Selena Wang

Network Science, Brain Imaging, Bayesian Analysis, Psychometrics.

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Major Research Interests

Methodology

- Social network analysis, network neuroscience
- High dimensional data analysis, clustering
- Neuroimaging, connectome-behavior linking
- Imaging genetics, imaging-genetics linking
- Psychometrics, item response theory, latent factor models
- Data integration
- Statistical machine learning, statistical philosophy

Application

- Children psychopathology and disorders
- Neurodegeneration through aging and Alzheimer's disease
- Social factor of learning, racial homophily
- International politics, networked military mobility, terrorist recruitment

Academic Appointment

Yale University
Postdoctoral Associate, Department of Biostatistics — Current

Education

The Ohio State University
Ph.D. in Quantitative Psychology, Department of Psychology — 2022
- Thesis: "Modeling dependence between a network and item responses."

M.S. in Statistics
- Thesis: "Joint analysis of social and item response networks with latent space models."

M.A. in Quantitative Psychology
- Thesis: "When reliability does not signal reliable detection of experimental effects."

University of Minnesota, Twin Cities — 2017
B.S. in Psychology, Summa cum Laude with Highest Distinction

University of Amsterdam — 2016
Visiting student

Publications

2023+

1. Xu, W., **Wang, S.**, Shen, L., & Zhao, Y. (n.d.). Collaborative survival analysis on predicting alzheimer's disease progression. *Under Review*.

2. Qiu, W., Chu, H., **Wang, S.**, Zuo, H., Li, X., Zhao, Y., & Ying, Z. (n.d.). Learning high-order relationships of brain regions. *Under Review*.

3. **Wang, S.**, Paul, S., & Sweet, S. (n.d.). The co-varying dynamics between networks and item responses via latent vectors. *Being Revised*.

4. **Wang, S.**, Liu, Y., Xu, W., Tian, X., & Zhao, Y. (n.d.). Inference-based statistical network analysis uncovers star-like brain functional architectures for internalizing psychopathology in children. *Being Revised*. (arXiv)

5. **Wang, S.**, Wang, Y., Xu, F. H., Shen, L., & Zhao, Y. (n.d.). Establishing group-level brain structural connectivity incorporating anatomical knowledge under latent space modeling. *Medical Image Analysis (Revision)*. (arXiv, code)

2024

6. Tian, X., Wang, Y., **Wang, S.**, Zhao, Y., & Zhao, Y. (n.d.). Bayesian mixed model inference for genetic association under related samples with brain network phenotype. *Biostatistics (In press)*. (arXiv)

2023

7. **Wang, S.**, Paul, S., & De Boeck, P. (2023). Joint latent space model for social networks with multivariate attributes. *Psychometrika*, 1–31. (paper, code)

8. **Wang, S.**, De Boeck, P., & Yotebieng, M. (2023). Heywood cases in unidimensional factor models and item response models for binary data. *Applied Psychological Measurement*, *47*(2), 141–154. (paper, arXiv)

9. Mishra, N. K., Kwan, P., Tanaka, T., Sunnerhagen, K. S., Dawson, J., Zhao, Y., … others (2023). Clinical characteristics and outcomes of patients with post-stroke epilepsy: protocol for an individual patient data meta-analysis from the international post-stroke epilepsy research repository (ipserr). *BMJ open*, *13*(11), e078684. (paper)

2022

10. **Wang, S**, & Edgerton, J. (2022). Resilience to stress in bipartite networks: application to the islamic state recruitment network. *Journal of Complex Networks*, *10*(4), cnac017. (paper)

11. **Wang, S**, & De Boeck, P. (2022). Understanding the role of subpopulations and reliability in between-group studies. *Behavior Research Methods*, 1–16. (paper)

12. **Wang, S.**, Wu, H., & Pek, J. (2022). Performance of alternative regression weights in the context of prediction versus inference (abstract). *Multivariate Behavioral Research*, *57*(1), 163–163. (abstract, poster)

2021-2019

13. **Wang, S.** (2021). Recent integrations of latent variable network modeling with psychometric models. *Frontiers in Psychology*, *12*. (paper)

14. Jamrozik, A., Clements, N., Hasan, S. S., Zhao, J., Zhang, R., Campanella, C., … others (2019). Access to daylight and view in an office improves cognitive performance and satisfaction and reduces eyestrain: A controlled crossover study. *Building and Environment*, *165*, 106379. (paper)

