

Yicheng Gao

Department of Bioinformatics, Tongji University, China

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Education

Tongji University, Shanghai, China

Sep. 2020 – Mar. 2026

Bioinformatics PhD student, supervised by Prof. Qi Liu

Helmholtz Munich, Munich, Germany

Aug. 2025 – Feb. 2026

Visiting Scholar, supervised by Prof. Fabian J. Theis

Huazhong Agricultural University, Wuhan, China

Sep. 2016 – Jun. 2020

Bachelor of Bioinformatics (Outstanding Graduates), supervised by Prof. Wen Zhang

Main Research Experience

Omics data understanding by LLMs

2025

Advisor: Prof. Fabian J. Theis

Helmholtz Munich

- Develop a new omics data study framework called CellHermes.
- Injecting Tabular data and graph data knowledge by emulating SSL techniques for different modalities with QA pairs.
- CellHermes is implemented based on PyTorch and achieved superior or comparable performance with modest datasets, deployed on github <https://github.com/theislab/CellHermes>.
- Paper is preprint on Biorxiv.

Causal disentanglement for single-cell data

2025

Advisor: Dr. Dongsheng Li and Dr. Caihua Shan

Mircosoft AI/ML Group

- Develop a new causal disentanglement representation framework for single-cell data, called CausCell.
- Propose a new optimization objective function for this framework.
- CausCell is implemented based on PyTorch and achieved superior or comparable performance on disentanglement and reconstruction, deployed on github <https://github.com/bm2-lab/CausCell>.
- Paper is accepted on Nature Communications.

Single-cell genetic perturbation prediction

2024

Advisor: Prof. Qi Liu

Tongji University

- Develop a new subtask decomposition-based genetic perturbation prediction model, called STAMP.
- Propose a three-subtasks-based benchmark evaluation strategy.
- STAMP is implemented based on PyTorch and achieved superior or comparable performance in this task, deployed on github <https://github.com/bm2-lab/STAMP>.
- Paper is published on Nature Computational Science.

Multi-modal representation for T-cells

2023

Advisor: Prof. Qi Liu

Tongji University

- Develop a new low-resource-aware multi-modal representation learning for cross-modality integration and analysis of T-cell receptor and T-cell transcriptomes in a unified way, called UniTCR.
- UniTCR is used for an array of downstream tasks, including single modality analysis, modality gap analysis, epitope-TCR binding prediction and cross-modality generation task.
- UniTCR is implemented based on PyTorch and achieved superior or comparable performance in these tasks, deployed on github <https://github.com/bm2-lab/UniTCR>.
- Paper is published on Cell Genomics.

Peptide-TCR binding modeling

2022

Advisor: Prof. Qi Liu

Tongji University

- Develop a new meta-learning framework combined with the ideas of meta learning and neural turning machine (NTM) for tackling the peptide-TCR binding prediction task, called PanPep.
- Based on the NTM, we propose a disentanglement distillation module for generalizing few-shot learning to the zero-shot learning.
- PanPep is implemented with PyTorch and achieved SOTA performance in this task, deployed on github <https://github.com/bm2-lab/PanPep>.
- Paper is published on Nature Machine Intelligence.

