

Tong Si (she/her)

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<https://www.slu.edu/medicine/health-and-clinical-outcomes-research/faculty/si-tong.php>

Academic Experience

Saint Louis University		Saint Louis, MO
▪ Assistant Professor in the Department of Health and Clinical Outcomes Research	Jul. 2025-present	
Culver-Stockton College		Canton , MO
▪ Assistant Professor of Computer Science & Math (tenure track)	Aug. 2024 – Jun. 2025	
Saint Louis University		Saint Louis, MO
▪ Ph.D. in Statistics (GPA 3.96/4.0)	<i>Aug. 2020- Aug. 2024</i>	
Advisor: Dr. Haijun Gong		
Department of Mathematics and Statistics		
▪ M.S. Candidate in Artificial Intelligence (GPA 3.96/4.0)	<i>Aug. 2022-Present</i>	
Department of Computer Science		
▪ M. A. in Mathematics	<i>Aug. 2020 - May 2022</i>	
Department of Mathematics and Statistics		
Jilin University		Changchun, China
▪ B. S. in Mathematics and Applied Mathematics.	<i>Sept. 2016 - Jun. 2020</i>	
▪ BEc in Actuarial Science(minor)	<i>Sept. 2017 - Jun. 2020</i>	

Research Publications

Peer-Reviewed Papers (published)

1. Graham Bishop, **Tong Si**, Isabelle Luebbert, Noor Al-Hammadi, Haijun Gong "tBN-CSDI: A time-varying blue noise-based diffusion model for time series imputation", accept to Bioinformatics Advances(2025)
2. Lingling Zhang, **Tong Si**, Lucas Koch, Haijun Gong "Gene Regulatory Network Inference from Pseudotime-Ordered scRNA-seq Data via Time-Lagged Divergence Measures", Proceedings of 12th International Conference on Bioinformatics Research and Applications(2025)
3. Lingling Zhang, Yunge Wang, **Tong Si**, Lucas Koch, Sarah Roberts, Haijun Gong, "Time-varying Gene Regulatory Networks Inference Using KL Divergence From Single Cell Data. " Proceedings of 17th International Conference on Bioinformatics and Biomedical Technology (2025)
4. Wang, Yunge, Lingling Zhang, **Tong Si**, Sarah Roberts, Yuqi Wang, and Haijun Gong. "Reconstructing Dynamic Gene Regulatory Networks Using f-Divergence from Time-Series scRNA-Seq Data." Current Issues in Molecular Biology 47, no. 6 (2025): 408.
5. Zhongyuan Zhao, Peng Zou, Yuan Fang, **Tong Si**, Bofang Yi, Tao Zhang. "Machine Learning Approaches for Assessing Medication Transfer to Human Breast Milk", *Journal of Pharmacokinetics and Pharmacodynamics* (2025): 52:25
6. Wen-Shan Liu, **Tong Si**, Aldas Kriauciunas, Marcus Snell, Haijun Gong, "Bidirectional f-Divergence-Based Deep Generative Method for Imputing Missing Values in Time Series Data", *Stats* 8(1), 7 (2025)
7. Yunge Wang, Lingling Zhang, **Tong Si**, Graham Bishop, Haijun Gong, "Anomaly Detection in High-Dimensional Time Series Data With a Scaled Bregman Divergence", *Algorithms* 18(2), 62 (2025)
8. **Tong Si**, Yunge Wang, Lingling Zhang, Evan Richmond, Tae-Hyuk Ahn, and Haijun Gong. "Multivariate Time Series Change-Point Detection with a Novel Pearson-like Scaled Bregman Divergence." *Stats* 7, no. 2 (2024): 462-480.
9. **Tong Si**, Zackary Hopkins, John Yanev, Jie Hou, and Haijun Gong. "A novel f-divergence based generative adversarial imputation method for scRNA-seq data analysis." *PLoS ONE* 18, no. 11 (2023): e0292792.
10. Helen Richards, Yunge Wang, **Tong Si**, Hao Zhang, and Haijun Gong. "Intelligent Learning and Verification of Biological Networks." *Advances in Artificial Intelligence, Computation, and Data Science: For Medicine and Life Science* (2021): 3-28.

Peer-Reviewed Abstracts

11. **Tong Si**, Zackary Hopkins, John Yanev, Jie Hou, and Haijun Gong. " sc-fGAIN: An f-divergence-based

Generative Adversarial Imputation Method for scRNA-sq Data Analysis.", *F1000Research*, 22nd International Conference on Bioinformatics (2023)

12. **Tong Si**, Yunge Wang, Lingling Zhang, Kate Cannell, Haijun Gong. "Change-point detection using scaled Bregman Divergence. *F1000Research*, 22nd International Conference on Bioinformatics (2023)
13. **Tong Si**, Zackary Hopkins, John Yanev, Jie Hou, Haijun Gong, "f-divergence based generative adversarial imputation method for enhanced single-cell RNAseq data analysis", *International Conference on Intelligent Biology and Medicine* (2023)

Ph.D. Dissertation

14. **Tong Si**. "Missing Value Imputation and Change-Point Detection in High-Dimensional Data." PhD dissertation, Saint Louis University, (2024).

