

Chang Liu

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Education

School of Computer Science

Carnegie Mellon University, Ph.D. Student in Computational Biology

08/2023 - 05/2028(est.)

- Advisor: Prof. Artur Dubrawski.
- QPA: **4.18**.
- Research Interests: Machine learning in healthcare, deep learning.
- Courses: Advanced Introduction to Machine Learning, Intermediate Statistics, Advanced Machine Learning: Theory and Methods, Advanced Deep Learning.

Institute for Interdisciplinary Information Sciences (IIIS)

Tsinghua University, B.Eng. in Computer Science

Yao Class, established by Prof. Andrew C. Yao

08/2019 – 06/2023

- GPA: **3.91/4.00**.
- TOEFL: **120/120**. Reading: 30, Listening: 30, Speaking: 30, Writing: 30.
- GRE: **340/340**. Quant: 170, Verbal: 170, Writing: 5.
- Mathematics Courses: Calculus, Linear Algebra, Abstract Algebra, Mathematics for Computer Science, Mathematics for Artificial Intelligence, Probability and Statistics.
- Computer Science Courses: Machine Learning, Reinforcement Learning, Computational Biology, Computer Vision, Deep Learning, Natural Language Processing, Introduction to Databases, Data Mining, Quantum Computer Science, Introduction to Robotics, Algorithm Design, Theory of Computation.

Research Experience

Learning MALDI-tof Representations that Respect Whole Genome Sequencing Labels

10/2023 – Now

Advised by Prof. Artur Dubrawski.

Carnegie Mellon University

- Developed a UNet-based autoencoder with a semi-supervised training framework and pretrained the autoencoder on species identification for large-scale public MALDI data (DRIAMS dataset).
- Fine-tuned the autoencoder on sequence type identification and outbreak cluster identification (WGS labels) on UPMC hospital data and extensively utilized data with unknown labels.
- Developed MALDI similarity metrics that respect WGS result similarity.

Identifying Disease Targets through a Probabilistic Knowledge Graph

09/2021 – 05/2023

Advised by Prof. Jianyang Zeng.

Tsinghua University

- Developed a novel method of augmenting biological networks with literature evidence to construct a probabilistic knowledge graph.
- Developed a graph neural network to predict target candidates from the knowledge graph, achieving superior performance to state-of-the-art models in terms of accuracy (esp. on sparse data) and literature support for top novel predictions.
- Conducted bioinformatics analyses and cooperated with experimental validation of the identified colorectal cancer and melanoma targets.

Reconstructing the Allele-specific Genome Structure from Hi-C Contacts

03/2022 – 03/2023

Advised by Prof. Jian Ma.

Carnegie Mellon University

- Developed an improved particle dynamics framework (based on *hickit*) that iterates between inferring chromosome contact phases and 3D genomic coordinates to fully exploit their common information.
- Developed a new graph neural network to implicitly impute the phases of the Hi-C contacts and reconstruct the allele-specific 3D genome structure (in progress).

Discovering Competitive Binding of Transcription Factors

05/2021 - 02/2023

Advised by Prof. Jianyang Zeng.

Tsinghua University

- Developed a framework to infer in-vivo competitive TF binding (the binding of one TF removes that of the other), consisting of a deep neural network, several motif analyses, and statistical tests.
- Cooperated with experimental validation of the predicted competing TF pairs (in progress).

Predicting Antigen Binding Sites through Graph Neural Networks

06/2021 - 08/2021

Advised by Prof. Boxue Tian.

Tsinghua University

- Developed a graph neural network to predict antigen binding residues using antigen-antibody compound data in the SAbDAb database based on *GraphBind*, a DNA/RNA-Protein binding site prediction model.
- Utilized the model to validate lab-generated compounds.

Intelligent Diabetes Management

12/2020 - 02/2021

Advised by Prof. Yang Yuan.

Tsinghua University

- Cooperated with Shanghai Zhongshan Hospital to investigate the needs of the endocrinology department and its patients.
- Developed a deep learning framework for predicting future patient blood sugar levels from patient records for pre-emptive alerts.
- Developed a deep learning framework for predicting the proper dosage of insulin to be administered to alleviate the demand for expert consultation.

Publications

1. **Liu Chang**[†]; Xiao Kaimin[†]; Yu Cuinan[†]; Lei Yipin[†];...; Zhao Dan^{*}; Zhou Fengfeng^{*}; Tang Haidong^{*}; Zeng Jianyang^{*}. "A Probabilistic Knowledge Graph Approach for Target Identification," *PLOS Computational Biology*, April 2024.
2. **Liu Chang**[†]; Yu Cuinan[†]; Lei Yipin[†];...; Zhao Dan^{*}; Zhou Fengfeng^{*}; Zeng Jianyang^{*}. "Improving Target-disease Association Prediction through a Graph Neural Network with Credibility Information," proceedings of the *Pacific Symposium on Biocomputing*, January 2023.

Honors & Awards

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| • Comprehensive Merit Award (7/32) , <i>Tsinghua University</i> | 2022 |
| • Comprehensive Merit Award (6/32) , <i>Tsinghua University</i> | 2021 |
| • Excellence Award for Volunteering Services , <i>Tsinghua University</i> | 2020 |
| • Freshmen Scholarship , <i>Tsinghua University</i> | 2019 |
| • University Full Scholarship for Future Scholars , <i>Tsinghua University</i> | 2019 |