

Zhilei Bei

UNDERGRADUATE STUDENT · TSINGHUA UNIVERSITY

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Education

Tsinghua University, B.Sc. COMPUTER SCIENCE AND ENGINEERING

Sep. 2021 - Present

- GPA: **3.93/4.0 (19/178)**; TOEFL: **119**; GRE: **336+5**
- Relevant Coursework: Fundamentals of Engineering Biology (**A+**), Fundamentals of Programming (**A+**), Theory of Computer Network (**A+**), Computational Biology (A), Introduction to Artificial Intelligence (A), Introduction to Machine Learning (A), Artificial Neural Network (A), Data Mining (A)

Oxford University, Study Abroad Programme

Jan. 2022

- Courses: Artificial Intelligence and Machine Learning

Publications

- Bo Chen*, **Zhilei Bei***, Xingyi Cheng, Pan Li, Jie Tang, Le Song. "MSAGPT: Neural Prompting for Protein Structure Prediction via MSA Generative Pre-Training." In *Proceedings of the 38th Annual Conference on Neural Information Processing Systems (NeurIPS)*, preprint at arXiv:2406.05347, (2024).
- Bo Chen*, Xingyi Cheng*, Pan Li, Yangli-ao Geng, Jing Gong, Shen Li, **Zhilei Bei**, et al. "xTrimoPGLM: Unified 100B-Scale Pre-Trained Transformer for Deciphering the Language of Proteins." Accepted in principle at *Nature Methods*, preprint at arXiv:2401.06199, (2024).
- Boyan Wang, Yangliao Geng, Xingyi Cheng, Bo Chen, **Zhilei Bei** et al. "ProtGO: Universal Protein Function Prediction Utilizing Multi-Modal Gene Ontology Knowledge." In submission to *Briefings in Bioinformatics*, (2024).

Research Experiences

Carnegie Mellon University Research Assistant, Advisor: Prof. Jian Ma

Jun. 2024 - present

- **Tissue Generator: Predicting Missing Tissue Regions in Spatial Transcriptomics**
 - Developed a Variational Autoencoder (VAE) model to embed single cell gene expression profiles.
 - Developed a Vision Transformer model to generate spatial transcriptomics data for missing tissue regions.

BioMap Inc. Research Intern, Advisors: Prof. Le Song & Prof. Jie Tang

Aug. 2023 - Jun. 2024

- **Protein Language Foundation Models**
 - Discovered multiple forms of scaling law for different downstream tasks.
 - Enhanced model generative performance by 300% with supervised fine-tuning and reinforced self-training.
- **Protein Multiple Sequence Alignment (MSA) Generation**
 - Designed a simple yet effective MSA generation framework to aid protein structure prediction in low-MSA regime, achieving state-of-the-art performance.
 - Further enhanced model performance by leveraging feedback from AlphaFold2 for reinforcement learning.

Tsinghua Knowledge Engineering Group Advisors: Prof. Yuxiao Dong & Prof. Jie Tang

Nov. 2022 - May. 2023

- **Molecule Generation with Diffusion Model**
 - Developed a Graph Neural Network (GNN) model for pocket-ligand pair affinity prediction.
 - Designed a mixed training strategy utilizing unlabeled protein and molecule for data augmentation.
 - Enhanced conditional generation performance by 13% using mixed training.

Tsinghua Machine Learning and Computational Biology Group Advisor: Prof. Jianyang Zeng

Jul. 2022 - Sep. 2022

- **Gene Selection and Drug Screening Based on Knowledge Graph and Community Detection**
 - Aligned embeddings from biological knowledge graphs with orthogonal gene and drug datasets for data integration.
 - Tested algorithms for community detection on heterogeneous knowledge graph.

Institute of Biophysics, Chinese Academy of Sciences Advisor: Prof. Pingsheng Liu

Jan. 2019 - Sep. 2020

- **Blocking the Binding of Bacterial Lipid Droplets to Phage DNA**
 - Discovered an effective blocker for MLDS protein and viral DNA binding through *in vitro* experiments.
 - Acquired expertise in laboratory techniques, including confocal microscopy imaging, spectrophotometry, cell culturing and Western blotting.

Skills

Programming Languages Python (Pytorch), C/C++, MATLAB, Rust, Javascript, HTML, CSS, SQL, x86 assembly

Tools & Frameworks Git, Django, MySQL, React

Honors & Awards

2024 Spark Scientific and Technological Innovation Fellowship , Top 1% of Tsinghua University	Beijing, China
2024 Zhong Shimo Scholarship , Top 1% of Computer Science Department, Tsinghua University	Beijing, China
2024 National Scholarship , Top 3% of Tsinghua University	Beijing, China
2023 Comprehensive Scholarship , Top 10% of Tsinghua University	Beijing, China
2022 Comprehensive Scholarship , Top 10% of Tsinghua University	Beijing, China

Service & Leadership

Field Research on Technology Equity and the Digital Divide

Kunming, Yunnan

LEADER

Jun. 2022-Aug. 2022

- Investigated technological solutions for elderly care such as smart management platforms, aging-friendly devices, and high-tech medical aids, and identified cognitive, cultural, and economic barriers in adopting these technologies.
- Published findings in news outlets, raising public awareness of the issue, and promoted the addition of dialect recognition function to Baidu's smart speaker products.
- Received the Tsinghua University Student Social Practice Silver Award.

Becoming Global Student Association

Beijing, China

CORE MEMBER

Jan. 2024-present

- Co-organized the "Life Design in the Era of AI" forum with Stanford Life Design Lab in Beijing, facilitating discussions on AI ethics, personal growth, and social responsibility among students from top universities.
- Co-founded the *AI Weekly* blog series, summarizing AI advancements and reaching over 400 readers per article.

Association of Student International Communication of Tsinghua University

Beijing, China

CORE MEMBER

Jan. 2024-present

- Organized the first post-pandemic TEDxTHU conference, featuring prominent speakers and attracting an audience of over 1,000 students and faculty.

Inspire Volunteer Program of Tsinghua University

Remote

VOLUNTEER

Sep. 2022-Jun. 2023

- Mentored middle school students from underserved regions in Henan Province, offering academic guidance and encouragement to help them navigate educational challenges.
- Honored as "Outstanding Volunteer" by the program for my dedications and contributions.

Women's Soccer Team of the Department of Computer Science and Engineering

Beijing, China

CAPTAIN

Sep. 2022-Jun. 2023

- Rebuilt the team after the departure of over half of the key players and the main coach.
- Organized semi-weekly trainings, morning runs, and match video analysis, enhancing team morale despite consecutive mid-season losses, culminating in a 9-2 victory that advanced us into the knockout stage.
- Led the reorganized team to a silver medal at Tsinghua University's Women's Soccer Tournament and earned the "Outstanding Captain" award.

Spark Scientific and Technological Innovation Program

Beijing, China

COUNCIL MEMBER

Apr. 2024-present

- Reviewed applications of the Spark Scientific and Technological Innovation Fellowship.
- Organized Spark Days to foster interdisciplinary communication between undergraduate students.

Extracurricular Activities

Pickleball Team of Tsinghua University

Beijing, China

KEY PLAYER

Oct. 2024-present

- Won the Women's Doubles Bronze Medal at the **National** University Student Pickleball Tournament.

Tennis Team of Tsinghua University

Beijing, China

KEY PLAYER

Oct. 2021-present

- Won the Women's Team Gold Medal and Women's Doubles Bronze Medal at the **Capital** University Student Tennis League Tournament.