

Research Interests

My research focuses on the intersection of computer vision, machine learning, and biomedical data science. Recently, I have been developing novel self-supervised strategies to learn better visual representations for biomedical microscopy.

Education

Ph.D., Bioinformatics, **University of Michigan**, Ann Arbor, MI Expected 2025
 Committee: Todd Hollon (advisor), Brian Athey, Honglak Lee, Kayvan Najarian, Arvind Rao, Jenna Wiens

M.S.E., Computer Science and Engineering, **University of Michigan**, Ann Arbor, MI 2021

B.S.E. *with Honors*, Computer Science, **University of Michigan**, Ann Arbor, MI 2019
 Summa Cum Laude, Minor in Physics

Experience

Graduate student research assistant, **Machine Learning in Neurosurgery Lab**, Ann Arbor, MI 2020 - Current

- Designed novel self-supervised representation learning methods for biomedical microscopy, including [SPT](#), [HiDisc](#) and [DeepGlioma](#), achieved significant improvement over baselines, and published in CVPR and Nature Medicine
- Curated [OpenSRH](#) dataset, open sourced ML training pipelines, and published benchmarks in NeurIPS
- Created machine learning solutions, such as [SpinePose](#) and [SkullBaseCNN](#), to solve challenging clinical problems
- Designed [MSDSR](#), a *conditional diffusion model* to super-resolve microscopy volumes with only 2D supervision

Machine learning research intern, **Apple**, Seattle, WA (Remote) Summer 2021

- Conducted ML experiments for a human-centered regression task using RGBD images and metadata
- Engineered heuristics and incorporated domain knowledge to improve model interpretability and robustness
- Visualized latent representations and input relevance heatmaps to provide interpretability to deep learning models

Research intern, **Motional**, Boston, MA (Remote) Summer 2020

- Improved multimodal motion prediction by integrating camera images and features with agent states
- Created annotation pipeline and coordinated with vehicle operators to annotate image attributes in driving logs

Student researcher, **Biomedical & Clinical Informatics Lab**, Ann Arbor, MI; Mentor: Kayvan Najarian 2016 - 2019

- Designed random forest [decision support system](#) to assess bleeding using image features from brain CT scans
- Proposed and benchmarked [mid-surface shift](#), a novel metric to predict outcome of patients with brain injury
- Benchmarked a convolutional network to predict cardiac arrhythmia on electrocardiogram time-series data
- Curated datasets for [drug-target interaction](#) prediction, and collaborated with physicians to annotate brain CT

Vehicle engineering intern, **General Motors**, Warren, MI Summer 2018

- Developed an autonomous vehicle planner using a cognitive architecture to demonstrate lane keeping

Projects

Evaluating brain tumor segmentation under adversarial attacks Winter 2021

- Designed a novel objective for *generative adversarial perturbation* to attack a MRI tumor segmentation model

Domain adaptation with contrastive learning Fall 2020

- Proposed a domain adaptation method that combines adversarial and contrastive objectives to improve generalization

Teaching + Out Reach + Service

- *Reviewer*, NeurIPS, NeurIPS Datasets and Benchmark Track 2022 - 2024
- *Instructor*, AI4ALL, University of Michigan Summer Program 2021 - 2022
- *Graduate student instructor*, [ENGR 101 Intro to Computers and Programming](#), University of Michigan 2019 - 2021

Skills

Languages: Python, Matlab, Julia, R, C++, Javascript, Bash, SQL, HTML/CSS

Frameworks: PyTorch, TensorFlow/Keras, OpenCV, Scikit-Learn, Vega-Altair, Matplotlib, Flask, React, Hadoop

Tools: Git, \LaTeX , Makefile, LLVM, GDB, Valgrind

Publications

(* denotes equal contribution)

