

Chang Shi

chang.shi@austin.utexas.edu · (310)-500-6806 · [linkedin.com/in/chang-shi](https://www.linkedin.com/in/chang-shi) · [changshiraine.github.io](https://github.com/changshiraine) · 1624 W 6th St Apt L, Austin, TX 78703

EDUCATION

The University of Texas at Austin

Ph.D. of Mechanical Engineering (Advisor: Prof. Amy Zhang)

Research Interest: Reinforcement Learning; Robotics; Computer Vision; Machine Learning

Selected Coursework: Reinforcement Learning: Theory/Practice; Advanced Computer Vision; Numerical Optimization: Graphics/AI; Robot Learning

Austin, TX

Started Aug 2021

Carnegie Mellon University

Master of Robotics System Development (Advisor: Prof. John Galeotti and Prof. Howie Choset)

Selected Coursework: Deep RL and Control; Robot Autonomy; Computer Vision; Multimodal ML; SLAM; Manipulation, Estimation and Control

Pittsburgh, PA

May 2021

Renmin University of China

Bachelor of Engineering in Computer Science (Advisor: Prof. Xinqi Gong)

Selected Coursework: Computer Vision; Computer Graphics; Image Processing; Deep Learning; Game Theory

Beijing, China

June 2019

PUBLICATIONS

Chang Shi, Ann Majewicz Fey. Haptic Guidance Using a Transformer-Based Surgeon-Side Trajectory Prediction Algorithm for Robot-Assisted Surgical Training. International Symposium on Robot and Human Interactive Comm (RO-MAN 2023).

Chang Shi, Zheng Yi, Ann Majewicz Fey. Recognition and Prediction of Surgical Gestures and Trajectories Using Transformer Models in Robot-Assisted Surgery. International Conference on Intelligent Robots and Systems (IROS 2022).

Chang Shi, Dustin P DeMeo, Emma L. Larson, John M. Galeotti, Bryan T. Carroll. Non-rigid cutaneous tissue deformation estimation with iterative RANSAC and TPS from digital images over semi-ambiguous artificial markings. Computer Assisted Radiology and Surgery (CARS 2021).

Yiling Qiao, Chang Shi, Chenjian Wang, Hao Li, Matt Haberland, Xiyang Luo, Andrew M. Stuart, Andrea L. Bertozzi. Uncertainty quantification for semi-supervised multi-class classification in image processing and ego-motion analysis of body-worn videos. Electronic Imaging (EI 2019).

ACADEMIC EXPERIENCE

Machine Intelligence through Decision-making and Interaction Lab, UT Austin

(Advisor: Prof. Amy Zhang)

Austin, TX

Aug 2023 - present

- Designed decomposition methods for reward ambiguity in inverse reinforcement learning for skill transfer among multiple robotics tasks
- Working on Few-Shot representation learning for imitation learning

Austin Villa Robocup@Home Team, UT Austin

Teammember (Advisor: Prof. Peter Stone, Prof. Justin Hart)

Austin, TX

Jan 2022 - present

- Trained object detection models for grocery storage and human tracking
- Wrote state machines for receptionist and restaurant tasks

Human-Enabled Robotic Technology Lab, UT Austin

Research Assistant (Advisor: Prof. Ann Majewicz Fey)

Austin, TX

Aug 2021 - Dec 2023

- Developed an optical flow-based method for surgical tool tracking on operation videos and conducted motion analysis
- Implemented trajectory prediction for da Vinci robot manipulators during surgical task operation based on time-series modeling and transformer models, trained on the JHU-ISI Gesture and Skill Assessment Working Set (JIGSAWS)
- Designed haptic guidance for surgical tasks and carried out preliminary human subject study on guidance training effect

Biomedical Image Guidance Lab, CMU

Research Assistant (Advisor: Prof. John Galeotti)

Pittsburgh, PA

May 2020 - May 2021

- Tuned customized calibration on Realsense D430 to get point cloud data for dermatological tissue samples 15cm away from the camera
- Operated iterative optimization of bidirectional blob matching and thin plate spline warping for 2D non-rigid registration on images of tissue with artificial pigment markers
- Fusing 2D non-rigid registration with 3D point cloud to construct a deformation model of tissue before and after slicing and cryostat freezing

Biorobotics Lab, CMU

MIRSD project (Advisor: Prof. Howie Choset)

Pittsburgh, PA

Sept 2019 - Jan 2021

- Designed a stiffness-based automatic tumor localization system for minimally invasive surgery on da Vinci Surgical System
- Used PCA and FFT for liver motion estimation, processed point cloud from depth camera and laser sensor to get organ surface information
- Developed customized dVRK robot control code with limited workspace and wrist constraints
- Merged motion compensation with robot control to avoid collisions during robot surgery
- Designed an intelligent palpation planner based on history stiffness feedbacks, successfully achieved 100% recall on tumor identification and only 1.69% of healthy tissue misclassification within 5min 27s

