Susan Wei

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Department of Econometrics and Business Statistics
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Caulfield East, VIC 3145
Australia

Research interests: statistics, deep learning, singular learning theory

Education

2014
Ph.D., Statistics
University of North Carolina at Chapel Hill
Advisors: Michael R. Kosorok and J.S. Marron

2009
B.A., Mathematics with Honors
University of California at Berkeley
Study abroad: Film Studies, Cambridge University, Summer 2005

Professional Experience

2024 –
Associate Professor
Department of Econometrics and Business Statistics
Monash University
Melbourne, Australia

2024
Visiting Faculty Researcher
Google Deepmind
Sydney, Australia

2018 – 2024
Lecturer (Assistant Professor)
School of Mathematics and Statistics
University of Melbourne
Melbourne, Australia

2016 – 2018
Assistant Professor
Division of Biostatistics
University of Minnesota, Twin Cities

2014 – 2015
Postdoctoral Researcher
Institute of Mathematics
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
Advisor: Victor Panaretos

Submitted

Hoogland, Jesse, Wang, George, Farrugia-Roberts, Matthew, Carroll, Liam, **Susan Wei**, and Murfet, Daniel (2024). *The Developmental Landscape of In-Context Learning*. (Received a best papers award at ICML 2024 Workshop on High-dimensional Learning Dynamics (HiLD): The Emergence of Structure and Reasoning). arXiv: 2402.02364 [cs.LG].

Lau, Edmund, Furman, Zach, Wang, George, Murfet, Daniel, and **Susan Wei** (2024). *The Local Learning Coefficient: A Singularity-Aware Complexity Measure*. arXiv: 2308.12108 [stat.ML].

Ng, Kenyon, Heide, Chris van der, Hodgkinson, Liam, and **Susan Wei** (2024). *Temperature Optimization for Bayesian Deep Learning*. arXiv: 2410.05757 [stat.ML].

Chen, Zhongtian, Lau, Edmund, Mendel, Jake, **Susan Wei**, and Murfet, Daniel (2023). *Dynamical versus Bayesian Phase Transitions in a Toy Model of Superposition*. arXiv: 2310.06301 [cs.LG].

Li, Hui, Solorzano, Carlos A. Pena, and Davis J. McCarthy, **Susan Wei** and (2023). *Technical outlier detection via convolutional variational autoencoder for the ADMANI breast mammogram dataset*. arXiv: 2305.12068 [eess.IV].

Publications

Ng, Kenyon and Wei, Susan (2024). "Pathwise Gradient Variance Reduction with Control Variates in Variational Inference". In: *37th Australasian Joint Conference on Artificial Intelligence*. url: https://openreview.net/forum?id=hoSaMvFdbx.

Wei, Susan and Lau, Edmund (2024). Variational Bayesian neural networks via resolution of singularities. *Journal of Computational and Graphical Statistics* (just-accepted), pp. 1–24.

Zuo, Aoqi, Li, Yiqing, **Susan Wei**, and Gong, Mingming (2024). "Interventional Fairness on Partially Known Causal Graphs: A Constrained Optimization Approach". In: *The Twelfth International Conference on Learning Representations*. url: https://openreview.net/forum?id=SKulT2VX9p.

Li, Hui, McCarthy, Davis J., Shim, Heejung, and **Wei, Susan** (Nov. 2022). Trade-off between conservation of biological variation and batch effect removal in deep generative modeling for single-cell transcriptomics. *BMC Bioinformatics* 23 (1), p. 460. issn: 1471-2105. doi: 10.1186/s12859-022-05003-3. url: https://doi.org/10.1186/s12859-022-05003-3.

Wei, Susan, Murfet, Daniel, Gong, Mingming, Li, Hui, Gell-Redman, Jesse, and Quella, Thomas (2022). Deep Learning Is Singular, and That's Good. *IEEE Transactions on Neural Networks and Learning Systems*, pp. 1–14. doi: 10.1109/TNNLS.2022.3167409.

Wei, Susan and Niethammer, Marc (2022). The fairness-accuracy Pareto front. *Statistical Analysis and Data Mining: The ASA Data Science Journal* 15 (3), pp. 287–302.

