Daniel J. McDonald

Contact information

Indiana University
Myles Brand Hall E210C
901 East 10th Street
Bloomington, IN 47408

phone: 812-855-7828
www: https://dajmcdon.github.io/
email: dajmcdon@indiana.edu

Research interests

Machine learning; risk estimation; computational approximations; time series; applications in economics, biology, chemistry, finance and music

Education

2012 Doctor of Philosophy in Statistics
Carnegie Mellon University, Pittsburgh PA, USA
Dissertation: "Generalization error bounds for state space models"
Advisors: Cosma R. Shalizi and Mark Schervish

2008 Master of Science in Statistics
Carnegie Mellon University, Pittsburgh PA, USA

2006 Bachelor of Arts in Economics
Indiana University, Bloomington IN, USA
Summa cum laude

2006 Bachelor of Science in Music and an Outside Field
Indiana University, Bloomington IN, USA
Majors: Cello Performance and Mathematics
Magna cum laude

Academic appointments

2018– **Associate Professor of Statistics** (with tenure)
Indiana University, Bloomington
Core faculty, Department of Statistics, Program on Data Science
Adjunct Faculty, Department of Computer Science
Affiliate, Center for Algorithms and Machine Learning

2018–2019 **Visiting Associate Professor of Econometrics and Statistics**
The University of Chicago Booth School of Business

2012–2018 **Assistant Professor of Statistics**
Indiana University, Bloomington

2007–2012 **Graduate Research and Teaching Assistant**
Carnegie Mellon University, Pittsburgh

Awards and honors

2018 National Science Foundation CAREER Award
2017 Indiana University Trustees' Teaching Award
2012 Umesh Gavasakar Memorial Thesis Award

2012	American Statistical Association, Pittsburgh Chapter Student of the Year
2006	Phi Beta Kappa
2006	Carroll Christenson Award in Economics
2005	Stadelmann Memorial Scholarship Award in Economics
2004	Mr. & Mrs. Harold E. Strow Award in Economics
2004	Hutton Honors College International Experiences Program Award
2004	Jacobs School of Music Summer Festival Scholarship
2003	James A. Moffat Award for Scholarship in Economics
2002	Alice Freese Honors College Scholarship
2002	Indiana Young Economist Award, Indiana Council of Economic Education
2002	The Reserve Officers Association White River Chapter Scholarship
2002	National Merit Scholarship

PEER-REVIEWED PUBLICATIONS

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2019+), "Compressed and penalized linear regression," *Journal of Computational and Graphical Statistics*, (in press).

KHODADADI, A., AND MCDONALD, D.J. (2019), "Algorithms for estimating trends in global temperature volatility," in *Proceedings of the 33rd AAAI Conference on Artificial Intelligence (AAAI-19)*, eds. P. V. Hentenryck and Z.-H. Zhou, Association for the Advancement of Artificial Intelligence.

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2018), "A study on tuning parameter selection for the high-dimensional lasso," *Journal of Statistical Computation and Simulation*, **88**, 2865–2892.

DING, L., AND MCDONALD, D.J. (2017), "Predicting phenotypes from microarrays using amplified, initially marginal, eigenvector regression," *Bioinformatics*, **33**(14), i350–i358.

MCDONALD, D.J. (2017), "Minimax Density Estimation for Growing Dimension," in *Proceedings of the 20th International Conference on Artificial Intelligence and Statistics (AISTATS)*, eds. A. Singh and J. Zhu, vol. 54, pp. 194–203, PMLR.

MCDONALD, D.J., SHALIZI, C.R., AND SCHERVISH, M. (2017), "Nonparametric risk bounds for time-series forecasting," *Journal of Machine Learning Research*, **18**(32), 1–40.

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2017), "Risk consistency of cross-validation for lasso-type procedures," *Statistica Sinica*, **27**(3), 1017–1036.

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2016), "On the Nyström and column-sampling methods for the approximate principal components analysis of large data sets," *Journal of Computational and Graphical Statistics*, **25**(2), 344–362.

MCDONALD, D.J., SHALIZI, C.R., AND SCHERVISH, M. (2015), "Estimating beta-mixing coefficients via histograms," *Electronic Journal of Statistics*, **9**, 2855–2883.

