

# Joshua Daniel Loyal

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EDUCATION	<b>Ph.D. Statistics</b> University of Illinois at Urbana-Champaign, Champaign, IL Advisors: Dr. Yuguo Chen and Dr. Ruqing Zhu  <b>M.S. Physics</b> Yale University, New Haven, CT  <b>B.S. Physics and Mathematics</b> Duke University, Durham, NC	Expected in May 2022       December 2016      May 2013
PUBLICATIONS	<p><b>Loyal, J.D.</b> and Chen, Y. (2020). Statistical network analysis: A review with applications to the coronavirus 2019 pandemic. <i>International Statistical Review</i>, 88(2):419–440. <a href="#">Article</a>.</p> <p><b>Loyal, J.D.</b> and Chen, Y. (2021). A Bayesian nonparametric latent space approach to modeling evolving communities in dynamic networks. Invited revision. <a href="#">arXiv</a>.</p> <p><b>Loyal, J.D.</b>, Zhu, R., Cui, Y., and Zhang, X. (2021). Dimension reduction forests: Local variable importance using structured random forests. Invited revision. <a href="#">arXiv</a>.</p> <p><b>Loyal, J.D.</b> and Chen, Y. (2021). An eigenmodel for dynamic multilayer networks. Under review. <a href="#">arXiv</a>.</p> <p>Cohen T., Golling, T., Hance, M., Henrichs, A., Howe, K., <b>Loyal, J.</b>, Padhi, S., and Wacker, J. G. (2014). SUSY Simplified Models at 14, 33, and 100 TeV Proton Colliders. <i>Journal of High Energy Physics</i>, 117. <a href="#">Article</a>.</p> <p>Gershtein, Y., Luty, M., . . . , <b>Loyal, J.</b>, et al. (2013). New Particles Working Group Report of the Snowmass 2013 Community Summer Study. In Proceedings at <i>Community Summer Study 2013: Snowmass on the Mississippi (CSS2013)</i>. <a href="#">Article</a>.</p> <p>Cohen, T., Golling, T., Hance, M., Henrichs, A., Howe, K., <b>Loyal, J.</b>, Padhi, S., and Wacker, J. G. (2013). A Comparison of Future Proton Colliders using SUSY Simplified Models: A Snowmass Whitepaper. In Proceedings at <i>Community Summer Study 2013: Snowmass on the Mississippi (CSS2013)</i>. <a href="#">Article</a></p> <p><b>Loyal, J.D.</b> and Chen, Y. (2021). Invited discussion for ‘Co-citation and Co-authorship Networks of Statisticians’. In preparation for <i>Journal of Business and Economics Statistics</i>.</p> <p><b>Loyal, J.D.</b> and Chen, Y. (2021). Bayesian model averaging and time-varying homophily in a latent space model for dynamic networks. In preparation.</p>	

SOFTWARE	<p><b>multidynet:</b> Variational inference of the eigenmodel for dynamic multilayer networks, Python package <a href="#">Github</a>.</p> <p><b>dynetlsm:</b> MCMC inference of latent space models for dynamic networks including the HDP-LPCM, Python package <a href="#">Github</a>.</p> <p><b>drforest:</b> Statistical estimation methods for dimension reduction forests and local subspace variable importance, Python package <a href="#">Github</a>.</p> <p><b>sliced:</b> Scikit-learn compatible sufficient dimension reduction methods, Python package <a href="#">Github</a>.</p>
AWARDS, HONORS, & SCHOLARSHIP	<p><b>Best Student Contributed Paper Award</b>, 2021 ISBA World Meeting. 2021</p> <p><b>Poster Award</b>, ICSA Applied Statistics Symposium. 2021</p> <p><b>Doctoral Student Leadership and Service Award</b>, UIUC Statistics Department. 2020</p> <p><b>Ranked as Excellent in Teaching</b>, UIUC. Spring 2018</p> <p><b>Ranked as Excellent in Teaching</b>, UIUC. Fall 2017</p> <p><b>Graduated Magna Cum Laude</b>, Duke University. 2013</p> <p><b>Graduated with High Distinction in Physics</b>, Duke University. 2013</p> <p><b>Science and Undergraduate Laboratory Internship</b>, US DOE, \$5,000. 2012</p> <p><b>Silver Medal</b>, The University Physics Competition. 2011</p> <p><b>Triangle University Nuclear Laboratory REU Program</b>, US NSF, \$4,500. 2011</p>
RESEARCH INTERESTS	<p>Statistical inference for networks, Bayesian inference and scalable computation, Bayesian nonparametrics, Clustering, State-space models, Sufficient dimension reduction, Random forests and trees, Statistical machine learning, Data science, Applied scientific problems.</p>
TEACHING & MENTORING EXPERIENCE	<p><b>Roundtable Panelist</b>, Blackwell Summer Scholars Program June 2021 University of Illinois at Urbana-Champaign, Champaign, IL - Discussed graduate school experience with URM college juniors and seniors.</p> <p><b>Sloan Peer Mentor</b>, Sloan UCEM Program 2019 – 2020 University of Illinois at Urbana-Champaign, Champaign, IL - Mentored a first-year Ph.D. student and trained in effective mentoring.</p> <p><b>Teaching Assistant</b>, Department of Statistics University of Illinois at Urbana-Champaign, Champaign, IL - STAT 542 : Statistical Learning Fall 2018 Guest lecture on “An Introduction to Statistical Forecasting” <i>Duties:</i> Held office hours, managed online discussion board,</p>

