 2023 - Present

Dr. Fumin Zhang and Dr. Matthew Gombolay

- Solving complex multi-robot scheduling problems via graph attentional networks with reinforcement learning.
- Combining Monte Carlo Tree Search with a graph attentional network for large-scale schedule problems.

Neural Network Approaches for EEG Classification

Neural Network Course Project

March 2019

Dr. Jonathan Kao

- Designed neural networks using CNN and RNN layers on **Keras** for electroencephalography (EEG) classification.
- Implemented subsampling and window slicing data augmentation techniques to enhance the models' performance substantially.
- Our architecture achieved above 75% testing accuracy on Graz data set A from BCI Competition 2008.

Find Phone Challenge

Brain Crop Interview Challenge

March 2019

- Created a convolutional neural network using **Tensorflow** to find the location of the phone in an image.
- The neural network achieved above 80% accuracy training on a small dataset with around 100 images.

Popularity Prediction on Twitter

Data Mining Course Project

March 2018

- Trained a binary classifier to predict the location of the author of a tweet for the 2015 Super Bowl.
- Applied linear regression to predict the number of related tweets in the next hour based on previous hours.
- Used k -fold cross validation for feature selection for the popularity predictor.

"Hospitably", a Hospital Navigator

Undergraduate Capstone Design Project

December 2016 - March 2017

Dr. Gregory Pottie

- Developed a Kalman Filter based indoor localization system on Intel Edison by utilizing IMUs and WiFi modules.
- Created an online Server (based on Firebase) containing all available maps and real-time locations of the patients.

Watchdog

UCLA IdeaHack 2016

June 2016

- Developed a security system for unattended items on Arduino Zero platform.
- Unauthorized activities will trigger the motion sensor and alarm the owner using a web server.

WORK

iRobot

Robotics Software Engineer Intern

May 2020 - August 2020

- Path-planning team for vacuum robots (Roomba).
- Analyzed error data (SQL) from customers around the world.
- Developed analytical tools (Python and Pandas) to find common errors and their possible causes.
- Wrote interactive reports (Jupyter Notebook) to aid engineers' understanding of the error data.
- Investigated the limitations of current path-planning algorithms based on the error data.

MENTORING

Ben Limpanukorn

B.S. Computer Science and Engineering, Class of 2021 Department of Computer Science

September 2018 - June 2019

- Worked on the communication modules of the robots in CoLo's physical experiment setup.

Clara Chun

June 2018 - September 2018

High School Student, Notre Dame Academy, Class of 2019

- Worked on the motion modules of the robots in CoLo's physical experiment setup.

Kyle Wong

January 2018 - September 2018

B.S. Computer Science, Class of 2020 Department of Computer Science

- Worked on the data analysis part of CoLo's analysis software.

Cade Mallett

Jan 2018 - Jun 2018

B.S. Computer Science, Class of 2020 Department of Computer Science

- Worked on the dataset part of CoLo's analysis software.

SERVICES

2021-present

Georgia Tech Mobile Robot Lab (GaTech MRL) Manager.

2022-2023

Reviewer for International Conference on Intelligent Robotics and Systems (IROS).

2022

Reviewer for International Conference on Robotics and Automation (ICRA).

2022

Student Volunteer for American Control Conference (ACC) in Atlanta, GA.

LEADERSHIP EXPERIENCES

UCLA Eta Kappa Nu (HKN) - Iota Gamma Chapter

September 2016 - June 2017

Internal Vice President

- Managed internal board affairs and work with the EE department for hosting professional events included info sections and Matlab workshops.

UCLA Eta Kappa Nu (HKN) - Iota Gamma Chapter

September 2015 - June 2016

Membership chair

- Hosted events for candidates included tutoring hours for engineering courses and technical events like tech talks.