Zuo, Aoqi, **Wei, Susan**, Liu, Tongliang, Han, Bo, Zhang, Kun, and Gong, Mingming (2022). "Counterfactual Fairness with Partially Known Causal Graph". In: *Thirty-sixth Conference on Neural Information Processing Systems*.

Bloomfield, Nathaniel J., **Wei, Susan**, A. Woodham, Bartholomew, Wilkinson, Peter, and Robinson, Andrew P. (Feb. 2021). Automating the assessment of biofouling in images using expert agreement as a gold standard. *Scientific Reports* 11 (1).

Hirche, Martin, Farris, Paul W., Greenacre, Luke, Quan, Yiran, and **Wei, Susan** (2021). Predicting Under- and Overperforming SKUs within the Distribution-Market Share Relationship. *Journal of Retailing* 97 (4), pp. 697–714.

Vialard, François-Xavier, Kwitt, Roland, **Wei, Susan**, and Niethammer, Marc (2020). "A shooting formulation of deep learning". In: *Advances in Neural Information Processing Systems*. Vol. 33, pp. 11828–11838.

Myhre, Jonas N., Launonen, Ilkka Kalervo, **Wei, Susan**, and Godtliebsen, Fred (2018). "Controlling Blood Glucose Levels In Patients With Type 1 Diabetes Using Fitted Q-Iterations And Functional Features". In: *2018 IEEE 28th International Workshop on Machine Learning for Signal Processing (MLSP)*. Aalborg, Denmark.

Ngo, Phuong D., **Wei, Susan**, Holubova, Anna, Muzik, Jan, and Godtliebsen, Fred (2018a). Control of Blood Glucose for Type-1 Diabetes by Using Reinforcement Learning with Feed-Forward Algorithm. *Computational and Mathematical Methods in Medicine.*

Ngo, Phuong D., **Wei, Susan**, Holubova, Anna, Muzik, Jan, and Godtliebsen, Fred (2018b). "Implementation Framework for the Reinforcement-Learning Based Optimal Control Algorithm on Patients with Type-1 Diabetes". In: *IEEE Biomedical and Health Informatics.* Las Vegas, USA.

Wei, Susan and Kosorok, Michael R (2018). The change-plane Cox model. *Biometrika* 105 (4), pp. 891–903.

Wei, Susan and Panaretos, Victor M. (2018). Empirical evolution equations. *Electron. J. Statist.* 12 (1), pp. 249–276.

Caspi, Caitlin Eicher, Wang, Qi, Shanafelt, Amy, Larson, Nicole, **Wei, Susan**, Hearst, Mary O., and Nanney, Marilyn S. (2017). School Breakfast Program Participation and Rural Adolescents' Purchasing Behaviors in Food Stores and Restaurants. *Journal of School Health* 87 (10), pp. 723–731.

Godtliebsen, Fred, Skrovseth, Stein O., and **Wei, Susan** (2017). Discussion on Statistical Scale Space Methods. *International Statistical Review* 85 (1), pp. 36–37.

Irimia, Andrei, **Wei, Susan**, Lu, Nanshu, Moore, Constance M., and Kennedy, David N. (2017). Mobile Monitoring of Traumatic Brain Injury in Older Adults: Challenges and Opportunities. *Neuroinformatics* 15 (3), pp. 227–230.

Larson, Nicole, Wang, Qi, Grannon, Katherine, **Wei, Susan**, Nanney, Marilyn S, and Caspi, Caitlin (2017). A low-cost, grab-and-go breakfast intervention for rural high school students: changes in School Breakfast Program participation among at-risk students in Minnesota. *Journal of Nutrition Education and Behavior* 50 (2), pp. 125–132.

Wei, Susan, Lee, Chihoon, Wichers, Lindsay, and Marron, J. S. (2016). Direction-Projection-Permutation for High-Dimensional Hypothesis Tests. *Journal of Computational and Graphical Statistics* 25 (2), pp. 549–569.

Wei, Susan and Kosorok, Michael R. (2013). Latent Supervised Learning. *Journal of the American Statistical Association* 108 (503), 957–970 (Featured Article; An earlier draft won a student paper award sponsored by the Statistical Learning and Data Mining Section of the American Statistical Association).