- developed grading rubric, graded assignments.
- STAT 400 : Statistics and Probability I Spring 2018  
*Duties:* Gave short lectures, led discussion sections, held office hours, graded assignments, proctored exams.
- STAT 400 : Statistics and Probability I Fall 2017  
*Duties:* Gave short lectures, led discussion sections, held office hours, graded assignments, proctored exams.

**Instructor**, Open Data Science Conference  
 DataRobot, Boston, MA

- Introduction to Data Science with Python Workshop November 2015  
*Duties:* Prepared course material and lectured.

**Teaching Fellow**, Department of Physics  
 Yale University, New Haven, CT

- PHYS 165L : General Physics Laboratory - Electricity and Magnetism Spring 2014  
*Duties:* Gave short lectures, supervised physics labs, developed grading rubric, graded assignments, proctored practicum.
- PHYS 165L : General Physics Laboratory - Mechanics Fall 2013  
*Duties:* Gave short lectures, supervised physics labs, developed grading rubric, graded assignments, proctored practicum.

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## RESEARCH EXPERIENCE

**Research Assistant** Spring 2020 – Present

Department of Statistics, UIUC

*Advisor:* Dr. Yuguo Chen

*Collaborators:* Dr. Asmeret Naugle and Dr. Kiran Lakkaraju

- Introduced a statistical model for analyzing dynamic multilayer network that infers time-varying global node effects, shared low-dimensional structure, and a mixture of assortative and disassortative relations. Developed an efficient variational inference algorithm.

**Doctoral Researcher**

Fall 2018 – Present

Department of Statistics, UIUC

*Advisor:* Dr. Ruqing Zhu

*Collaborators:* Dr. Yifan Cui and Dr. Xin Zhang

- Developed a novel locally adaptive kernel smoothing method based on random forests and sufficient dimension reduction. The smoother inherits the flexibility of random forests while also providing an interpretable local variable importance measure.

**Research Assistant**

Spring 2019 – 2020

Department of Statistics, UIUC

*Advisor:* Dr. Yuguo Chen

*Collaborators:* Dr. Asmeret Naugle and Dr. Fred Rothganger

- Developed new methodology for estimating evolving community structure in dynamic networks. The model infers a variable number of communities at each point in time and quantifies the uncertainty in the community assignments using a nonparametric prior.

**Doctoral Researcher** 2013 – 2014

Department of Physics, Yale University

*Advisor:* Dr. Tobias Golling

- Determined statistical upper limits and discovery reach of SUSY simplified models based on a statistical analysis of high dimensional Monte Carlo simulations. Contributed to the development of deep learning models for identifying particle jets in  $H \rightarrow c\bar{c}$  decays.
- Collaborated with physicists at the ATLAS experiment at CERN.

**Undergraduate Researcher** 2010 – 2013

Department of Physics, Duke University

*Advisors:* Dr. Alfred T. Goshaw and Dr. Sergei Chekanov

- Analyzed data and performed statistical analyses to detect  $H \rightarrow Z\gamma$  decays and  $W / Z$  boson production at the ATLAS detector.
- Collaborated with physicists at the ATLAS experiment at CERN and Argonne National Laboratory.