- **Super-resolution of biomedical volumes with 2D supervision**
CVPR Workshop on Computer Vision for Microscopy Image Analysis, 2024
Cheng Jiang*, Alexander Gedeon*, ..., and Todd C. Hollon
- **Development and validation of an artificial intelligence model to accurately predict spinopelvic parameters**
Journal of Neurosurgery: Spine, 2024
Edward S. Harake, Joseph R. Linzey, Cheng Jiang, ..., Todd C. Hollon, and Paul Park
- **Hierarchical discriminative learning improves visual representations of biomedical microscopy**
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2023 **[HIGHLIGHT]**
Cheng Jiang*, Xinhai Hou*, ..., Honglak Lee, and Todd C. Hollon
- **Artificial-intelligence-based molecular classification of diffuse gliomas using rapid, label-free optical imaging**
Nature Medicine 29, 2023
Todd C. Hollon, Cheng Jiang, ..., Honglak Lee, and Daniel A. Orringer
- **OpenSRH: optimizing brain tumor surgery using intraoperative stimulated Raman histology**
Conference on Neural Information Processing Systems (NeurIPS) Datasets and Benchmarks Track, 2022
Cheng Jiang*, Asadur Chowdury*, Xinhai Hou*, ..., Honglak Lee, and Todd C. Hollon
- **Rapid automated analysis of skull base tumor specimens using intraoperative optical imaging and AI**
Neurosurgery 90 (6), 2022 **[COVER]**
Cheng Jiang, ..., Honglak Lee, and Todd C. Hollon
- **Coupled matrix-matrix and coupled tensor-matrix completion methods for predicting drug-target interactions**
Briefings in Bioinformatics 22 (2), 2021
Maryam Bagherian, Renaud Kim, Cheng Jiang, Maureen A. Sartor, Harm Derksen, and Kayvan Najarian
- **Prediction of cardiac arrhythmia using deterministic probabilistic finite-state automata**
Biomedical Signal Processing and Control 63, 2021
Zhi Li, Harm Derksen, Jonathan Gryak, Cheng Jiang, ..., and Kayvan Najarian
- **Automated segmentation and severity analysis of subdural hematoma for patients with traumatic brain injuries**
Diagnostics 10 (10), 2020
Negar Farzaneh, Craig A. Williamson, Cheng Jiang, ..., Kayvan Najarian, and S. M. Reza Soroushmehr
- **Midline shift vs. mid-surface shift: correlation with outcome of traumatic brain injuries**
IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2019
Cheng Jiang, Jie Cao, ..., Kayvan Najarian, and S. M. Reza Soroushmehr
- **Automated subdural hematoma segmentation for traumatic brain injured (TBI) patients**
International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2017
Negar Farzaneh, S. M. Reza Soroushmehr, Craig A. Williamson, Cheng Jiang, ..., and Kayvan Najarian

Under Review / Preprints

- **Visual foundation models for fast, label-free detection of diffuse glioma infiltration**
Akhil Kondepudi, Melike Pekmezci, Xinhai Hou, Katie Scotford, Cheng Jiang, ..., and Todd Hollon, 2024
- **A self-supervised framework for learning whole slide representations**
Xinhai Hou*, Cheng Jiang*, ..., Honglak Lee, and Todd C. Hollon, 2024
- **Step-calibrated diffusion for biomedical optical image restoration**
Yiwei Lyu, Sung Jik Cha, Cheng Jiang, ..., Honglak Lee, and Todd C. Hollon, 2024

Awards

- **F31 Individual Predoctoral Fellowship**, National Institutes of Health (\$122,457), December 2023
- **Outstanding Graduate Student Instructor Award**, University of Michigan Rackham Graduate School, March 2022
- **Biomedical Informatics and Data Science Training Program Fellowship**, University of Michigan, August 2021
- **Graduate Research Fellowships Program (GRFP) Honorable Mention**, National Science Foundation, March 2021
- **Donald R. Shepherd Graduate Fellowship**, University of Michigan Marching Band, May 2019
- **Outstanding Research Award**, U-M Electrical Engineering and Computer Science Department, March 2019
- **James B. Angell Scholar**, University of Michigan, March 2017
- **Dean's List**, University of Michigan College of Engineering, 2015 - 2019
- **University Honors**, University of Michigan, 2015 - 2019