Miedema, Jayson, Marron, J.S., Niethammer, Marc, Borland, David, Woosley, John, Coposky, Jason, **Wei, Susan**, Reisner, Howard, and Thomas, Nancy E. (2012). Image and statistical analysis of melanocytic histology. *Histopathology* 61 (3), pp. 436–444.

Wei, Susan and Nobel, Andrew B. (2011). Comment on "Adaptive Confidence Intervals for the Test Error in Classification". *Journal of the American Statistical Association* 106 (495), pp. 931–936.

Honors and Awards

2022	Recipient of Unrestricted Gift from Google Research
2020-2023	Discovery Early Career Researcher Award (DECRA)
	• Australian Research Council (ARC)

2018	**Andrew Sisson Fund**
	• University of Melbourne
2014	**Institute of Mathematical Statistics (IMS) Travel Award**
	• IMS Annual Meeting
2013	**Student Travel Grant**
	• 10th International Conference on Health Policy Statistics
	NSF Graduate Research Opportunities Worldwide Award
	• Provided funding for research visit to the University of Tromso, Norway
	Student Paper Award
	• American Statistical Association Section on Statistical Learning and Data Mining
2011−2014	**NSF Graduate Research Fellowship**
	• Highly competitive three-year grant providing stipend, tuition and travel funds
2004−2008	**Regents' and Chancellor's Scholar at University of California at Berkeley**
	• Top 1 percent of incoming freshmen are invited to interview

Presentations in Conferences/Workshops

- *Joint Meeting of the NZMS, AustMS and AMS*, "A Bayesian Model Selection Criterion for Better Fine-tuning" (Invited), Auckland, December 2024

- *Sydney Workshop on Mathematics of Data Science*, "Dynamical versus Bayesian Phase Transitions in a Toy Model of Superposition" (Invited), University of Sydney, December 2024

- *Oppenheim Workshop 2024: Machine Learning and AI: Theory and Practice* "What's Degeneracy Got to Do with It?" (Inivted), National University of Singapore, November 2024

- *WIMSIG Conference 2024, SMRI*, "Quantifying degeneracy in singular models via the learning coefficient" (Invited), Sydney, October 2024

- *Summer School on Mathematical Statistics and Machine Learning*, "Quantifying degeneracy in singular models via the learning coefficient" (Invited), Vietnam Institute for Advanced Study in Mathematics (VI-ASM), Hanoi, July 2024

- *Hangzhou International Conference on Frontiers of Data Science*, "Quantifying degeneracy in singular models via the learning coefficient" (Invited), Hangzhou, July 2024

- *IMS-APRM*, "Variational Bayesian Neural Networks via Singular Learning Theory" (Invited), Melbourne, January 2024

- *CMStatistics*, "A Desingularized Mean Field Approximation" (Invited), London, December 2021

- *63rd ISI World Statistics Congress*, "A Desingularized Mean Field Approximation" (Invited), Virtual, July 2021

- *Statistical Society of Australia (SSA) webinar*, "A Desingularized Mean Field Approximation" (Invited), Virtual, June 2021

- *NeurIPS 2020*, "A Shooting Formulation of Deep Learning" (Invited), Virtual, December 2020

- *WNAR*, "The Change-Plane Cox Model" (Invited), Santa Fe, New Mexico, June 2017

- *Workshop on Functional Data Analysis*, "Empirical Evolution Equations" (Invited), Les Diablerets, Switzerland, May 2016

- *SIAM Conference on Uncertainty Quantification*,"Empirical Evolution Equations" (Contributed), Lausanne, Switzerland, April 2016

- *CMStatistics*, "Empirical Evolution Equations" (Invited), London, UK, December 2015

- *Methodological advances in Statistics related to Big Data*, "Empirical Evolution Equations" (Contributed), Castro Urdiales, Spain, June 2015

- *2014 IMS Annual Meeting*, "Latent Supervised Learning for Treatment Effect Heterogeneity" (Contributed), Sydney, Australia, July 2014

- *The 3rd Institute of Mathematical Statistics Asia Pacific Rim Meeting*,"DiProPerm" (Invited), Taipei, Taiwan, June 2014