Grant Experiences

- **Trajectory-based Multimodality Brain-age Delta AD Prediction across Life Span (2023)**
  Agency: National Institute of Aging
  Status: Pending
  Role: Principle Investigator

- **Gender and racial measurement bias in vocational interest assessment (2016-2017)**
  Agency: UROP Grant, University of Minnesota
  Amount: 2,100
  Status: Completed
  Role: Principle Investigator

Teaching

- **Lead instructor of the course** at the Ohio State University (SEI available) Fall 2020, Spring 2021
  Introduction to Psychology (PSYCH 1100)
  - Lead online courses during pandemic
  - Develop syllabus
  - Design course assignments
  - Deliver live lectures

- **Teaching Assistant** at the Ohio State University Fall 2018 –Spring 2020
  Quantitative and Statistical Methods in Psychology (PSYCH 3321)
  Data Analysis in Psychology (PSYCH 2220)
  - Design and grade course assignments
  - Quest lecture at weekly lab and review sessions
  - Tutor students and hold office hours

Student Mentees (Graduate)

Yunhe Liu
Master student, Biostatistics, Yale University
- Training in high speed computing, coding, statistics methodology and paper writing

Yiting Wang
Master student, Biostatistics, Yale University
- Training in coding, simulation and paper writing
- Now PhD student of Statistics at University of Virginia

Xinzhi Zhang
Master student, Biostatistics, Yale University
  – Training in coding, simulation and data analysis

Softwares

- **jlsm:** An R package estimating joint latent space models for social networks and multivariate attributes using a fast inference approach.
  Link: https://github.com/selenashuowang/jlsm.git
- **jnirm:** An R package estimating the attributes-informed brain connectivity model.
  Link: https://github.com/selenashuowang/ABCModel.git
- **LatentSNA:** An R package estimating the latent variables-assisted statistical network analysis model.
  Link: https://github.com/selenashuowang/LatentSNA.git

Honours, Awards and fellowships

- DETxDigital Harbor Fellowship in Computational Psychometrics, Duolingo English Test 2021
- Finalist, Student Paper Competition, IISA 2021
  – Project: Joint latent space model for social networks with high-dimensional multivariate attributes.
- Ray Travel Award (for Service and Scholarship), Graduate Student Council, Ohio State 2020
- Graduate Student Conference Presentation Award, Ohio State 2018, 2019
- The International Meeting of the Psychometric Society Travel Award 2019
  – Project: The integration of social network analysis with psychometric models.
- Algorithms for Threat Detection (ATD) Travel Award 2018
  – Project: Joint Analysis of Social and Item Response Networks with Latent Space Models.
- College of Arts and Sciences Division of Social and Behavioral Sciences (SBS) Fellowship, Ohio State 2018
- Distinguished University Fellowship, Ohio State 2017, 2022
- Donald G. Paterson Award, Minnesota Psychological Association 2017
- Innovative Community Building Grants Award, University of Minnesota 2016
- Undergraduate Research Opportunities Program Grant, University of Minnesota 2016
  – Project: Gender and racial measurement bias in vocational interest assessment.
- Global Excellence Scholarship, University of Minnesota (4-years of in-state tuition) 2013

Talks

Invited Presentations

1. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *University of Illinois Urbana-Champaign, Urbana-Champaign, January, 2024.*
2. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *Rush University, Chicago, January, 2024.*
3. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *Indiana University, Indianapolis, January, 2024.*

4. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *University of Minnesota, Online, December, 2023.*

5. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *University of Utah, Online, November, 2023.*

6. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *St Children's Research Hospital, Online, November, 2023.*

7. **S. Wang** "Detect Imaging Biomarkers with Statistical Network Analysis", *Georgia Tech University, Atlanta, November, 2023.*

8. **S. Wang** "The integration of psychometric and network models for behavior and neuroscience research", *University of Maryland, College Park, April, 2023.*

9. **S. Wang** "The integration of psychometric and network models for educational research", *Michigan State University, February, 2023.*

10. **S. Wang** "The integration of psychometric and network models for educational research", *University of Nebraska, Lincoln, January, 2023.*

11. **S. Wang**, J.R. Lockwood, and Y. Attali, "Fitting psychometric models to digital-first assessment", *Duolingo English Test, August, 2021.*

12. **S. Wang**, S. Paul, and P. De Boeck, "Joint latent space model for social networks with high-dimensional multivariate attributes.", *International Indian Statistical Association Conference, May, 2021.*

13. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, "Joint modeling of network and psychometric data", *International Meeting of Psychometric Society, July, 2019.*