LOEWENSTEIN, G., KRISHNAMURTI, T., KOPSIC, J., AND MCDONALD, D.J. (2015), "Does increased sexual frequency enhance happiness?" *Journal of Economic Behavior and Organization*, **116**, 206–218.

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2014), "Leave-one-out cross-validation is risk consistent for lasso," *Machine Learning*, **97**(1-2), 65–78.

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2013), "The lasso, persistence, and cross-validation," in *Proceedings of the 30th International Conference on Machine Learning (ICML)*, eds. S. Dasgupta and D. McAllester, vol. 28, pp. 1031–1039, PMLR.

JUE, J.J.S., PRESS, M.J., MCDONALD, D.J., VOLPP, K.G., ASCH, D.A., MITRA, N., STANOWSKI, A.C., AND LOEWENSTEIN, G. (2012), "The impact of price discounts and calorie messaging on beverage consumption: A multi-site field study," *Preventive Medicine*, **55**, 629–633.

MCDONALD, D.J., SHALIZI, C.R., AND SCHERVISH, M. (2011), "Estimating beta-mixing coefficients," in *Proceedings of the Fourteenth International Conference on Artificial Intelligence and Statistics (AISTATS)*, eds. G. Gordon, D. Dunson, and M. Dudík, vol. 15, pp. 516–524, PMLR.

MCDONALD, D.J., AND THORNTON, D.L. (2008), "Primer on the mortgage market and mortgage finance," *The Federal Reserve Bank of St. Louis Review*, **90**(1), 31–46.

WORKING PAPERS

MCDONALD, D.J., MCBRIDE, M., GU, Y., AND RAPHAEL, C. (2019+), "Markov-switching state space models for uncovering musical interpretation," submitted, arXiv:1907.06244.

DING, L., AND MCDONALD, D.J. (2019+), "High-dimensional prediction with sparse principal components," submitted.

MCDONALD, D.J., SHARPNACK, J., BASSETT, R., AND SADHANALA, V. (2019+), "Exponential family trend filtering on grids," in preparation.

MCDONALD, D.J., AND SHALIZI, C.R. (2019+), "Empirical macroeconomics and DSGE modeling in statistical perspective," in preparation.

MCDONALD, D.J., AND LOEWENSTEIN, G. (2019+), "Factor analysis for panel data," in preparation.

MCDONALD, D.J. (2019+), "Sparse additive state-space models," in preparation.

MCDONALD, D.J., AND SHALIZI, C.R. (2019+), "Rademacher complexity of stationary sequences," submitted, arXiv:1106.0730.

TECHNICAL REPORTS

HOMRIGHAUSEN, D., AND MCDONALD, D.J. (2011), "Spectral approximations in machine learning," arXiv:1107.4340.

MCDONALD, D.J., SHALIZI, C.R., AND SCHERVISH, M. (2011), "Estimated VC dimension for risk bounds," arXiv:1111.3404.

MCDONALD, D.J., SHALIZI, C.R., AND SCHERVISH, M. (2011), "Generalization error bounds for stationary autoregressive models," arXiv:1103.0942.

MCDONALD, D.J., LOEWENSTEIN, G.F., AND KADANE, J. (2009), "The behavior of weight-loss study participants in response to incentives," technical report.

GRANTS

2018–2023   CAREER: Calibrating regularization for enhanced statistical inference. PI. National Science Foundation, DMS–1753171, $400,000.

2014–2018   Collaborative research: Statistical and computational efficiency for massive data sets via approximation-regularization. PI. National Science Foundation, DMS–1407439, $89,911.

2014–2016   High-Dimensional Statistics for Macroeconomic Forecasting. Co-PI. (with C. Shalizi as PI), Institute for New Economic Thinking, Grant # INO14–00020, $146,142.

2011–2013   Model Complexity and Prediction Error in Macroeconomic Forecasting. (with C. Shalizi as PI), Institute for New Economic Thinking, $170,000.

