HAORAN ZHANG

Phone: (+1) 412-514-7332 ◇ Email: `haoranz5@andrew.cmu.edu`

Homepage: `users.ece.cmu.edu/~haoranz5`

Google Scholar ◇ Github ◇ LinkedIn

EDUCATION

Carnegie Mellon University (CMU)   *May 2025 (expected)*
M.S. in Electrical and Computer Engineering (Advanced Study)
GPA: 4.0/4.0
Related courses: Introduction to Deep Learning (18-786), Information Theory Measures for Artificial and Natural Intelligence Systems (18-753), Machine Learning for Signal Processing (18-797).

Huazhong University of Science and Technology (HUST)   *June 2023*
B.E. in Automation (Advanced Class)
GPA: 3.9/4.0   GRE: 327+3.5
Related courses and scores: Pattern Recognition and Machine Learning (93/100), Control Theory (I, 97/100) and (II, 95/100), Game Theory (85/100), Computational Methods (99/100).

The Technical University of Munich (TUM)   *April 2023 - August 2023*
Exchange student in Electrical Engineering Department

RESEARCH INTERESTS

My current project involves federated learning, resource allocation, and optimization. I am happy to continue researching these areas. I am also open to exploring new fields.

RESEARCH EXPERIENCE

Client-Task Sampling in Multiple Models Federated Learning [1]   Jan 2024 - Present
Supervisors: Dr. Marie Siew, Prof. Carlee Joe-Wong, and Prof. Rachid El-Azouzi   CMU

· Proposed a client sampling method (gradient-norm based) in multiple models federated learning (MMFL), achieving a **30%** higher accuracy than the baselines.
· Found that loss based sampling method performs even better than gradient-norm based one, **which is counter-intuitive at first**. Proposed an explanation to illustrate this.
· Completed the **convergence proof** for the proposed algorithm.
· Modified the above client sampling algorithm to enhance the task fairness in MMFL.
· Our work is the first to extend MMFL to a multi-processor level and accept some clients cannot handle all training tasks.

Task Fairness in Multiple Models Federated Learning [2]   Dec 2023 - Feb 2024
Supervisors: Dr. Marie Siew and Prof. Carlee Joe-Wong   CMU

· Ran experiments for the proposed algorithm (FedFairMMFL) in various settings.
· Organized the original code to make it more efficient and clear.
· Explored an improved method using the Bayesian rule to model the sampling probability of each client.

Efficient Segmentation and Domain-adversarial Learning [3]   Feb - Nov 2022
Supervisor: Prof. Hao Chen   The Hong Kong University of Science & Technology (HKUST)

· Proposed a pyramidally downsampled 3D Transformer, improving the model's accuracy by 1.72% and efficiency by 12% on brain stroke lesion and prostate segmentation tasks.
· Proposed a cluster-based domain-adversarial learning method to exploit domains at a fine-grained level, improving generalization ability by 2.61% on multi-domains segmentation tasks.
· Finished the code and manuscript independently.

4D Artery Reconstruction and Motion Magnification   Apr - Aug 2023
Supervisor: Dr. Zhongliang Jiang   TUM

· Implemented motion magnification algorithm to enhance the motion of the artery, facilitating the detection of potential diseases of arteries (demo: tinyurl.com/m-Magnification).
· Implemented a method based on the Transformer and Siamese-like network for tracking 2D arteries from ultrasound videos (demo: tinyurl.com/arterytrack).
· Designed an algorithm to reconstruct the 4D artery model from ultrasound videos, showing the motion of the artery in 3D (demo: tinyurl.com/4dartery).

DNA Computing and Molecular Circuits Design (Undergrad Thesis) Sept 2022 - June 2023
Supervisor: Prof. Linqiang Pan   HUST

· Studied the principles and applications of DNA computing and built molecular circuits.
· Designed DNA switching circuits to simulate the computational devices made of DNA.
· Simulated and synthesized multiple 3D nanostructures using DNA origami.
· Further verified the reliability and efficiency of the polymerase DNA kirigami by constructing even more complex 3D nanostructures.

PUBLICATIONS

[1] **H. Zhang**, Z. Li, Z. Gong, M. Siew, C. Joe-Wong, and R. El-Azouzi, "Poster: Optimal variance-reduced client sampling for multiple models federated learning," in *2024 IEEE 44th International Conference on Distributed Computing Systems (ICDCS)*, IEEE, 2024.
[2] M. Siew, **H. Zhang**, J.-I. Park, *et al.*, "Fair concurrent training of multiple models in federated learning," *arXiv preprint arXiv:2404.13841*, 2024.
[3] **H. Zhang** and H. Chen, "Efficient 3d transformer with cluster-based domain-adversarial learning for 3d medical image segmentation," in *2023 IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, IEEE, 2023, pp. 1–5.

ACHIEVEMENTS

Outstanding Graduate, HUST	*Summer 2023*
Scholarship for Scientific and Technological Innovation, HUST	*Fall 2022*
Honorable Mention in Mathematical Contest In Modeling 2022, COMAP	*Summer 2022*
Scholarship for Extracurricular Activities and Sports, HUST	*Fall 2019*

SKILLS/HOBBIES

Programming Languages	Python, C/C++, MATLAB, HTML
Machine Learning Tools	Pytorch, Tensorflow, Sklearn, Pandas, Numpy
Hobbies	birding and hiking