James Carter PIC Lab, UCLA

Research Assistant (Advisor: Prof. Andrea Bertozzi) | CSST Research Program

Los Angeles, CA
June 2018 - Sept 2018

- Optimized feature extraction and change point detection based on video motion on LAPD body-worn camera videos
- Introduced Uncertainty Quantification for graph-based semi-supervised multi-class classification problems, designed a human-in-the-loop system to improve classification accuracy

INDUSTRIAL EXPERIENCE

Amazon Robotics

Applied Scientist Intern

Boston, MA
May 2023 - Aug 2023

- Optimized the robot-automated package consolidation planning procedure
- Validated the optimized solution both in simulation and on real robots

NEC Laboratories America

Research Intern

Princeton, NJ
May 2021 - Aug 2021

- Operated object detection and key frame detection using DETection TRansformer (DETR) model on CoLLision Events for Video REpresentation and Reasoning (CLEVRER) dataset
- Designed a transformer style model for inter-object counterfactual reasoning and video question answering on collision events

Cisco

Research Intern

San Jose, CA
Sept 2018 - July 2019

- Developed novel fusion algorithms to combine AP data with phone IMU data to do path-matching for Connected Mobile Experiences (CMX) Indoor Location, improved indoor localization accuracy
- Set up hardware chips, simulation environment and light-weighted real-time data pipelines to get TB magnitudes of data on physical layer of wireless data transmission
- Designed a deep learning model deepPHY, to surpass Bit and Package Error Rate (BER & PER) of 802.11ax PHY baseline from traditional channel estimation methods, especially on low SNR cases

PROJECTS

Deep Graph Network (DGN) for Multi-agent Cooperation on StarCraft II 25 vs 25 Battle Game

UT Austin | Spring 2022

- Formulated the problem as a Decentralized Partially Observable Markov Decision Process (Dec-POMDP) and compared the performance of DGN and Deep Q Network in StarCraft II game setting
- Did Ablation study on DGN with epsilon-greedy action selection and preference-based action selection

Collaborative Robot Manipulation over Two-arm Handover Problem in Robosuite Simulation

UT Austin | Fall 2021

- Approached the multi-robot collaboration problem through imitation learning and reinforcement learning perspectives
- Formulated the problem as a Centralized Training Decentralized Execution (CTDE) reinforcement learning paradigm. Tested Independent Soft Actor-Critic (ISAC) and Multi-Agent Deep Deterministic Policy Gradient (MADDPG) algorithms

May I See Your Face? Automatic Face Mask Removal using Generative Adversarial Networks

Carnegie Mellon | Spring 2021

- Tested CycleGAN, Pixel2Pixel and several versions of StyleGAN2 on Flickr-Face-HQ (FFHQ) and MaskedFace-Net dataset. Used Poisson blending for further image generation improvement.

Multimodal Graph-structured Trajectory Prediction with Spatio-temporal Attention Mechanism

Carnegie Mellon | Fall 2020

- Explored Trajectron++ model on NuScenes autonomous vehicle trajectory prediction task, proposed improvements by fusing Lidar data, LaneGCN and Spatial-temporal attention Mechanism

Autonomous Bin Picking in RLBench Simulation

Carnegie Mellon | Spring 2020

- Implemented a state-machine for both forward and resetting process of moving objects between containers for bin picking.
- Used Grasp Quality Convolutional Neural Networks (GQCNN) for optimal grasping pose prediction, and Rapidly-exploring Random Tree (RRT) for trajectory planning.

Arduino Car Based Auto Tracking & Guidance System for The Blind

Renmin University | Fall 2017

- Build a small Arduino car with functionality of voice control, obstacle avoidance and path tracking using real-time video processing, voice recognition and stereo system

TEACHING

- 10-708: Probabilistic Graphical Models. Teaching Assistant, Carnegie Mellon, Fall 2020.
- 10-716: Advanced Machine Learning: Theory and Methods. Teaching Assistant, Carnegie Mellon, Spring 2021.

SKILLS

- **Programming Languages:** Proficient - Python, C/C++, MATLAB; Intermediate - Javascript; Basic - Shell, Scala
- **Frameworks & Libraries:** Proficient - PyTorch, Keras, OpenCV, ROS; Intermediate - TensorFlow, Scikit-Learn
- **Others & Tools:** Docker, Git, Scrapy, Django, Arduino, Raspberry Pi

AWARDS

- Meritorious Winner of the American Mathematical Contest in Modeling, COMAP 2017
- 1st Prize in National Mathematical Modeling Contest, China Capital Areas 2017
- Scholarship of Academic Excellence, Renmin University 2016, 2017 & 2018