

Joshua Daniel Loyal

CONTACT

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EDUCATION

Ph.D. Statistics

August 2022

University of Illinois at Urbana-Champaign, Champaign, IL
Advisors: Dr. Yuguo Chen and Dr. Ruoqing Zhu

M.S. Physics

December 2016

Yale University, New Haven, CT

B.S. Physics and Mathematics

May 2013

Duke University, Durham, NC

PUBLICATIONS

Loyal, J.D., Zhu, R., Cui, Y., and Zhang, X. (2022). Dimension reduction forests: Local variable importance using structured random forests. *Journal of Computational and Graphical Statistics*. In press. [Article](#).

Loyal, J.D. and Chen, Y. (2021). A Bayesian nonparametric latent space approach to modeling evolving communities in dynamic networks. *Bayesian Analysis*. In press. [Article](#).

Loyal, J.D. and Chen, Y. (2022). Discussion of “Co-citation and Co-authorship Networks of Statisticians”. *Journal of Business and Economics Statistics*. 40(2):497–498. [Article](#).

Loyal, J.D. and Chen, Y. (2020). Statistical network analysis: A review with applications to the coronavirus 2019 pandemic. *International Statistical Review*, 88(2):419–440. [Article](#).

Loyal, J.D. and Chen, Y. (2021+). An eigenmodel for dynamic multilayer networks. Invited revision at *Journal of Machine Learning Research*. [arXiv](#).

Cohen T., Golling, T., Hance, M., Henrichs, A., Howe, K., **Loyal, J.**, Padhi, S., and Wacker, J. G. (2014). SUSY Simplified Models at 14, 33, and 100 TeV Proton Colliders. *Journal of High Energy Physics*, 117. [Article](#).

Gershtein, Y., Luty, M., . . . , **Loyal, J.**, et al. (2013). New Particles Working Group Report of the Snowmass 2013 Community Summer Study. In Proceedings at *Community Summer Study 2013: Snowmass on the Mississippi (CSS2013)*. [Article](#).

Cohen, T., Golling, T., Hance, M., Henrichs, A., Howe, K., **Loyal, J.**, Padhi, S., and Wacker, J. G. (2013). A Comparison of Future Proton Colliders using SUSY Simplified Models: A Snowmass Whitepaper. In Proceedings at *Community Summer Study 2013: Snowmass on the Mississippi (CSS2013)*. [Article](#)

Loyal, J.D. and Chen, Y. (2021+). Spike-and-Slab priors for dimension selection in latent space models for static and dynamic networks. In preparation.

Plummer, S., **Loyal, J.D.**, and Chen, Y. (2021+). Statistical properties of variational Bayes for AME network models. In preparation.

SOFTWARE	<p>multidynet: Variational inference of the eigenmodel for dynamic multilayer networks, Python package Github.</p> <p>dynetlsm: MCMC inference of latent space models for dynamic networks including the HDP-LPCM, Python package Github.</p> <p>drforest: Statistical estimation methods for dimension reduction forests and local subspace variable importance, Python package Github.</p> <p>sliced: Scikit-learn compatible sufficient dimension reduction methods, Python package Github.</p>
AWARDS, HONORS, & SCHOLARSHIP	<p>Norton Prize for Outstanding Doctoral Thesis in Statistics, UIUC. 2021</p> <p>Best Student Contributed Paper Award, 2021 ISBA World Meeting. 2021</p> <p>Poster Award, ICSA Applied Statistics Symposium. 2021</p> <p>Doctoral Student Leadership and Service Award, UIUC Statistics Department. 2020</p> <p>Ranked as Excellent in Teaching, UIUC. Spring 2018</p> <p>Ranked as Excellent in Teaching, UIUC. Fall 2017</p> <p>Graduated Magna Cum Laude, Duke University. 2013</p> <p>Graduated with High Distinction in Physics, Duke University. 2013</p> <p>Science and Undergraduate Laboratory Internship, US DOE, \$5,000. 2012</p> <p>Silver Medal, The University Physics Competition. 2011</p> <p>Triangle University Nuclear Laboratory REU Program, 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>Roundtable Panelist, Blackwell Summer Scholars Program May 2022 University of Illinois at Urbana-Champaign, Champaign, IL - Discussed graduate school experience with URM college juniors and seniors.</p> <p>Roundtable Panelist, 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>Sloan Peer Mentor, 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>

Teaching Assistant, Department of Statistics
 University of Illinois at Urbana-Champaign, Champaign, IL

- STAT 525 : Computational Statistics Spring 2021
Duties: Held office hours, wrote solutions for assignments, developed grading rubric, and graded assignments.
- STAT 542 : Statistical Learning Fall 2018
 Guest lecture on “An Introduction to Statistical Forecasting”
Duties: Held office hours, managed online discussion board, 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.

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.

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.

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> , <i>Journal of Data Science</i> , and <i>Statistics and Computing</i> .	
UNIVERSITY SERVICE	Chair: Ph.D. Student Invited Seminar Committee at UIUC	2020 – 2022
	Liaison: Primary Grad Student Liaison to NISS at UIUC	Fall 2021 – 2022
	Chair: Ph.D. Student Lunchtime Seminar Committee at UIUC	2021 – Spring 2022
	Member: Ph.D. Student Lunchtime Seminar Committee at UIUC	2019 – 2020
	Participant: Prospective Graduate Students Visiting Day at UIUC	2018 – 2021
	Participant: 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	<p>Languages: Python/Cython, R/Rcpp, C/C++, Bash, SQL.</p> <p>Libraries: NumPy, Scipy, Scikit-learn, TensorFlow, PyTorch, Keras, JAX, Stan, PyMC3, NumPyro, Pandas, Tidyverse, Matplotlib, Seaborn, NetworkX, igraph.</p> <p>Misc: Linux, Git and Github, Docker, L^AT_EX, HPC (e.g., SLURM, TORQUE).</p>
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