- *2014 ENAR Spring Meeting*, "Latent Supervised Learning for Treatment Effect Heterogeneity" (Contributed), Baltimore, Maryland, May 2014

- *10th International Conference on Health Policy Statistics*, "Latent Supervised Learning for Survival Data" (Poster), Chicago, Illinois, October 2013

- *Joint Statistical Meeting*, "Latent Supervised Learning" (Contributed), Montreal, Canada, August 2013

Invited Seminars

- Quantifying degeneracy in singular statistical models. School of Computer and Mathematical Sciences, University of Adelaide (General colloquium talk and specialised seminar talk, August 2024)

- What's degeneracy got to do with it? Department of Econometrics and Business Statistics, Monash University (August 2024)

- What's degeneracy got to do with it? CEREMADE, Université Paris Dauphine (June 2024)

- An Invitation to Singular Learning Theory with Applications to Deep Learning. School of Mathematical Sciences, Peking University (May 2023)

- Variational Inference for Singular Models via Resolution of Singularities. Department of Statistics and Data Science, National University of Singapore (2022).

- Variational Inference for Bayesian Neural Networks via Resolution of Singularities. School of Physics, University of Melbourne (2022).

- Variational Inference for Bayesian Neural Networks via Resolution of Singularities. School of Engineering, RMIT (2021).

- A Desingularized Mean Field Approximation. Department of Mathematics and Statistics, IISER Kolkata (2021).

- A Desingularized Mean Field Approximation. School of Mathematical and Physical Sciences, University of Technology Sydney (2021).

- A Desingularized Mean Field Approximation. Centre for Data Science, Queensland University of Technology (2021).

- Reinforcement learning for functional state spaces with application to Type 1 Diabetes. Women in Data Science (WiDS) Conference, Institute for Mathematics and its Applications (IMA) (2018).

- Empirical Evolution Equations. Department of Computer Science and Engineering, University of Minnesota (2018).

- Empirical Evolution Equations. Department of Mathematics and Statistics, University of Melbourne (2017).

- Empirical Evolution Equations. Department of Statistics, University of California Riverside (2017).

- Empirical Evolution Equations. Department of Statistics, University of Minnesota (2016).

- Introduction to Machine Learning. Nestlé Institute of Health Sciences, Lausanne (2014).

- Latent Supervised Learning. Institute of Mathematics, École Polytechnique Fédérale de Lausanne, Lausanne (2014).

- Latent Supervised Learning. Department of Statistics and Applied Probability, University of California at Santa Barbara (2013).

- Latent Supervised Learning. Department of Statistics, University of Pittsburgh (2013).

- Latent Supervised Learning. Department of Biostatistics, University of Pittsburgh (2013).

- Latent Supervised Learning. Division of Biostatistics, University of Minnesota (2013).

- Latent Supervised Learning. Division of Biostatistics, Yale University (2013).

- Latent Supervised Learning. School of Mathematical Sciences, Ohio State University (2013).

- Latent Supervised Learning. Department of Statistics, University of California at Davis (2013).

- Latent Supervised Learning. Department of Statistics and Applied Probability, National University of Singapore (2013).

- Latent Supervised Learning. Department of Economics, University of Mannheim (2013).

- Latent Supervised Learning. School of Mathematical Sciences, University of Nottingham (2013).

Research Experience

Summer 2013	Visiting Researcher Tromso Telemedicine Laboratory, Norway
2009–2013	Research Assistant Melanoma Group, University of North Carolina at Chapel Hill
Summer 2010	Research Assistant School of Dentistry, University of North Carolina at Chapel Hill
Summer 2008	Research Experience for Undergraduates (REU) participant Program on geometric group theory, University of Illinois at Urbana-Champaign

Teaching Experience

2024 — Instructor, Probability for Statistics (MAST20006/90057), University of Melbourne

- Delivered lectures, tutorial and lab sessions for a combined undergraduate and master's level course on probability theory, engaging a diverse group of 500 students.

- Designed assignments and final exam

- Taught one of the two streams

2024 — Instructor, Australian Mathematical Sciences Institute (AMSI) Summer School

- Created a new course on the theoretical foundations of deep learning

- Taught two of the four weeks with the remainder of the teaching split between Pavel Krupisky and Matthew Tam

2021 — Instructor, Australian Mathematical Sciences Institute (AMSI) Winter School

- Taught the first of two weeks of "Neural Networks and Related Models," focusing on the latest advancements in machine learning and neural network theory.