Selected Publications

- **Causal disentanglement for single-cell representations and controllable counterfactual generation**
Yicheng Gao*, Kejing Dong*, Caihua Shan, Dongsheng Li, Qi Liu
Nature Communications, 2025
- **Toward subtask decomposition-based learning and benchmarking for genetic perturbation outcome prediction and beyond**
Yicheng Gao*, Zhiting Wei*, Kejing Dong, Jingya Yang, Guohui Chuai, Qi Liu
Nature Computational Science (Research Highlight), 2024
- **Unified cross-modality integration and analysis of T-cell receptors and T-cell transcriptomes**
Yicheng Gao*, Kejing Dong*, Yuli Gao, Xuan Jin, Qi Liu
Cell Genomics (Featured Article), 2024
- **Pan-Peptide Meta Learning for T-cell receptor–antigen binding recognition**
Yicheng Gao*, Yuli Gao*, Yuxiao Fan, Chengyu Zhu, Zhiting Wei, Chi Zhou, Guohui Chuai, Qinchang Chen, He Zhang, Qi Liu
Nature Machine Intelligence (Research Highlight, ESI highly cited), 2023
- **Benchmarking algorithms for generalizable single-cell perturbation response prediction**
Zhiting Wei*, Yiheng Wang*, Yicheng Gao*, Shuguang Wang, Ping Li, Duanmiao Si, Yuli Gao, Siqi Wu, Danlu Li, Kejing Dong, Xingbo Yang, Cheng Tang, Shaliu Fu, Xiaohan Chen, Wannian Li, Yuzhou You, Chen Zhang, Guohui Chuai, Aibin Liang, Qi Liu
Nature Methods (Accepted), 2025
- **Delineating the cell types with transcriptional kinetics**
Yicheng Gao, Qi Liu
Nature Computational Science, 2024
- **Benchmarking multi-slice integration and downstream applications in spatial transcriptomics data analysis**
Kejing Dong*, Yicheng Gao*, Qi Zou, Yan Cui, Chuangyi Han, Senlin Lin, Zhikang Wang, Chen Tang, Xiaojie Cheng, Fangliangzi Meng, Xiaohan Chen, Shuguang Wang, Xuan Jin, Jingya Yang, Chen Zhang, Guohui Chuai, Zhiyuan Yuan, Qi Liu
Genome Biology, 2025
- **Weakly-supervised peptide-TCR binding prediction facilitates neoantigen identification**
Yuli Gao*, Yicheng Gao*, Sqi Wu*, Danlu Li, Chi Zhou, Fangliangzi Meng, Kejing Dong, Xueying Zhao, Ping Li, Aibin Zhang, Qi Liu
Cell Systems, 2025
- **PerturBase: a comprehensive database for single-cell perturbation data analysis and visualization**
Zhiting Wei*, Duanmiao Si*, Bin Duan*, Yicheng Gao*, Qian Yu, Ling Guo, Qi Liu
Nucleic Acid Research, 2024

Selected Awards and Grants

- **National Natural Science Foundation of China (NSFC) Support for PhD student (¥ 300,000)**, 2025
- **Shanghai Interdisciplinary Innovation Foundation for Intelligent Science & Technology (¥ 50,000)**, 2025
- **Chinese Association for Artificial Intelligence (CAAI) Potential Qingyuan Scholar** (15 people in China), 2025
- **Academic Pioneer Award** at Tongji University (Top 0.05%), ranked 1st, 2024
- **Stars of Tomorrow** in Microsoft Research (Top 10% interns in MSR), 2024
- **National scholarship** for PhD students in China (Top 0.2%), 2025
- **National scholarship** for PhD students in China (Top 0.2%), 2024
- **National scholarship** for PhD students in China (Top 0.2%), 2023
- **Tongji University Scholarship for Outstanding Ph.D. Freshman** (Top 5%), 2020
- **Top Ten Students** of Huazhong Agricultural University (Top 0.1%), ranked 1st, 2020
- The 9th MathorCup University Mathematical Modeling Challenge, **First Prize**, 2019

Intern Experience

Microsoft | AI/ML group Research Intern

Dec. 2023 – Oct. 2024

- Mentors: [Dr. Dongsheng Li](#) and [Dr. Caihua Shan](#)

- Disentanglement representation method design for single-cell data

- Accepted on Nature Communications

BGI Genomics | Algorithm Engineer

Jul. 2020 – Sep. 2020

- Algorithm optimization for detection of structural variation

BGI Genomics | Algorithm Engineer

Jul. 2019 – Sep. 2019

- Algorithm optimization for detection of SNP variation.