Chang Liu

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Education

Institute for Interdisciplinary Information Sciences (IIIS) Yao Class, established by Prof. Andrew C. Yao
Tsinghua University, B.Eng. in Computer Science 08/2019 – 06/2023 (est.)

- 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

Reconstructing the Allele-specific Genome Structure from Hi-C Contacts 03/2022 – Present
Undergraduate Researcher. 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).

Identifying Disease Targets through a Probabilistic Knowledge Graph 09/2021 – Present
Undergraduate Researcher. 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.

Discovering Competitive Binding of Transcription Factors 05/2021 - Present
Undergraduate Researcher. 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
Undergraduate RA. 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
Undergraduate Researcher. 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.

Course Projects Tsinghua University

- Separating Bone Inscription Images through Computer Vision Techniques
- Avoiding Catastrophic Failure in Reinforcement Learning
- Encoding Semantics into Word Embeddings through Dictionaries
- Detecting and Ranking Communities in the DBLP Database

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," *submitted to Nature Machine Intelligence*.

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

- **Comprehensive Merit Award (7/32)**, *Tsinghua University* 2022
- **3rd place in the 100m Men's Freestyle**, *Tsinghua University* 2021
- **Comprehensive Merit Award (6/32)**, *Tsinghua University* 2021
- **Gold Prize in the Magnus Royal Youth International Piano Competition Semi-Final in China**, *Magnus Conservatory of Music, Lithuania* 2021
- **2nd place in the National College Water Polo Championship (university water polo team)**, *Federation of University Sports of China* 2021
- **4th place in the 50m Men's Freestyle**, *Tsinghua University* 2021
- **1st place in the 200m Mens' Medley**, *Tsinghua University* 2021
- **37th place in the Campus Mini Marathon**, *Tsinghua University* 2020
- **Excellence Award for Volunteering Services**, *Tsinghua University* 2020
- **Freshmen Scholarship**, *Tsinghua University* 2019
- **University Full Scholarship for Future Scholars**, *Tsinghua University* 2019

Others

- **Campus Works and Affiliations:** Active member of the University Art Troupe, Swim Team, and Water Polo Team.