

# RUZHANG ZHAO

Email: zrz15@mails.tsinghua.edu.cn ◇ Mobile: (+86) 1352-180-6787

Building 28 536, Tsinghua University, Beijing, China 100084

## EDUCATION

**Tsinghua University (THU), Beijing, China**

Department of Mathematical Sciences

Bachelor of Science in Pure and Applied Mathematics

Aug. 2015-Jul. 2019(expected)

GPA: **3.79/4.00**

major GPA: **3.90/4.00**

**Relevant Courses:** Probability Theory(A), Functional Analysis(A), Statistical Inference(A-), Applied Stochastic Processes(A), Linear Regression(A+), Methods of Optimization(A+), Complex Analysis(A)

## PUBLICATIONS AND MANUSCRIPTS

- [1] **Zhao, R.**, Yang, L., “Modeling of the HFMD with the Carrier Population.” *International Journal of Applied Physics and Mathematics (IJAPM)*, ISSN: 2010-362X. (in press)
- [2] **Zhao, R.**, Fang, Y., Horn, B.K.P., “A Simple Change Comparison for Image Sequence Based on Relative Mutual Information.” In *IEEE UV 2018*, MIT Boston, USA. (accepted)[[arXiv](#)]
- [3] **Zhao, R.**, et al., “Protective Quarantine Model of Hand-Foot-Mouth Disease.” In *AMS 2019 Oral*, Kuala Lumpur, Malaysia. (accepted)
- [4] Li, J., Liu, H., Lv, Z., **Zhao, R.**, Deng, F., Wang, C., Qin, A., Yang, X., “Updating PM2.5 Health Effects in China with New Exposure Estimation and Local C-R Functions.” *Environmental Pollution*. (SCI)[[PDF](#)]
- [5] Li, J., **Zhao, R.**, Ouyang, Y., Li, M., “A Bottom-Up Design Model for Improving Efficiency of Transit System.” In *IEEE UV 2018*, MIT Boston, USA. (accepted)
- [6] **Zhao, R.**, Hong, P., Liu J., “R package: Immigrate: Iterative Max-Min Entropy Margin-Maximization with Interaction Terms for Feature Selection.” [[CRAN](#)]
- [7] **Zhao, R.**, Hong, P., Liu J., “IMMIGRATE: A Margin-based Feature Selection Method with Interaction Terms.” (under review at AISTATS 2019)[[arXiv](#)]
- [8] **Zhao, R.**, Li, D., “Linear Regression with ARCH( $\infty$ ) Errors under Constrained Coefficients applying Maximum A Posteriori Estimation.” (to be submitted to Journal of Econometrics)
- [9] **Zhao, R.**, et al., “Continuous Inoculation Model of HFMD.” (to be submitted to Mathematical Biosciences)

## RESEARCH EXPERIENCES

**Iterative Max-Min-Entropy Margin-Max with Iteration Term**

Jul. 2018 - Sep. 2018

Advisor: Prof. [Jun S. Liu](#), Dept. of Statistics, *Harvard University*; Prof. [Pengyu Hong](#), Dept. of Computer Science, *Brandeis University*

- Proposed innovative IMMIGRATE algorithm for feature selection with interaction terms and imIM4E for feature selection with margin-quality. Designed new classification method for IMMIGRATE.
- Compared the results of IMMIGRATE, imIM4E with about 20 classifiers on UCI datasets while IMMIGRATE outperforms in most times.
- Complete the R package for IMMIGRATE, imIM4E and some other margin-based methods. [[CRAN](#)]

**Classification for Coronary Heart Disease Dataset**

Jul. 2018 - Sep. 2018

Advisor: Prof. [Jun S. Liu](#), Dept. of Statistics, *Harvard University*

- Implemented SODA, Logistic LASSO Regression and etc. Compared the performance of classification for Coronary Heart Disease high-dimensional dataset among about 10 methods.
- Designed innovative Deep-learning framework for raw audio files with small sample size and compared the results of deep-learning with statistical methods. Obtained satisfactory results.

