Liangliang Zhang

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WORK

Case Western Reserve University, Cleveland, OH, USA
Assistant Professor in Department of Population and Quantitative Health Sciences — Nov 2021 – present
Chair: Jonathan L. Haines
Roles: Independent research, collaboration, service.

University of Texas MD Anderson Cancer Center, Houston, TX, USA
Postdoctoral Scholar in Departments of Biostatistics — Nov 2017 – Nov 2021
Advisors: Christine B. Peterson, Kim-Anh Do and Robert R. Jenq.
Research areas: Bayesian methods, variable selection, hypothesis testing, microbiome data analysis.

EDUCATION

Michigan State University, East Lansing, Michigan, USA
Doctor of Philosophy (Ph.D.) in Statistics — Aug 2012 – Aug 2017
Dissertation: High dimensional computational models for biomedical imaging data analysis
Advisor: Tapabrata Maiti; Cumulative GPA: 4.0 / 4.0
Research areas: Bayesian calibration, multi-level model, multi-state model, variable selection, dynamic network.

Michigan State University, East Lansing, Michigan, USA
Master of Statistics — Aug 2012 – Aug 2015
Advisor: Chae Young Lim; Cumulative GPA: 4.0 / 4.0
Research areas: Alzheimer's disease, abdominal aortic aneurysm (AAA), image data analysis.

Soochow University, Suzhou, Jiangsu, China
Master of Applied Mathematics — Sep 2009 – Jun 2012
Thesis: On optimal drift vector and importance sampling for pricing options based on direct simulations
Cumulative GPA: 3.7 / 4.0; Graduation with Honors.
Research areas: Monte Carlo methods, partial differential equations, option pricing, martingale.

Nanjing University of Posts and Telecoms, Nanjing, Jiangsu, China
Bachelor of Science (B.S.) in Statistics — Sep 2005 – Jun 2009
Cumulative GPA: 3.96 / 4.00; Graduation with Honors.

EXPERIENCE

Postdoctoral Scholar, University of Texas MD Anderson Cancer center — Nov 2017 – present

- Performed extensive collaborative research with clinical faculty (e.g. medical oncology, head and neck, infectious diseases) on learning how microbiota in different body sites influence immune responses and the natural history of cancer related diseases.
- Gained experience in statistical genetics and bioinformatics techniques of processing 16S rRNA sequences.
- Released R package and R Shiny App implementing progressive permutation on differential tests.
- Gained technical skills in data science and visualization to describe microbiome data and patient data.
- Developed Bayesian variable selection to identify the microbial biomarkers impacting a continuous outcome.
- Received systematic training in scientific communication and writing that supports research excellence.

Statistical Training and Consulting, Michigan State University — May 2015 – May 2016

- Received professional training in multi-tasking, scheduling meetings and providing services.
- Gained hands-on experiences in communicating with diverse clients from different research areas.
- Gained exposure to the connection between statistical analysis and all kinds of real-world problems.

Graduate Assistant, Michigan State university — Dec 2012 – Aug 2017

- Gained experience and accumulated interests in Alzheimer's disease (AD) research.
- Developed skills in processing Magnetic Resonance Imaging (MRI) and functional MRI (fMRI).
- Performed multi-state model and functional data analysis to model the progression of Alzheimer's disease using structural and functional volumetric variables.
- Developed Bayesian methods for the analysis of high-dimensional image data and completed the project for the prediction of AAA (Abdominal Aortic Aneurysm) enlargement.
- Received solid training in probability and statistics, such as asymptotic theory, decision theory and Bayesian theory.
- Gained hands-on experience in teaching undergraduate and graduate level courses

Master in Applied Mathematics, Soochow University — Sep 2009 – Jun 2012

- Received systematic training in partial differential equations, stochastic analysis and optimization methods.
- Developed Monte Carlo method with importance sampling to solve the stochastic partial differential equations.
- Gained modeling skills for stock and option pricing, such as HJM Model, Heston model and LIBOR model.

PUBLICATIONS

Peer Reviewed

17) Y. Shi, L. Zhang, K. Do, C. Peterson, R. Jenq, "Performance determinants of unsupervised clustering methods for microbiome data," in *Microbiome*, Jan 2022.

16) M. Schmiester,…, L. Zhang, et al. "Flow Cytometric Analysis of Microbial Diversity in Patients with Aggressive Lymphoma Disease Undergoing Chemoimmunotherapy," in *Blood*, Nov 2021.

