# YUNRAN CHEN

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## EDUCATION

**Duke University, Durham, USA**                                            *Aug 2019 - present*
*Ph.D. Candidate in Statistics (GPA: 3.9/4.0)*
*Master of Science in Statistics (GPA: 3.9/4.0)*                            *Aug 2017 - May 2019*
Thesis: Testing Poisson versus Poisson mixtures with applications to neuroscience

**Ben-Gurion University of Negev, Be'er Sheva, Israel**                     *July 2017 - Aug 2017*
*Summer Exchange Program (GPA: 4.0/4.0)*
Data Mining and Business Intelligence for Cyber Security

**Renmin University of China, Beijing, China**                             *Sept 2013 - June 2017*
*Bachelor of Science in Statistics (GPA: 3.8/4.0)*
*Double degree: Bachelor of Economics (GPA: 3.8/4.0)*
Thesis: Pairwise estimation of mixed spatial autoregressive model with sampled network data

## MANUSCRIPTS & PRESENTATIONS

- Chen, Y. and S. T. Tokdar. Bayesian estimation of block correlation matrices with an unknown block assignment
- Chen, Y. and S. T. Tokdar. Modeling neural population coordination via a block correlation matrix of fluctuating weights
- Chen, Y. and S. T. Tokdar. Testing Poisson versus Poisson mixtures with applications to neuroscience
- Chen, Y. and A. Volfovsky. Dynamic latent space models for directed networks
- Presenter at the AISC Conference (UNC Greensboro)

## RESEARCH EXPERIENCE

**Research Assistant, Duke University (Advisor: Prof. Surya Tokdar )**              *Feb 2020 - present*
*Title: Bayesian estimation of block correlation matrices with an unknown block assignment*
- Incorporated clustering into Bayesian factor models by allowing for identical factor loadings within the same block
- Achieved dimension reduction by a block structure on covariance matrices induced by block factor models
- Proposed semi-conjugate priors based on a canonical representation on block covariance matrices together with mixture of mixtures model allowing for unknown block assignments

**Research Assistant, Duke University (Advisor: Prof. Surya Tokdar & Prof. Jennifer Groh)**    *Feb 2020 - present*
*Title: Modeling neural population coordination via a block correlation matrix of fluctuating weights*
- Developed Bayesian model to depict neuron coordination of selection preference when exposed to multiple stimuli
- Defined a fluctuate weight to measure selection preference for a single neuron at a trial by a Poisson mixture model, and extended it to model neuron population by using a Gaussian copula model
- Introduced block structure on the correlation matrix to facilitate interpretation and improve statistical efficiency
- Designed a MCMC sampler to estimate a block correlation matrix with an unknown block assignment

**Research Assistant, Duke University (Advisor: Prof. Surya Tokdar)**              *May 2018 - Jan 2021*
*Title: Testing Poisson versus Poisson mixtures with applications to neuroscience*
- Proposed testing to identify Poisson versus Poisson mixtures based on Bayes factor with marginal likelihood estimated by predictive recursion (PR) algorithm
- Developed testing to identify four different kinds of Poisson mixtures by transforming the density estimation to optimization problem using Laplace approximation, and reduced computation by applying predictive recursion gradient (PRG) algorithm
- Reduced computation and facilitated interpretation for practical use by applying two different reparametrizations
- Conducted extensive simulations showing great improvement compared to the traditional testing procedure

**Research Assistant, Duke University (Advisor: Prof. Alexander Volfovsky)** *May 2018 - Oct 2020*

*Title: Dynamic latent space models for directed networks*

- Extended bilinear mixed-effects model for a static network to a model for directed dynamic network by allowing asymmetric multiplicative effect and setting each element evolving with time via Gaussian process
- Applied Gibbs sampling scheme with Pólya-Gamma data augmentation strategy
- Conducted extensive simulations and modeled on international interaction data, showing good performance and interpretability

**Research Assistant, Renmin University of China (Advisor: Prof. Cunjie Lin)** *July 2016 - May 2017*

*Thesis: Pairwise estimation of mixed spatial autoregressive model with sampled network data*

- Applied pairwise maximum likelihood method and used Taylor expansion to convert it to a quadratic function, avoiding calculation of inverse and determinant of large-scale matrix
- Reduced the computation especially for sparse large-scale network because the resulting simplified estimator of autoregression coefficients only contains information from connected pairs
- Won the first prize for Excellent Graduation Thesis

## PROFESSIONAL EXPERIENCE

### Teaching

- Instructor for Regression Analysis (STA 210) (course website)
- Teaching Assistant for Introduction for Bayesian Statistics (STA 602), Bayesian Statistical Modeling and Data Analysis (STA 360/602), Causal Inference (STA 640), Social Networks (STA 650), Probability (MATH 230)
- Self-designed tutorials for lab session (intro-net-r)
- Hold weekly two-hour office hours, graded homework, and prepared rubrics and solutions

### Programming

- Built a shiny app to display movie information, support movie recommendations and allow people searching
- Wrote a R package (prml) for predictive recursion marginal likelihood (PRML) algorithm to test Poisson mixtures
- Wrote a Python package (VIonLDA) for variational inference on Latent Dirichlet Allocation

### Data Collection, Cleaning and Visualization

- Web-scraping, API requests, text data cleaning, and spatial data visualization

### Statistical Modeling

- Built a Bayesian Hierarchical Model to capture the differences and similarities among different companies to explore how Indeed can better serve its existing customers
- Applied epidemiological models to capture the information diffusion process of Twitter network data
- Adopted a traditional Network Equilibrium Model and Queuing Theory to subsidize and optimize the taxi resource configuration in the context of the Internet
- Extended evaluation criterion of Return on Investment in business to charitable activities by incorporating selected variables and simplified the grant allocation process into a linearly constrained optimization problem

### Neuroscience

- Research Assistant in Neural Basis of Perception Laboratory (Advisor: Prof. Jennifer Groh)
- Completed course "Brain and Space" by Duke University on Coursera

## HONORS & AWARDS

- ASA NC Chapter and AISC Young Researcher Award (2018)
- Honorable Mention for the 2017-2018 BEST Award for Student Research (2018)
- First Prize for Excellent Graduation Thesis (2017)
- Honorable Mention in the Mathematical Contest in Modeling (2016)
- Second prize in the Chinese Undergraduate Mathematical Contest in Modeling (2015)
- Excellent Individual Work in the School of Statistics (2014, 2015)
- Second Prize for Academic Scholarship (2013, 2014)

## PROGRAMMING SKILLS & SOFTWARE DEVELOPMENT

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| **Programming:** | R, Python, Matlab, EXCEL VBA, C language, SPSS, Latex, Git |
| **Packages on Github:** | **R:** prml |
| | **Python:** VIonLDA |