Paper Under Review

15. Noor Al Hammadi, Andrew J. Aschenbrenner, David C. Brown, Yiqi Zhu, Matthew Blake, Semere Bekena, Ramkrishna K. Singh, Johathan P. Williams, Chen Chen, **Tong Si**, Jean-Francois Trani, David B. Carr, Ramon Cassanova, Jason J. Hassenstab, Ganesh M. Babulal. "Driving Toward Early Detection of Cognitive Decline: A Novel Convolutional Neural Networks—Long Short-Term Memory Model Integrating Naturalistic Driving Data and High-Frequency Cognitive Assessments", *Submitted to Journal of Gerontology: Psychological Sciences* (2025)

Research Projects

GANs and Transformer for Separating Patient Data from Caregiver Driving Data Sep. 2024-present

Collaboration with Dr. Noor Al-Hammadi, Department of Health & Clinical Outcomes Research, SLU

- Developed a GAN-based clustering approach specifically tailored for large Clinical Outcomes data.
- Applied the model to extract Alzheimer's patient data from a dataset of 956,377 mixed patient and caregiver records; Expanded the approach with Transformer models to enhance data separation.
- Evaluated model performance and optimized extraction accuracy through iterative refinements.
- Preparing a manuscript for submission to a peer-reviewed journal.

Predicting PK Parameters by Antibody Glycosylation with GANs

Sep. 2024-present

Collaboration with Dr. Tao Zhang, School of Pharmacy and Pharmaceutical Sciences, SUNY Binghamton

- Segment amino acid sequences to separate Fab and Fc regions, preparing data for analysis.
- Apply Generative Adversarial Networks (GANs) to uncover hidden relationships between antibody characteristics and pharmacokinetic (PK) parameters, enabling prediction of PK parameters.
- Reproduce and benchmark the model against existing techniques for comparison.
- Prepare a manuscript for submission to a peer-reviewed journal.

Estimating Drug Transfer into Breast Milk using Machine Learning Approach

Oct. 2023-Sep. 2024

Collaboration with Dr. Tao Zhang's lab, School of Pharmacy and Pharmaceutical Sciences, SUNY Binghamton

- Categorize Milk/Plasma (M/P) drug ratios into distinct intervals based on a comprehensive literature review.
- Implement various machine learning models, including K-Nearest Neighbors (KNN), Random Forest, Support Vector Machine (SVM), and Deep Neural Networks in Python.
- Compare model performance, providing novel insights into the prediction of M/P ratios.
- Submitted a manuscript [7] to a peer-reviewed journal, currently under review.

Imputation of Time Series Data via Generative Models and GRU

Oct. 2023-Present

Team leader, Dr. Gong's group, SLU

- Conduct a thorough literature survey on time series data imputation to identify prevalent limitations and gaps in current methodologies.
- Develop a GRU-based time-series generative adversarial imputation network algorithm and investigate the mathematical theory underlying the algorithm; Implement the time series imputation algorithm based on different divergence functions using Python.

- **A paper [2] was published in Stats in 2025, I am a corresponding author.**

Change-Point Detection for Time Series Data Using Scaled Bregman Divergence June 2023 - Dec 2024

Team leader, Dr. Gong's group, SLU

- Developed a Pearson-like Scaled Bregman Divergence Method [1,3] for Change-point Detection [3] and Anomaly detection [1] in multivariate time series data; investigated the mathematical foundation of the algorithm and reinforce the algorithm's generality and reliability across a broader range of applications.
- Reproduced comparative methods in R and Python to benchmark our model against existing techniques. Compare the accuracy in identifying change-points, and performance across diverse datasets and conditions.
- **Two papers [1,3] were published in Stats in 2024 and Algorithms in 2025.** I am a **corresponding author** in [3].

Imputation of sc-RNA Sequencing Data via Generative Adversarial Networks

Oct. 2022 -May. 2023

Team leader, Dr. Gong's group, SLU

- Led the team to develop a novel single cell f-divergence based generative adversarial imputation network (sc-fGAIN) algorithm to impute the missing values in the single cell RNA sequencing data.
- Implemented the sc-fGAIN algorithm using Python and provide mathematical proofs to confirm its effectiveness and general applicability in imputation tasks.
- Managed a massive dataset with dimensions 10,164 by 3,918, ensuring efficient data preprocessing and algorithm application.
- Implemented and compared different state-of-the-art imputation methods as benchmarks using R, Python, and MATLAB to validate the superiority of our approach.
- **A paper [4] was published in PLOS ONE in 2023.** I received a **Best Oral Presentation Award** [8] at 2023 **International Conference on Bioinformatics**, held in Brisbane, Australia.

