

## Joshua Agterberg

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<https://jagterberg.github.io>

### Education

- 2017 - Present Johns Hopkins University  
2019 - Present PhD in Applied Mathematics and Statistics  
2017 - 2019 Master of Science in Engineering in Applied Mathematics and Statistics  
Advised by Professor Carey Priebe
- 2013 - 2017 University of Wisconsin-Madison  
Bachelor of Business Administration, Major in Actuarial Science and Mathematics  
Advised by Professor Marjorie Rosenberg  
GPA: 3.73/4.0, Actuarial Science Major GPA: 4.0/4.0  
Graduated with Distinction

### Research Interests

- Statistical Network Analysis
- Kernel Methods
- Spectral Perturbation Theory and Matrix Analysis
- High-dimensional Statistics
- Nonparametric Statistics

### Preprints and Publications

1. *Improving the Power of a Two-Sample Graph Test with Applications in Connectomics*  
Jaewon Chung, Bijan Varjavand, Jesús Arroyo, Anton Alyakin, **Joshua Agterberg**, Minh Tang, Joshua Vogelstein, and Carey Priebe, Submitted, 2020.
2. *Nonparametric Two-Sample Hypothesis Testing for Random Graphs with Negative and Repeated Eigenvalues*  
**Joshua Agterberg**, Minh Tang, and Carey Priebe, Submitted, 2020.
3. *Correcting a Nonparametric Two-sample Graph Hypothesis Test for Graphs with Different Numbers of Vertices*  
Anton Alyakin, **Joshua Agterberg**, Hayden Helm, and Carey Priebe, Submitted, 2020.
4. *On Two Distinct Sources of Nonidentifiability in Latent Position Random Graph Models*  
**Joshua Agterberg**, Minh Tang, and Carey Priebe, Submitted, 2020.
5. *Spectral Graph Clustering via the Expectation-Solution Algorithm*  
Zachary Pisano, **Joshua Agterberg**, Carey Priebe, Daniel Naiman, Submitted, 2020.
6. *Vertex Nomination, Consistent Estimation, and Adversarial Modification*  
**Joshua Agterberg**, Youngser Park, Jonathan Larson, Chris White, Carey Priebe, and Vince Lyzinski, Published in the *Electronic Journal of Statistics*, 2020.

7. *Social Determinant-Based Profiles of US Adults with the Highest and Lowest Health Expenditures Using Clusters*  
Fanghao Zhong, Margie Rosenberg, **Joshua Agterberg**, and Richard Crabb, Published in *North American Actuarial Journal*, 2020.
8. *Cluster Analysis Application to Identify Groups of Individuals with High Health Expenditures*  
**Joshua Agterberg**, Fanghao Zhong, Richard Crabb, and Margie Rosenberg, Published in *Health Services and Outcomes Research Methodology*, 2020.

## Talks

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|-----------|--|
| 2/2/2021  | “Nonparametric Two-Sample Hypothesis Testing for Random Graphs with Negative and Repeated Eigenvalues,” <i>Applied Math and Statistics Student Seminar</i> , JHU |
| 8/6/2020  | “Consistent Nonparametric Hypothesis Testing for Low Rank Random Graphs with Negative and Repeated Eigenvalues,” <i>Joint Statistical Meetings</i>               |
| 4/7/2020  | “Nonidentifiability and nonparametric random graph hypothesis testing,” <i>MINDS Seminar</i> , JHU   |
| 1/28/2020 | “On Two Distinct Sources of Nonidentifiability in Latent Position Random Graph Models,” <i>Applied Math and Statistics Student Seminar</i> , JHU                 |
| 4/23/2019 | “Vertex Nomination, Consistent Estimation, Adversarial Modification,” <i>Applied Math and Statistics Student Seminar</i> , JHU                                   |

## Honors and Awards

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|--------------|--|
| 2020-Present | Applied Mathematics and Statistics Apprentice Teaching Fellow        |
| 2019-Present | Charles and Catherine Counselman Fellowship                          |
| 2019-2020    | MINDS (Mathematical Institute of Data Science) Fellowship            |
| Spring 2017  | Graduated with distinction (top 20% of graduating business students) |
| Spring 2017  | DW Simpson Scholarship   |
| Fall 2016    | Bicknell Scholarship   |
| 2013-2014    | Arthur C. Nielsen Scholarship  |
| 2013         | Directly Admitted to Wisconsin School of Business                    |
| 2014-2017    | Dean’s list (>3.8 Semester GPA – achieved five separate times)       |

