Zhengtao Gui

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Education

University of Science and Technology of China (Anhui, China) Sept. 2020 - Present
School of the Gifted Young B. S. in Statistics

- Major GPA: 3.72/4.0 (WES)
- Major GPA: 3.64/4.3
- Overall GPA: 3.62/4.0 (WES)
- Overall GPA: 3.56/4.3

Relevant Courses

- Mathematical Statistics
- Machine Learning
- Stochastic Processes
- Data Structures and Database
- Applied Statistical Software
- Probability Theory
- Multivariate Analysis
- Regression Analysis
- Linear Algebra
- Mathematical Analysis
- Real Analysis
- Functional Analysis
- Convex Optimization
- Statistical Algorithm
- Non-parametric Statistics

Publications and Manuscripts (* co-first author)

- **Gui, Z.**, Li, H., Xu, S., and Chen, Y. (2023) A novel decomposed-ensemble time series forecasting framework: capturing underlying volatility information. *Submitted to Expert Systems with Applications.*
- Jin, S., **Gui, Z.,** Hu, J., and Chen, Y. (2023) Community Detection and Network Reconstruction with Dependent Connectivity from Rich but Noisy Network Data. *Submitted to Australian & New Zealand Journal of Statistics.*
- **Gui, Z.** (2023) M-SCORE: SCORE for Community Detection in Multi-layer Heterogeneous Networks with Covariates. *Manuscript in preparation.*
- Yang, S.*, and **Gui, Z.*** (2023) An introduction on the multivariate normal-ratio distribution. *Completed Manuscript.*

Research Experience

Time Series Forecasting Framework: Capturing Underlying Volatility Information **USTC, China**
Team Leader, University of Science and Technology of China *Dec. 2022 - Jul. 2023*

- Investigated contemporary time series hybrid forecasting models, proposing a novel time series decomposition-ensemble forecasting framework that integrates traditional statistical model GARCH with neural networks.
- Implemented diverse time series forecasting algorithms, evaluated their predictive efficacy on the German Consumer Price Index dataset, and explained the superiority of our proposed framework.
- Compared the experimental results using MAE, RMSE and MAPE metrics, revealing the superior performance of our model through substantial reductions in MAE, RMSE and MAPE values.

SCORE for Community Detection in Multi-layer Networks with Covariates **USTC, China**
Team Leader, University of Science and Technology of China *Mar. 2023 - Present*

- Introduced a novel multi-layer degree-corrected stochastic block model and developed the MSCORE algorithm to model the Multi-layer network clustering problem with covariates.
- Demonstrated the superiority of the MSCORE algorithm by the performance of ARI in different simulation experiments, explained the core principles of the algorithm.
- Proposed a novel multivariate normal-ratio distribution and derived its density function from different perspectives, investigated the basic theory of this distribution.

Network Clustering: Several Feasible Extensions to the Network Embedding Model **USTC, China**
Team Leader, University of Science and Technology of China *Jul. 2023 - Present*

- Conducted research on the Network Embedding Model and organized a research group for related discussions.
- Extended Network Embedding Model so that it can be applied to highly degree-heterogeneous networks, studied the impact of different penalty functions on the effect of the extended model.
- Completed the simulation experiment and evaluated our method against various clustering algorithms, including SCORE, Classic Network Embedding Model, Spectral Clustering, etc.

Network Reconstruction with Dependent Connectivity from Rich but Noisy Data **USTC, China**

Core Participant, University of Science and Technology of China *Mar. 2023 - Oct. 2023*

- Participated in proposing a generalized EM algorithm to restore the network structure and led the project's simulation experiments, improving computational efficiency through data sparsification and integration of the Rcpp package.
- Investigated fMRI images and derived correlation matrices from blood oxygen level time series, reconstructed matrices and grouped regions of interest in the human brain to obtain structural information, aiding in Alzheimer's diagnosis.
- Provided strong consistent estimates of the reconstructed network and communities under the setting where both the number of nodes and each pairwise measurements tend to infinity.

CODIA Intelligent Diagnosis Development Team of BDAA Laboratory **USTC, China**

Core Participant, University of Science and Technology of China *Jul. 2022 - Jan. 2023*

- Designed and developed the front-end web pages using the Vue framework, offering users exercise recommendations and personal ability assessments.
- Investigated literature related to intelligent diagnosis and recommendation systems, reproduced associated algorithms and implemented API interfaces for these algorithms.
- Developed and launched the CODIA website with our team. (This project won the championship in the "Spark Cup" Cognitive Large Model Scene Innovation Competition. Congratulations!) CODIA website link

Network Analysis and Time Series Theory Reading Group **USTC, China**

Advisor: Prof. Yu Chen (Department of Statistics and Finance, USTC) *Nov. 2022 - Present*

- Conducted in-depth network analysis and time series literature review exploration, and actively participated in workshops to exchange research ideas with peers and supervisors.
- Delivered eight presentations as the principal presenter, introducing combined models related to Time Series, as well as algorithms for Network Clustering, Tucker Decomposition, and others.
- Guided discussions and actively proposed research ideas in each group meeting, evaluating the feasibility of research ideas through theoretical analysis and simulation experiments.

Neural Networks and Cognitive Diagnosis Seminar **USTC, China**

Advisor: Prof. Qi Liu (Department of Data Science, USTC) *Jul. 2022 - Feb. 2023*

- Actively participated in and discussed the research on cognitive diagnostic models, offering insights and reporting on research progress.
- Systematically read and studied several books (e.g. Hands-on Deep Learning, Statistical Learning Methods), as well as some review papers and popular neural network models.
- Delivered presentations on articles related to neural cognitive diagnostic models and led the research group to understand the core principles of the model and discuss research ideas.

Skills

Programming	Python, R, C++, Matlab, Html, JavaScript, Java
Tools	Latex, ChatGPT, Markdown, Git, Vue
Soft Skills	Academic Writing and Cooperation, Public Speaking, Time Management

Honors and Awards

- Outstanding Freshman Scholarship 2020
- The Rose Endeavor Scholarship (Top 5% Awarded) 2022
- USTC Outstanding Students Award 2022
- National Mathematics Competition For College Students (Second prize) 2021 & 2022

Teaching

Teaching Assistant in Stochastic Process **USTC**

Duty: correcting homework, conducting exercise classes, providing consultation during office hours. *Feb. 2023 - Jul. 2023*

Extracurricular

Minister of Culture and Sports Department of Student Union **USTC**

Organized more than 10 large-scale school activities impacting over 5000 people. *Sept. 2021 - Jun. 2023*

Safety Councilor of University of Science and Technology of China **USTC**

Responsible for ensuring the safety of students and handling some campus emergencies. *Sept. 2020 - Present*

Participant of the First Joint Conference on Statistics and Data Science **Beijing**

Actively participated in the discussion of more than ten interesting reports during the conference. *Jul. 2023*