Innovative Web-Based Library Management System

Sept. 2023 - Dec. 2023

Team leader of Course Project, SLU

- Utilized SQL for robust database design and management, ensuring efficient data storage, retrieval, and manipulation; Implement the user interface using HTML, creating an intuitive and responsive web application.
- Built the core functionality of the system using Python, ensuring seamless integration with the database and frontend components;
- Apply GitHub for source code management and team collaboration, maintaining an organized and efficient development workflow.
- Used CircleCI for continuous integration, automating code testing and deployment processes, to enhance code quality and deployment efficiency
- Employed Docker Hub for containerizing the application, ensuring consistent deployment across different environments.

Analytical Text Processing Using Machine Learning

Sept. 2022 - Nov. 2022

Course Project, SLU

- Applied Python libraries Pandas for data manipulation and Scikit-Learn for machine learning model implementation, including using feature `sklearn.feature_extraction.text.CountVectorizer` for text preprocessing and feature extraction
- Processed raw text data using tokenization and lemmatization techniques.
- Implemented a variety of classification algorithms, including Naive Bayes, SVM, and Random Forest, to compare performance. Optimize models using cross-validation and grid search techniques.

Statistical Inference and verification of Regulatory Networks

Sept. 2020 - May 2021

Collaborative Research Project, Dr. Gong's group, SLU

- Applied a weighted dynamic Bayesian network method to reconstruct gene regulatory network from time series microarray data with other team members.
- Implemented different model checking technique, including SMV and PRISM for the network verification.

- A paper [5] was published in 2021.

Teaching at Culver-Stockton College

Computer Programming (Python)	Fall 2024
Elementary Statistics	Fall 2024
Beginning Math	Fall 2024
College Algebra	Fall 2024
Calculus II	Spring 2025
Applications of Python Programming	Spring 2025

Teaching at Saint Louis University

Data Management	Fall 2025
Programming for Health Data Scientists	Fall 2025
Instructor of College Algebra	Jan. 2022-Dec. 2022
Teaching Assistant: Regression Analysis; Bayesian Statistics & Statistical Computing	2023-2024
Teaching Assistant: Calculus I	Aug. 2021 - Dec. 2021

Professional Service

NSF Proposal Panel: ad hoc Reviewer	Nov. 2024-present
Topical Advisory Panel (TAP) for <i>Current Issues in Molecular Biology</i> , MDPI	Sep.2024-present
Member of International Society for Computational Biology	Mar. 2024-present
Research Assistant, Dr. Gong's Group, Saint Louis University	Jan. 2023-Present
Reviewer of the following Journals: BMC Bioinformatics; Heliyon; PLOS ONE ; Journal of Bioinformatics & Computational Biology; Journal of Theoretical Biology; Genomics ...	
Treasurer of Association for Women in Mathematics (AWM), SLU	Aug. 2022- Jan. 2023

Conference Presentation

Oral Presentation at International Symposium on Bioinformatics Research and Applications	Jul. 2024
Poster Presentation at 16 th Great Lakes Bioinformatics (GLBIO) conference, Pittsburgh, PA	May.2024
Oral Presentation at Annual Graduate Research Symposium, Saint Louis University	Apr. 2024
Oral Presentation at the Mathematical Association of America Missouri Section, Liberty, MO	Apr. 2024
Oral Presentation at the Danforth Plant Sciences Center, St. Louis, MO	Jan. 2024
Oral Presentation, 22 nd International Conference on Bioinformatics, Brisbane, Australia	Nov. 2023
Poster Presentation, International Conference on Intelligent Biology & Medicine, Tampa, FL	Jul. 2023

Awards and Certificate

Best Oral Presentation Award, 22 nd International Conference on Bioinformatics, Australia	Nov. 2023
Full financial support for Mathematical Problems in Industry (MPI) Workshop	Jun. 2024
Full financial support for Graduate Student Mathematical Modeling Camp (GSMMC)	Jun. 2024
2nd Place for Oral Presentation Award, Annual Graduate Research Symposium, SLU	Apr. 2024
GLBIO 2024 travel fellowship	Mar.2024
Dean's Travel Award, Saint Louis University	2023-2024
Travel Award, Forty Third Midwest Probability Colloquium	Oct. 2022
Teaching Certificate, Saint Louis University	Sept. 2025
Certificate of Data Science with SQL and Tableau from Cornell University	Feb. 2025

SKILLS AND CERTIFICATIONS

- Computer Skills: Python, R, MATLAB, SQL, HTML, Tensorflow, Pytorch, HPC
- Skills: Data analysis for big data, Software development, Database skills, Website building skills