- Coordinated with the week two instructor, Rob Salomone, collaborating on lecture content

2019-2020 — Instructor, University of Melbourne

- Taught "Applied Data Science" (MAST30034, 12.5-credit undergraduate course) in Semester 2, 2020. Coordinated the project and self-reflection components, which constituted 50

- Instructed the first six weeks of "A First Course In Statistical Learning" (MAST90104, 25-credit graduate course) in Semester 2, 2019, equivalent to a full 12.5-credit course.

- Taught "Computational Statistics and Data Mining" (MAST90083, 12.5-credit graduate course) in Semester 2, 2019, focusing on practical applications of data mining techniques.

2016-2018 — Instructor, University of Minnesota

- Taught "Advanced Regression and Design" (PhD/MS course) in Spring 2018, covering complex regression models and experimental design principles.

- Instructed "Advanced Statistical Inference" (PhD course) in Spring 2017 and 2018, focusing on theoretical and practical aspects of statistical inference.

Fall 2014 — Instructor, École Polytechnique Fédérale de Lausanne (EPFL)

- Co-taught Principles of Statistical Inference (PhD course), with Anthony Davison

2009−2010 — Instructional Assistant, University of North Carolina at Chapel Hill

- Statistics, Spring 2010, Professor Shankar Bhamidi

- Statistics, Fall 2009, Professor Ross Leadbetter

2007–2008	**Undergraduate Student Instructor, University of California at Berkeley** • Statistics, Fall 2008, Professor Ani Adhikari • Statistics, Spring 2008, Professor Roger Purves • Linear Algebra, Fall 2007, Professor Ming Gu • Calculus, Spring 2007, Professor Ole Hald
2004–2007	**DeCal Course Instructor, University of California at Berkeley** • The DeCal program is a collection of student-created and student-run courses at the University of California at Berkeley • Created and taught class on the mathematics of the Rubik's Cube

Professional Service

- Co-organizer of inaugural workshop "Frontiers of Statistical Machine Learning", Nashville, August 2025.
- NeurIPS 2024 Top Reviewer
- Area chair AJCAI 2024
- Founding organizing member of Google Research AI for Science - Australia (2024-ongoing)
- ISBA Computational Section Treasurer (2024-ongoing)
- Co-organizer of Matrix 2025 program on "Bayesian Learning of Very High-Dimensional Physical Process Models" (23rd June to 4th July 2025)
- Co-organized inaugural Deep Learning Down Under (January 2024) with Peter Bartlett, an invitation-only week-long workshop on deep learning, held in Lorne, Australia. Partly funded by Google Research gift and part sponsored by Google Research.
- Organized invited session at IMS-APRM 2024 in Melbourne Australia
- Associate Editor, ACM Transactions on Probabilistic Machine Learning (TOPML)
- Organized invited session at 15th International Conference of the ERCIM WG on Computational and Methodological Statistics 2022
- Journal reviews
  - Biometrics
  - Biometrika
  - Journal of the American Statistical Association (JASA)
  - Journal of the Royal Statistical Society Series B/C (JRSSB/JRSSC)
  - Journal of Machine Learning Research (JMLR)
  - Journal of Multivariate Analysis (JMVA)
  - Journal of Computational and Graphical Statistics (JCGS)
  - Computational Statistics and Data Analysis (CSDA)
  - PLOS One
- Conference reviews
  - NeurIPS 2021, 2023, 2024

- ICML 2023, 2022, 2021
- ICLR 2022, 2021

- Reviews for Australian Research Council (ARC)
  - DECRA Fellowship 2023, 2022, 2021
  - Discovery Project 2022
  - Future Fellowship 2022
  - NISDRG 2022, 2020

- Contributor to HealthNewsReview.org, 2016-2018

- In 2016, represented the University of Minnesota in support of an USAID-sponsored one-year Masters of Public Health degree at Hanoi Medical University, Vietnam where I created and taught an intensive statistics module