National & Regional Conferences

14. **S. Wang**, Y. Liu, W. Xu, X. Tian and Y. Zhao, " Inference-based statistical network analysis uncovers star-like brain functional architectures for internalizing psychopathology in children", *Eastern North American Region Spring Meeting 2024, March, 2024.*

15. **S. Wang**, Zhang, X., Y. Liu, W. Xu, X. Tian and Y. Zhao, "Unveiling Star-Like Brain Networks in Adolescent Internalizing Psychopathology: An Inference-Based Statistical Approach (Poster)", *Neuroscience Track Brunch and Poster Sessions, February, 2024.*

16. **S. Wang**, Y. Wang, F. Xu, L. Shen and Y. Zhao, " Establishing group-level brain structural connectivity incorporating anatomical knowledge under latent space modeling", *Statistical Methods in Imaging Conference 2023, May, 2023.*

17. W. Qiu, **S. Wang**, X. Li, Y. Zhao, R. Ying ", Understanding Interactions of ROIs via Learnable Hyperedges (Poster)" , *Organization for Human Brain Mapping, July, 2023.*

18. **S. Wang**, Y. Wang, F. Xu, L. Shen and Y. Zhao, " Identifying Gender based Neuromarkers of Alzheimer's Disease Using ABC Network Model" (Poster), *Organization for Human Brain Mapping, July, 2023.*

19. P. De Boeck **S. Wang** and S. Cho, "Binary Time Series for Eye Fixations: The Quality of Parameter Estimates", *National Council on Measurement in Education Conference, April, 2023.*

20. P. De Boeck and **S. Wang**, "Pervasive measurement bias", *Quantitative Methodology Center 2022 Conference, June, 2022.*

21. **S. Wang**, J.R. Lockwood, and Y. Attali, "Fitting psychometric models to digital-first assessment", *National Council on Measurement in Education, April, 2022.*

22. **S. Wang**, S. Paul, and P. De Boeck, "Modeling classroom outcome with network analysis", *National Council on Measurement in Education, April, 2022, cancelled.*

23. **S. Wang**, S. Paul, and P. De Boeck, "Joint latent space model for social networks with high-dimensional multivariate attributes", *International Meeting of Psychometric Society, July, 2021.*

24. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, "Joint modeling with network analysis and psychometrics", *Geometry and Topology meet Data Analysis and Machine Learning, May, 2019.*

25. **S. Wang**, S. Paul, J. Logan, P. De Boeck, "Joint Analysis of Social and Item Response Networks with Latent Space Models", *Algorithms for Threat Detection (ATD), November, 2018.*

26. **S. Wang** and P. De Boeck, "Does low reliability lead to low replication rates?", *International Meeting of Psychometric Society, July, 2018.*

27. **S. Wang**, B. Wiernik and B. Morgan, "Gender measurement bias versus trait differences in vocational interest assessment.", *Society for Industrial and Organizational Psychology conference, April, 2017*

28. C.D. Nye, J. J. Prasad, J.C.Bradburn, F.Elizondo, W.M.J.Phan, R.Amrhein, S.Cho, J.Rounds, B.M.Wiernik, **S.Wang**, B.Morgan, C.J.M.Wee, E.Wetzel, D.Ispas, "New directions for vocational interest research in organizations.", *Society for Industrial and Organizational Psychology conference, April, 2017*

Colloquiums & Symposiums

29. **S. Wang** and J. Edgerton, "Disrupting terrorist recruitment: Network knockouts of Islamic State recruiters.", *OSU Psychological Studies Quantitative Colloquium, 2021.*

30. **S. Wang** and J. Edgerton, "Disrupting terrorist recruitment: Network knockouts of Islamic State recruiters.", *OSU Political Science Studies Methodological Colloquium, 2021.*

31. **S. Wang** and P. De Boeck, "Understand reliability with the reliability paradox.", *OSU Psychological Studies Quantitative Colloquium, 2020.*

32. **S. Wang**, S. Paul, J. Logan, and P. De Boeck, "A joint modeling framework for social network analysis and psychometrics", *OSU Psychological Studies Quantitative Colloquium, 2019.*

33. **S. Wang** and P. De Boeck, "The role of reliability in the replication crisis.", *OSU Psychological Studies Quantitative Colloquium, 2018.*

34. **S. Wang**, "Applications of differential item functioning analysis with item response theory.", *Undergraduate Research Symposium, April, 2016.*

Relevant Experiences

Department of Biostatistics/Yale University

Postdoctoral Associate — Current

- Predictive Bayesian methods for fMRI, behavior and genetics data
- Write scientific publications with strong methodology components.
- Mentor master students of biostatistics to conduct scientific research.
- Present in professional statistical conferences.
- Manage multiple statistical projects and coordinate collaborations.

