Cheng Jiang

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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 incorprated 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 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, Renaid 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