- Committees
  - Multiple hiring committees for Lecturer in Data Science (continuing and fixed-term), School of Mathematics and Statistics, University of Melbourne (2018, 2019, 2021)
  - Engagement and Publicity (EPC) Committee, School of Mathematics and Statistics, University of Melbourne (2021-present)
  - Diversity and Inclusion (D&I) committee, School of Mathematics and Statistics, University of Melbourne (2018-2021)
  - MSc Masterclass committee, School of Mathematics and Statistics, University of Melbourne (2018-2019)
  - Undergraduate Studies (UGS) committee, School of Mathematics and Statistics, University of Melbourne (2018-2020)
  - Helen Freeman Scholarship committee, School of Mathematics and Statistics, University of Melbourne (2021, 2022)
  - Organized Find Your Supervisor session for data science, School of Mathematics and Statistics, University of Melbourne (2020)
  - MSc Data Science Curriculum committee, School of Mathematics and Statistics, University of Melbourne (2018)
  - Faculty recruiting committee, Division of Biostatistics, University of Minnesota (2016-2018)
  - PhD qualifying exam committee, Division of Biostatistics, University of Minnesota (2016-2018)
  - Doctoral Dissertation Fellowship, School of Public Health, University of Minnesota (2016-2018)
  - Diversity Equity Action Leadership Team, School of Public Health, University of Minnesota (2016-2018)

- Outreach
  - Featured guest for Women in Math Day at Western Sydney University, May 2022
  - Vacation scholar panel member, summer 2021 and 2022
  - MS Walkers, School of Mathematics and Statistics, University of Melbourne (2022-present)
  - Undergraduate Research Science Research Competition, University of Melbourne (2021)
  - Panelist at A Celebration of the Mathematical Sciences, Australian Mathematical Sciences Institute (2021)
  - Panelist in ARC Development Program (pitching panel), Faculty of Science, University of Melbourne (2020)
  - BSc Academic Advising Pilot, University of Melbourne (2020)
  - Data Science Open Day, University of Melbourne (2020)
  - Choosemaths, Australian Mathematical Sciences Institute (2019)

Research training

- BSc supervision

  - Joshua Brown, 2022 Vacation Scholarship, School of Mathematics and Statistics, University of Melbourne
  - Jiani Xie, 2022 Vacation Scholarship, School of Mathematics and Statistics, University of Melbourne
  - Bui Binh An (Andrew) Pham, 2021 Vacation Scholarship, School of Mathematics and Statistics, University of Melbourne

- MSc supervision (with year of completion)

  - Afiq Effiezal Aswadi, University of Melbourne (ongoing)
  - Isabel Hannebery, University of Melbourne (2024)
  - Naryman Tarvand, University of Melbourne (2024)
  - John Kris Hannebery, University of Melbourne (2023)
  - Wenbin Zhou, University of Melbourne (2022)
  - Vivienne Bear, University of Melbourne (2022)
  - Yiran Quan, University of Melbourne (2020)
  - Yijing Yang, University of Melbourne (2020)
  - Yaoyao Zhu, University of Melbourne (2020)
  - Alexandre Mosching, École Polytechnique Fédérale de Lausanne (EPFL) (2016)
  - John Ery, École Polytechnique Fédérale de Lausanne (EPFL) (2015)

- PhD supervision

  - Kenyon Ng, University of Melbourne (2022 to present). Primary supervision.
  - Edmund Tiew Hong Lau, University of Melbourne (2020 to present). Co-supervised with Daniel Murfet.
  - Aoqi Zuo, University of Melbourne (2020 to present). Co-supervised with Mingming Gong.
  - Hui Li, University of Melbourne (Feb 2019 to Dec 2023). Primary supervision. Now a research associate at Case Western University's Center for Artificial Intelligence in Drug Discovery.

Work Experience

2007–2008	Quantitative analyst, Weatherbill, San Francisco, CA
Summer 2007	Actuarial intern, Mercer Human Resource Consulting, San Francisco, CA
Summer 2006	Quality assurance intern, Omneon Video Networks, Sunnyvale, CA

Professional Memberships

- Statistical Society of Australia (2022–present)
- American Statistical Association (2012–present)
- Eastern North American Region, International Biometric Society (2012–present)
- Institute of Mathematical Statistics (2012–present)