Tianhao Luo

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EDUCATION

University of Pennsylvania, **The Wharton School & College of Arts and Sciences** 2021 - 2025

- B.A. in Mathematics, Computational Biology; B.S. in Statistics Philadelphia, PA
- **Minors:** Computer Science, Data Science.
- **GPA:** 3.97/4.00 (*Beta Gamma Sigma* Honors Society)
- **GRE (General):** 340/340
- **Relevant Courses (Grad Courses*)**: Machine Learning*, Statistical Methodology*, Statistical Genomics*, Mathematical Biology*, Genome Science*, Real Analysis, Probability, Advanced Linear Algebra, Mathematical Statistics, Molecular Biology and Genetics, Statistical Inference.

PUBLICATION & CONFERENCES

- Freda, P.J., Ghosh, A., **Luo, T.**, et al. Automated quantitative trait locus analysis (AutoQTL). *BioData Mining* 16, 14 (2023). https://doi.org/10.1186/s13040-023-00331-3.
- **Luo, T**., & Koo, P. Deciphering the Genetic Code behind Single-Cell Chromatin Accessibility: Interpreting scBasset (2023). [Poster]. Research Exposition, University of Pennsylvania, Philadelphia, PA.
- **Luo, T.**, & Li, M. (2024). Integrating Foundation Models to Address Batch Effects in Spatial Transcriptomics Analysis.
  [Poster] MidAtlantic Bioinformatics Conference, Philadelphia, PA.
  [Poster] Harvard University Program in Quantitative Genomics Conference, Boston, MA.
  [Oral Presentation] Rice University Gulf Coast Undergraduate Research Symposium, Houston, TX.
- Yuan, M., Jin, K., Yan, H., **Luo, T**. et al. Designing Smart Spatial Omics Experiments with S2Omics. (2024) Submitted to *Nature Methods*.

AWARDS & HONORS

- $6,000 Summer REU Research Grant from NSF, Cold Spring Harbor Laboratory. Jun 2023
- $6,000 Research Award, the Wharton Summer Program for Undergraduate Research. Jun 2024
- Outstanding Presentation Award, Gulf Coast Undergraduate Research Symposium, Rice University. Nov 2024
- GCURS Travel Award 2024 ($600). Oct 2024
- University of Pennsylvania Travel Award 2024 ($600). Oct 2024

RESEARCH EXPERIENCES

Integrating Foundation Models to Rectify Batch Effects in Spatial Transcriptomics Philadelphia, PA
Dr. Mingyao Li, Department of Biostatistics ,University of Pennsylvania Sep 2022 - Present

- Developing a novel computational pipeline to address batch effects in high-resolution histology images, enabling robust cross-patient and cross-tissue imputation of spatial single-cell gene expression based on histology images.
- Achieved improved near-single-cell gene expression prediction for clinically relevant genes (ERBB2, ESR1, PGR) based on histology images, validated across breast cancer samples using multiple spatial technologies (Legacy ST, Visium, Xenium).
- Preparing my honors thesis on rectifying image batch effects for spatial omics studies.
- Benchmarked the performance of BASS and MAPLE on Biogen rat brain datasets as part of a larger benchmarking project on multi-sample single-cell spatial transcriptomics data integration.

Exploring RNA Modification in *A. Thaliana* Using Nanopore Direct RNA Sequencing Philadelphia, PA
Dr. Brian Gregory, Department of Biology, University of Pennsylvania Aug 2023 - Present

- Investigating temporal dynamics of N6-methyladenosine (m6A) modification in nascent RNA using Oxford Nanopore direct RNA sequencing, revealing new insights into RNA processing in *Arabidopsis thaliana*.
- Using m6anet, I am developing a machine learning pipeline to characterize m6A modification mechanisms in RNA processing, uncovering novel relationships between modifications and downstream biological processes.
- Preparing my biology honors thesis in decoding co-transcriptional dynamics of m6A in Nascent RNA of *Arabidopsis thaliana*.

REU at CSHL: Improving Interpretability of CNN for Single-Cell Chromatin Accessibility Cold Spring Harbor, NY
Dr. Peter Koo, NSF-funded REU, Cold Spring Harbor Laboratory Jun 2023 - Aug 2023

- Enhanced prediction accuracy and interpretability of a Convolutional Neural Network model, scBasset, for single-cell chromatin accessibility prediction using scATAC-seq data.

- Engineered comprehensive interpretability pipeline incorporating multiple visualization techniques (filter visualization, saliency maps, TF-MoDISco) to reveal biological mechanisms underlying chromatin accessibility predictions

Wharton Directed Reading Program Fellow in Statistics Philadelphia, PA

Dr. Zongming Ma & Dr. Shuxiao Chen, Department of Statistics, University of Pennsylvania Aug 2022 - Dec 2022

- Conducted in-depth study of statistical learning and multi-modal integration in genomics, focusing on advanced techniques in single-cell analysis.

Automated Quantitative Trait Locus Analysis Using Auto-ML Los Angeles, CA

Dr. Jason Moore, Department of Computational Biomedicine, Cedars-Sinai Medical Center May 2022 – Aug 2022

- Built an automated machine learning pipeline (AutoQTL) in Python that automates the quantitative trait locus analysis using evolutionary programming and pareto optimization.
- Led epistasis evaluation by simulating 1000+ datasets with marginal effects and epistasis effects; successfully established correlations between number of interactions and AutoQTL's ability to detect epistasis and interactions.
- Published a co-authored paper on *BioData Mining*.

TEACHING EXPERIENCES

Teaching Assistant for Statistical Inference Jan 2024 - Present

- Lead grading and feedback for weekly assignments in advanced statistics course (120+ students).
- Conduct weekly office hours and exam review sessions, providing individualized support to strengthen students' understanding of statistical concepts.

Head Teaching Assistant for Bayesian Statistics Jan 2024 - May 2024

- Independently graded weekly problem sets and exams with detailed feedback for the class with 50+ students.
- Developed standardized rubrics and assessment criteria, ensuring consistent evaluation across multiple teaching assistants.

EXTRACURRICULARS AND LEADERSHIP EXPERIENCES

Founder & Vice President International

Liyue Education Consulting Mar 2022 - Present

- Founded and scaled non-profit organization to 50+ members, providing college admissions and financial aid guidance to underprivileged students; mentored 20+ students each year from underprivileged backgrounds with their college application planning and essays.

Research Peer Mentor Philadelphia, PA

Center for Undergraduate Research and Fellowship, University of Pennsylvania Aug 2024 - Present

- Provide weekly one-on-one mentorship and group workshops focusing on outreach for researchers in industry, fostering a collaborative learning environment and promoting the importance of academic research across different fields.
- Guided 10+ undergraduate students in identifying research interests and potential mentors.

Research Committee Philadelphia, PA

Penn Undergraduate Biotechnology Society Sep 2022 - May 2023

- Delivered comprehensive presentation on advances in Glioblastoma treatment to 100+ members, facilitating engagement between research and clinical applications.

Outreach Chair Philadelphia, PA

Philosophy Undergraduate Society Sep 2021 - Dec 2022

- Spearheaded 5 course selection events connecting 60+ first-year students with philosophy majors.
- Established partnerships with 5+ campus organizations to create interdisciplinary speaker series and academic advising.
- Bridged between undergraduates interested in philosophy with philosophy professors and 20+ graduate students at Penn.

SKILLS & INTERESTS

- **Programming:** Java (advanced), Python (advanced), R (advanced), Linux (advanced).
- **Hobbies:** Classical music, Violin (13 years), Running.