15) K. Lee and L. Zhang, "Cumulative Effects of Poverty on Children's Social-Emotional Development: Absolute Poverty and Relative Poverty," in *Community Mental Health Journal*, Nov 2021

14) L. Zhang, Y. Shi, K. Do, R. Jenq, C. Peterson, "ProgPerm: Progressive permutation for a dynamic representation of the robustness of microbiome discoveries," in *BMC Bioinformatics*, Jan 2021.

13) L. Zhang, B. Zambrano, J. Choi, W. Lee, S. Baek, C. Lim, "Intraluminal thrombus effect on the progression of abdominal aortic aneurysms by using a multistate continuous-time Markov chain model," in *Journal of International Medical Research*, Nov 2020.

12) Y. Li, L. Zhang, T. Maiti. "High dimensional linear discriminant analysis for spatially dependent data," in *Electronic Journal of Statistics*, Sep 2020.

11) C. Reyes-Gibby, J. Wang, L. Zhang, et al. "Oral microbiome and onset of oral mucositis in patients with squamous cell carcinoma of the head and neck," in *Cancer*, Sep 2020.

10) L. Zhang, Y. Shi, K. Do, R. Jenq, C. Peterson, "Bayesian compositional regression with structured priors for microbiome feature selection," in *Biometrics*, Jul 2020.

9) Y. Shi, L. Zhang, K. Do, C. Peterson, R. Jenq, "aPCoA: Covariate adjusted principal coordinates analysis," in *Bioinformatics*, Apr 2020.

8) Y. Li, L. Zhang, A. Bozoki, D. Zhu, J. Choi, T. Maiti, "Early prediction of Alzheimer's disease using longitudinal volumetric MRI data from ADNI," in *Health Services and Outcomes Research Methodology*, Dec 2019.

7) M. Shang, L. Zhang, et al. "Identification of hub genes and regulators associated with pancreatic ductal adenocarcinoma based on integrated gene expression profile analysis," in *Discovery Medicine*, Sep 2019.

6) E. Riquelme, Y. Zhang, L. Zhang, et al. "Tumor microbiome diversity and composition influence pancreatic cancer outcomes," in *Cell*, Aug 2019.

5) L. Zhang, Z. Jiang, J. Choi, C. Lim, T. Maiti and S. Baek, "Patient-specific prediction of abdominal aortic aneurysm expansion using Bayesian calibration," in *IEEE J Biomed Health Inform.*, Jan 2019.

4) L. Zhang, Y. Li, C. Lim, T. Maiti, J. Choi, D. Zhu, "Analysis on conversion of Alzheimer's disease using a multi-state Markov chain model," in *Statistical Methods in Medical Research*, Jul 2018.

3) C.L. Holz, R. K. Nelli, M. E. Wilson, L. Zarski, W. Azab, R. Baumgardner, N. Osterrieder, A. Pease, L. Zhang, et al. "Viral genes and cellular markers associated with neurological complications during herpesvirus infections," in *Journal of General Virology*, Feb 2017.

2) S. Seyedsalehia, L. Zhang, J. Choi, S. Baek, "Prior distributions of material parameters for Bayesian calibration of growth and remodeling computational model of abdominal aortic wall ," in *Journal of Biomedical Engineering*, Oct 2015.

1) L. Zhang, "Survey to monthly consumption of college students-taking Nanjing University of Posts & Telecommunications as an example," in *Journal of Statistical Thinktank*, Beijing, China, Feb 2009.

Under Review

3) Z Schwabkey, …,L. Zhang, et al. "Diet-derived metabolites and mucus link the gut microbiome to fever after cytotoxic cancer treatment," in *Science*, Dec 2021. (Under review)

2) Y Shi, L. Zhang, K. Do, R. Jenq, C. Peterson, "Bayesian approaches for flexible clustering of microbiome data using Dirichlet tree multinomial mixtures," in *Annals of Applied Statistics*, May 2020. (Under review)

1) K. Lee, L. Zhang, et al. "Cumulative effects of poverty on children's social-emotional developmental outcomes," in *Journal of Social Policy*, Aug 2020. (Under review)

TEACHING

Collaborative teaching

University of Texas MD Anderson Cancer Center, TX, USA Mar 2018 – Aug 2020

I taught collaborators the routine steps on microbiome data analysis to support their interpretations and writings.

Graduate level teaching

Bayesian Statistics (STT874), MSU, MI, USA Aug 2016 – Dec 2016

I assisted the professor in designing/grading homework problems, collecting topics for class projects, giving lectures when the professor traveled and holding office hours to answer their questions.