## Teaching

*Johns Hopkins University (Applied Mathematics and Statistics)*

- |             |  |
|-------------|--|
| Winter 2021 | Instructor for 553.283 Introduction to R   |
| Summer 2020 | Instructor for Financial Mathematics Master’s Program Statistics Review                |
| Summer 2020 | Teaching Assistant for 553.310 Probability and Statistics for Vittorio Loprinzo        |
| Fall 2019   | Co-created a topics course in probability with another graduate student                |
| Summer 2019 | Instructor for Financial Mathematics Master’s Program Statistics Review                |
| Summer 2019 | Teaching Assistant for 553.310 Probability and Statistics for Vittorio Loprinzo        |
| Spring 2019 | Teaching Assistant for 553.762 Nonlinear Optimization II for Professor Daniel Robinson |
| Fall 2018   | Teaching Assistant for 553.730 Statistical Theory for Professor Carey Priebe           |
| Summer 2018 | Instructor for Financial Mathematics Master’s Program Statistics Review                |

*University of Wisconsin-Madison (Wisconsin School of Business, Risk and Insurance)*

Spring 2017      Grader for ActSci 655 Health Analytics for Professor Margie Rosenberg  
Fall 2016        Grader for ActSci 651 Life Contingencies II for Professor Paul Johnson  
Spring 2016      Grader for ActSci 650 Life Contingencies I for Professor Margie Rosenberg

*University of Wisconsin-Madison (School of Music)*

Spring 2015-Spring 2017, Private Piano Instructor

## Professional Service

2019-Present      Reviewer: IEEE Transactions on Pattern Analysis and Machine Intelligence  
2019-Present      Member: ASA, IMS  
2020-Present      Organizer: Johns Hopkins Applied Mathematics and Statistics student seminar  
2021                Member: Graduate student committee to meet with potential JHU AMS tenure-track faculty  
2020                Organizer: Summer reading group on eigenvectors and random graph inference  
2020                Speaker: Fall reading group on theoretical foundations of data science  
2019                Member: Graduate student committee to meet with potential JHU AMS faculty head

## Experience

2018 - Present    **Research Assistant**, Johns Hopkins University, Baltimore, MD

Research assistant to Professor Carey Priebe in the Applied Mathematics and Statistics Department.

2017                **Analytics Intern**, CNA Financial, Chicago, IL

Examined the predictive value of FDA data on losses for products and professional liability for medical devices.

Cleaned and edited FDA data to merge with internal data and Dun and Bradstreet data. Modeled losses in R using a GLM with Tweedie family and log-link to account for zero-inflation.

Created univariate with-without plots to examine effect of specific FDA variables on losses

2016                **Actuarial Intern**, CNA Financial, Chicago, IL

Developed a Markov Chain model for predicting the probability of payment for insurance claims given the current legal state.

Generated piecewise linear splines to implement time dependence of Markov Model.

2013                **Actuarial Intern**, CUNA Mutual Group, Madison, WI

Created spreadsheets from scratch to replicate GAAP and Statutory reserves results from PolySystems for equity-indexed annuity policies as a control for auditors.

Analyzed mortality experience study data in Excel by comparing actual to expected ratios with the proposed new table and helped management determine to use new table across all annuity products.

## Research Activities

2019-Present    `nonparGraphTesting` R Package

R package implementing the nonparametric hypothesis test studied in the forthcoming paper *Consistent Nonparametric Hypothesis Testing for Random Graphs with Negative or Repeated Eigenvalues*

Summer 2018    DARPA D3M Summer Workshop

Implemented Python code for graph-related problems for the D3M (Data-Driven Discovery of Models) summer workshop in Arlington, VA, under the direction of Professors Youngser Park and Carey Priebe. Responsibilities included updating primitives (individual algorithms), editing pipelines (collections of algorithms), and submitting results for formal evaluation.

2017 - 2018    `iGraphMatch`

Wrote R code for `splrMatrix` object (a sparse plus low-rank matrix) for faster calculations and cheaper storage of centered adjacency matrices in the `iGraphMatch` R package under direction of Professors Daniel Sussman and Carey Priebe.

2016 - 2018    `catDist` R Package

Personal project implementing several different categorical dissimilarity measures for use with K-Medoids and spectral clustering methods.

## Skills and Qualifications

Proficient in R, Java, Python, Linux, Git, C++ (Rcpp), Matlab, LaTeX, Microsoft Excel, and VBA  
Passed three actuarial exams (P, FM, and MFE)

## Quantitative Coursework

*Johns Hopkins University*

Probability Theory I and II, Statistical Theory I and II, Nonlinear Optimization I and II, Combinatorial Optimization, Matrix Analysis, Topics in Statistical Pattern Recognition, Statistical Inference on Random Graphs, Riemannian Geometry, Complex Variables, Functional Analysis, Topics in Probability (co-organized), Sparse Representations in Computer Vision and Machine Learning

*University of Wisconsin-Madison*

Real Analysis I and II, Measure Theory, Actuarial Mathematics, Loss Models I and II, Linear Programming, Numerical Analysis, Stochastic Processes, Stochastic Calculus, Linear Regression, Theory of Probability

## Hobbies

Playing jazz piano, playing with synthesizers, reading fantasy, and biking