**Existence of DNA Sequences based on K-mer Natural Vector Method** Oct. 2018 - now  
Advisor: Prof. [Stephen Shing-Toung Yau](#), Dept. of Mathematical Sciences, **THU** and **UIC**

- Developed Advanced Swarm Particle Optimization Algorithm for finding global minimum to achieve breakthrough for the project which was stuck for several months.
- Proposed an innovative natural vector method which outperformed original one in existence testing.

**Change Comparison for Image Sequence** Jan. 2018 - Feb. 2018  
Advisor: Prof. [Berthold K.P. Horn](#), Dr. Yajun Fang, CSAIL, **MIT**

- Proposed CCUC method applying uncertainty coefficient to compare change between image sequences.
- Implemented CCUC on comparable image sequences and showed it is applicable in real situation.

**Comprehensive Evaluation for Transit-Oriented Development** Jan. 2018 - Feb. 2018  
Advisor: Prof. [Berthold K.P. Horn](#), CSAIL, **MIT**; Dr. Faan Chen, **Harvard University**

- Combined Density, Diversity and Design principles with Rank sum ratio(RSR) method to establish a new indicator for ranking Transit-Oriented Development level, which outperforms the results of RSR.
- Analyzed the relationship between built environment and vehicles miles traveled by Tobit Regression and Structural Equational Method on Shanghai Road datasets.

**Linear Regression with ARCH( $\infty$ ) Errors under Constrained Coef.** Nov. 2017 - Mar. 2018  
Advisor: A/Prof. [Dong Li](#), Center for Statistical Science **THU**

- Applied maximum a posterior estimation to obtain the estimation of regression coefficient and coefficients of ARCH( $\infty$ ) errors.
- Computed an upper bound for convergence rate of the coefficients of ARCH( $\infty$ ) errors under elliptical constraint. Applied constrained estimator under euclidean norm to evaluate consistency results.
- Ran simulation to show the robustness of the new estimation.

**Modeling of the Hand-Foot-Mouth-Disease (HFMD) related topics** Dec. 2016 - Jun.2017  
Advisor: A/Prof. Lijun Yang, Dept. of Mathematical Sciences, **THU**

- Developed an innovative infectious model including people carrying pathogen as new research subject when analyzing distribution channel and analyzed the stability of equilibriums by Liapunov function.
- Proposed new models using the continuous/impulsive inoculation analyzed the stability of equilibriums, and obtained the minimum/maximum inoculation rate under continuous/impulsive inoculation.
- Simulated models under different conditions, which supports the stability analysis well.

## ACADEMIC ACHIEVEMENTS AND LEADERSHIP

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- Honors:** 1. Meritorious Winner in the MCM/ICM Contest (2017);  
2. Bank of Tokyo-Mitsubishi UFJ Scholarship (2017) for Excellent Comprehensive Performance (1/92).  
3. Qualcomm Scholarship (2017) for Outstanding Achievements in Scientific Research in THU (50/3000).  
4. Evergrande Scholarship (2018) for Excellent Comprehensive Performance (2/92).  
5. Excellent Project of Scientific Research Program in THU (20/3000, only 1 from Dept. of Math).  
**Fellowships:** 1. Membership of International Academy of Science and Engineering for Development;  
2. Fellowship of Spark Talents Program, for Excellent Performance on Research at THU (top 48 in THU, top 1 and only 1 in Dept. of Math);  
**Leadership:** 1. Minister, Ministry of Sports of Student Union of Dept. of Math(Aug.2016 - Jun.2017);  
2. Held a Marathon Game with 2000+ Participants. Held 100+ Basketball Matches in THU;  
3. Be the Captain of Class Football Team and Lead Football Team to Rank 16/100+ twice in THU.

## PROFESSIONAL SKILLS AND MISCELLANEOUS

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<b>Computer Languages</b>	Python, R, Matlab, C/C++, Java, MATLAB
<b>Software &amp; Tools</b>	LaTeX, Microsoft Office, Markdown, vim, git
<b>Standardized tests</b>	GRE General: Verbal 161 (88%) + Quantitative 170 (99%) TOEFL: 107/120 (Reading 28, Listening 27, Speaking 24, Writing 28)