Undergraduate level teaching

Statistical Method: Lab session (STT201), MSU, MI, USA Jan 2014 – May 2014

I gave lectures to teach students how to solve Statistical problems using MINITAB, besides I did grading and help-room.

Probability and Statistics for Engineering (STT351), MSU, MI, USA Jun 2015 – Aug 2015

Introduction to Probability and Statistics for Business (STT315), MSU, MI, USA Aug 2014 – Dec 2014

Statistical Methods (STT200), MSU, MI, USA Jan 2013 – May 2013

I did grading, help-room, monitoring exams and recitations of the homework problems.

ACADEMIC HONORS & AWARDS

Winner in student poster competition, ISBIS, IBM T. J. Watson Research Center, NY, USA — Jun 2017
Dissertation Completion Fellowship, Michigan State University, USA — Dec 2016
Paid Workshop on Challenges in Computational Neuroscience, SAMSI, USA — Jul 2015
Dissertation Continuation Fellowship, Michigan State University, USA — May 2015
Admitted by MSU with a TA scholarship, USA — Mar 2012

Honorary Title of outstanding post-graduate student, Soochow University, China — Jun 2011
The Third Prize in National Post-Graduate Mathematical Contest in Modeling. — Dec 2009
The Tri-Excellent Student, Nanjing University of Posts & Telecoms, China. — Nov 2008
The National Inspirational Scholarship. — Nov 2008
The First Prize in National College Mathematical Modeling Contest of Jiangsu, China. — Dec 2007
The First-class Scholarship of NUPT & of Jiangsu Province. — Nov 2006

CONFERENCE & WORKSHOP

Presentation of ”Bayesian logistic regression and survival models with structured priors for microbiome feature selection”, Joint Statistical Meetings (JSM), Virtual Meeting — Aug 2020

Presentation of ”Progressive permutation for a dynamic representation of the robustness of microbiome discoveries”, iBright Conference, Houston, TX — Nov 2019

Presentation of ”A new flexible prior being local and nonlocal for Bayesian variable selection”, Joint Statistical Meetings (JSM), Denver, CL — Jul 2019

Presentation of ”Bayesian variable selection in regression with compositional covariates”, Eastern North American Region (ENAR), Philadelphia, PA — Mar 2019

Attending talks on ”Gut health, microbiota & probiotics throughout the lifespan”, Harvard Probiotics Symposium, Boston, MA — Oct 2018

Poster presentation of ”Supervised learning on the progression of Alzheimer’s disease using a multi-state Markov model”, Eastern North American Region (ENAR), IBM T. J. Watson Research Center, NY Jun 2017

Presentation of ”Patient-specific prediction of abdominal aortic aneurysm expansion using Bayesian calibration”, Joint Statistical Meetings (JSM), Chicago, IL — Aug 2016

Presentation of ”Bayesian calibration methods and its application in biomedical science”, Eastern North American Region (ENAR), Austin, TX — Mar 2016

Attending CCNS: Computational neuroscience summer school, SAMSI (Statistical and Applied Mathematical Sciences Institute), Durham, NC — Jul 2015

SOFTWARE

R Shiny App for visualizing the results from progressive permutation analysis of microbiome data (https://biostatistics.mdanderson.org/shinyapps/ProgPerm/)
R package “ProgPerm” for preforming progressive permutation analysis on microbiome data (https://github.com/LyonsZhang/ProgPerm)
MATLAB package “BAZE” for Bayesian zero-constrained regression with compositional covariates (https://github.com/LyonsZhang/BAZE)

SKILLS

Programming: MATLAB, R, SAS, SQL, Python, MINITAB, SPSS, C++, Mathematica, HPCC, LaTeX.
Computing: Monte Carlo simulation, MCMC, Gibbs sampling, EM-algorithm, variance reduction, importance sampling, Metropolis-Hastings, simulated annealing, search and optimization methods, finite-element, clustering, permutation, PCoA, dimension reduction, Laplace approximation, graphical models, image processing, gene sequencing, etc.

PROFESSIONAL MEMBERSHIP & SERVICE

Reviewer
Annals of Applied Statistics
Computational Statistics and Data Analysis
Statistics in Biosciences
Health Services & Outcomes Research Methodology (HSOR)
Journal of Dynamic Systems, Measurement and Control

Session Chair
Bayesian Statistical Science Section, Joint Statistical Meetings — Aug 2020

Member
American Statistical Association (ASA), — Jan 2013-present
Eastern North American Region (ENAR) International Biometric Society — Jan 2015-present
International Chinese Statistical Association (ICSA) — Oct 2019-present