Assessment Team/Duolingo English Test

Computational Psychometrics fellow — Summer 2021

- Estimation of IRT parameters for AI-generated test items.

- Perform simulations with multidimensional IRT models.
- Write a proposal accepted and presented at NCME.
- Give a company-wide presentation.

Well Living Lab/Mayo Clinic & Delos Research Company
Data Analyst Intern Summer 2017

- Wellness in the workspace.
- Collect and clean the Stroop Test data and record Inhibition Reaction Time Data.
- Liaise between behavioral scientists and administrative staff to ensure success of the studies.

Skills

- **Software:** R, Python, SAS, Github, FLEXMirt, Mplus, SPSS
- **Statistical Frameworks:** Network Analysis, Bayesian Inference, Latent Variable Models, Generalized Linear Models, Variational Inference, Statistical Machine learning
- **Psychometrics:** Classical Test Theory, Item Response Theory, Item and Test analyses, Differential Item Functioning, Multidimensional Item Response Theory, Covariance Structure Models, Factor Analysis
- **Soft Skills:** Communication, Project Management, Documentation, Public Speaking, Team Collaboration

Services

- Ad Hoc Review
  Journal of Educational Measurement
  Developmental Science
  Big Data Mining
  President's Research Excellence (PRE) program Catalyst concept papers
  National Council on Measurement in Education
- Conference
  Organize session on Statistical Methods for Brain Connectomes, SMI 2023 (Speakers include Dr. Yi Zhao (Indiana) and Dr. R.J. Liu (Florida)
  Chair for parallel sessions, International Meeting of Psychometric Society (2018,2021)
  Planning committee, Translational Data Analytics Institute Fall Forum (2021)
- Consulting
  Consultation for a COVID and mobility research project at the College of Public Health, Ohio State University
  Consultation for a network project at the College of Medicine, Ohio State University
- School/Departmental
  Graduate Student Diversity, Equality and Inclusivity Committee, Ohio State University (2021)
  Quantitative Psychology Group, Ohio State University (2019)
  Discussion Panel, the Office of Diversity and Inclusion, Ohio State University (2019)
  Psychology Diversity Council, University of Minnesota (2016)
  International and LGBTA: A Panel Discussion, University of Minnesota (2015)
  Orientation committee, International Student and Scholar Services, University of Minnesota (2015)
- Professional Organizations
  Columbus Metropolitan Library (2020)
  American Statistical Association, the Caucus for Women in Statistics (2019)
  State Science Day (2019)

Current/Past Collaborators

Tracy Sweet
Associate Professor, QMMS, University of Maryland

- Collaborations: Network Methodology

J.R. Lockwood
Principal Assessment Scientist, Assessment Team, Duolingo English Test

- Collaborations: Psychometric models

Hao Wu
Associate Professor, Peabody College, Vanderbilt University

- Collaborations: Machine learning, statistical philosophy

Jolynn Pek
Associate Professor, Quantitative Psychology, Ohio State University

- Collaborations: Unit weight, statistical philosophy

Jared Edgerton
Assistant Professor, Political Science, University of Texas at Dallas

- Collaborations: Networked military mobility, terrorist recruitment

Carolyn Fredericks
Assistant Professor, Neurology, Yale University

- Collaborations: Alzheimer's research

Subhadeep Paul
Associate Professor, Statistics, Ohio State University

- Collaborations: Network/Psychometric Methodology

Ryan O'Dell
Assistant Professor, Psychiatry, Yale University

- Collaborations: ADNI Hearing Loss

Nishant Mishra
Assistant Professor, Neurology, Yale University

- Collaborations: Stroke

Todd Constable
Professor, Radiology and Biomedical Imaging, Yale University

- Collaborations: fMRI computational modeling

Li Shen
Professor, Informatics and Radiology, University of Pennsylvania

- Collaborations: medical image computing, bioinformatics and machine learning

Xiaoxiao Li
Assistant Professor, Electrical and Computer Engineering, University of British Columbia

- Collaborations: Hypergraph

Rex Ying
Assistant Professor, Computer Science, Yale University

- Collaborations: Hypergraph

Jessica Logan
Associate Professor, Special Education, Vanderbilt University

- Collaborations: Children social networks and learning outcomes