

# Chang Liu

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## Education

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### **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

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### **Learning MALDI-tof Representations that Respect Whole Genome Sequencing Labels**

10/2023 – Now

*Advised by Prof. Artur Dubrawski.*

Carnegie Mellon University

- Developed a semi-supervised pretraining and finetuning framework with a UNet-based autoencoder for MALDI data.
- 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**

Advised by Prof. Jianyang Zeng.

05/2021 - 02/2023

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**

Advised by Prof. Boxue Tian.

06/2021 - 08/2021

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**

Advised by Prof. Yang Yuan.

12/2020 - 02/2021

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**

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1. **Liu Chang**<sup>†</sup>; Xiao Kaimin<sup>†</sup>; Yu Cuinan<sup>†</sup>; Lei Yipin<sup>†</sup>;...; Zhao Dan<sup>\*</sup>; Zhou Fengfeng<sup>\*</sup>; Tang Haidong<sup>\*</sup>; Zeng Jianyang<sup>\*</sup>. "A Probabilistic Knowledge Graph Approach for Target Identification," *PLOS Computational Biology*, April 2024.
2. **Liu Chang**<sup>†</sup>; Yu Cuinan<sup>†</sup>; Lei Yipin<sup>†</sup>;...; Zhao Dan<sup>\*</sup>; Zhou Fengfeng<sup>\*</sup>; Zeng Jianyang<sup>\*</sup>. "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)**, *Tsinghua University* 2022
- **Comprehensive Merit Award (6/32)**, *Tsinghua University* 2021
- **Excellence Award for Volunteering Services**, *Tsinghua University* 2020
- **Freshmen Scholarship**, *Tsinghua University* 2019
- **University Full Scholarship for Future Scholars**, *Tsinghua University* 2019