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**PROFESSIONAL EXPERIENCE** **Consultant** 2020

Illinois Consulting Office, University of Illinois, IL

*Project:* Plant Functional Trait Variation in Arctic Shrubs

*Client:* Dr. Jennifer Fraterrigo, Department of Natural Resources and Environmental Science, UIUC

Inferred how soil and climate properties influenced plant functional traits using a Bayesian hierarchical model with random effects combined with Bayesian model averaging.

**Data Scientist** 2015 – 2018

DataRobot, Boston, MA

Led projects to incorporate deep learning models, text mining algorithms, and time-series model evaluation procedures into the platform.

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**PRESENTATIONS** “An Eigenmodel for Dynamic Multilayer Networks”, *ICSA Applied Statistics Symposium*, online, September 2021.

“Emergent Recursive Multiscale Interaction”, *Sandia – Illinois LDRD Student Virtual Poster Session*, online, September 2021.

“An Eigenmodel for Dynamic Multilayer Networks”, *Joint Statistical Meetings*, online, August 2021.

“An Eigenmodel for Dynamic Multilayer Networks”, *2021 ISBA World Meeting*, online, July 2021.

“An Eigenmodel for Dynamic Multilayer Networks”, *Statistical Inference for Network Models (SINM)*, online, June 2021.

“An Eigenmodel for Dynamic Multilayer Networks”, *Bohrer Workshop in Statistics*, Department of Statistics, University of Illinois at Urbana-Champaign, April 2021.

“Modeling Evolving Communities in Dynamic Networks”, *Prospective Graduate Students Visiting Day*, Department of Statistics, University of Illinois at Urbana-Champaign, March 2021.

“A Bayesian Nonparametric Latent Space Approach to Modeling Evolving Communities in Dynamic Networks”, *Joint Statistical Meetings*, online, August 2020.

“Quantifying Uncertainty in Random Forests”, *Statistics Journal Club*, University of Illinois at Urbana-Champaign, October 2019.

“Dimension Reduction Forests: Adapting to Local Subspaces with Random Forests”, *Statistics Graduate Student Lunchtime Seminar*, University of Illinois at Urbana-Champaign, October 2019.

“Efficient Local Kernel Estimation using Structured Random Forests”, *Joint Statistical Meetings*, Denver, CO, July 2019.

“Latent Space Modeling of Relational Data”, *Statistics Journal Club*, University of Illinois at Urbana-Champaign, February 2019.

“Dimension Reducing Random Forests”, *Prospective Graduate Students Visiting Day*, Department of Statistics, University of Illinois at Urbana-Champaign, March 2018.

“Classifying Products Based on Images and Text”, *PyCon Ukraine*, Lviv, Ukraine, April 2017.

“Classifying Products Based on Images and Text”, *PyData Meetup*, Chicago, Illinois, March 2017.

PEER REVIEW SERVICE	Reviewer for <i>Journal of the American Statistical Association</i> , <i>Biometrika</i> , <i>Statistica Sinica</i> , <i>Journal of Computational and Graphical Statistics</i> , and <i>Statistics and Computing</i> .	
UNIVERSITY SERVICE	<b>Chair:</b> Ph.D. Student Invited Seminar Committee at UIUC	2020 – Present
	<b>Chair:</b> Ph.D. Student Lunchtime Seminar Committee at UIUC	2021 – Present
	<b>Member:</b> Ph.D. Student Lunchtime Seminar Committee at UIUC	2019 – 2020
	<b>Participant:</b> Prospective Graduate Students Visiting Day at UIUC	2018 – 2021
	<b>Participant:</b> Aspire Illinois Program Visiting Day at UIUC	Fall 2017
PROFESSIONAL MEMBERSHIPS	American Statistical Association, Institute of Mathematical Statistics, International Society for Bayesian Analysis, International Chinese Statistical Association, International Network for Social Network Analysis.	

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COMPUTING  
SKILLS

**Languages:** Python/Cython, R/Rcpp, C/C++, Bash, SQL.

**Libraries:** NumPy, Scipy, Scikit-learn, TensorFlow, PyTorch, Keras, JAX, Stan, PyMC3, NumPyro, Pandas, Tidyverse, Matplotlib, Seaborn, NetworkX, igraph.

**Misc:** Linux, Git and Github, Docker, L<sup>A</sup>T<sub>E</sub>X, HPC (e.g., SLURM, TORQUE).

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