INVITED PRESENTATIONS

2019   "Trend filtering in exponential families," University of Chicago and Toyota Technological Institute Machine Learning Seminar

"Regularization, optimization, and approximation: The benefits of a convex combination," Texas A&M University, Department of Statistics

"Regularization, optimization, and approximation: The benefits of a convex combination," University of Toronto, Department of Statistics

"Regularization, optimization, and approximation: The benefits of a convex combination," Colorado State University, Department of Statistics

"Regularization, optimization, and approximation: The benefits of a convex combination," University of Pittsburgh, Department of Statistics

2018   "Matrix sketching for alternating direction method of multipliers optimization," Symposium on Statistics and Data Science

"Statistical implications of (some) computational approximations," University of Virginia, Department of Statistics

2017   "Predicting phenotypes from microarrays using amplified, initially marginal, eigenvector regression," 25th Intelligent Systems for Molecular Biology and the 16th European Conference on Computational Biology

"Compressed and penalized linear regression," Toyota Technological Institute at Chicago, Machine Learning Seminar

"Compressed and penalized linear regression," Pontificia Universidad Católica del Perú, Department of Mathematics and Statistics

"Estimating β-mixing coefficients with histograms," American Mathematical Society Spring Central Sectional Meeting, Special Session on Dependence in Probability and Statistics

2016   "Approximation-regularization for analysis of large data sets," University of Louisville, Department of Bioinformatics and Biostatistics

"Approximation-regularization for analysis of large data sets," University of California, Davis, Department of Statistics

"Approximation-regularization for analysis of large data sets," Indiana University-Purdue University Indianapolis, Department of Biostatistics

"Approximation-regularization for analysis of large data sets," National Center for Atmospheric Research

"Risk estimation for high-dimensional lasso regression," Joint Statistical Meetings

2015 "Approximate principal components analysis of large data sets," Yale University, Department of Statistics

2014 "Approximate principal components analysis of large data sets," Joint Statistical Meetings

"Clustering classical music performance," Université Laval, Department of Mathematics and Statistics

2013 "Clustering classical music performance," 15th IMS New Researchers Conference

2012 "Nonparametric risk bounds for time-series prediction," Yahoo! Research

"Nonparametric risk bounds for time-series prediction," George Mason University, Department of Statistics

"Nonparametric risk bounds for time-series prediction," Bocconi University, Department of Decision Sciences

"Nonparametric risk bounds for time-series prediction," Indiana University, Department of Statistics

"Estimating beta-mixing coefficients," 14th International Conference on Artificial Intelligence and Statistics

"Estimating beta-mixing coefficients," American Statistical Association, Pittsburgh Chapter Annual Meeting

"Spectral approximation methods: performance evaluations in clustering and classification" The Classification Society Annual Meeting

2010 "Generalization error bounds for state-space models with an application to economic forecasting," Joint Statistical Meetings

Invited short courses

2015 "Short course on the predictive viewpoint," Institute for New Economic Thinking Young Scholar Workshop, New York

2013 "Short course on the predictive viewpoint," Institute for New Economic Thinking Young Scholar Workshop, Hong Kong

Contributed talks

2017 "Compressed and penalized linear regression," Indiana University, Department of Statistics

"Predicting phenotypes from microarrays using amplified, initially marginal, eigenvector regression," Joint Statistical Meetings

2015 "Approximate principal components analysis of large data sets," Indiana University SOIC, Intelligent & Interactive Systems

2014 "Statistical machine learning with structured data," Indiana University, Department of Statistics

2012   "Nonparametric risk bounds for time-series prediction," Indiana University, Department of Economics

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Course instruction

Indiana University Department of Statistics, *2012–present*
S301   Introduction to Business Statistics (Fa13, Sp14, Fa14)
S432   Applied Linear Models II (Sp16, Sp17, Sp18)
S682   Topics in Statistical Machine Learning (Sp14)
S721   Advanced Statistical Theory I (Fa12, Fa14)
S722   Advanced Statistical Theory II (Sp13)
S771   Advanced Data Analysis I (Fa16, Sp17, Fa19)
S772   Advanced Data Analysis II (Fa16, Sp17, Fa19)
S782   Topics in Statistical Learning Theory (Fa17)
S785   Seminar on Statistical Theory (Fa17, Sp17, Fa19)

University of Chicago Booth School of Business, *2018*
41911   Advanced Econometrics (Fa18)

Carnegie Mellon University, *2010–2011*
36–226   Introduction to Probability and Statistics II (Su10, Su11)

Student advising

(year indicates actual or anticipated completion)

PhD advisor
2020   Lei Ding

PhD dissertation committee
2021   Sanna Wager (PhD Informatics)
2020   Yucong Jiang (IU Computer Science)
2020   Chao Tao (IU Computer Science)
2020   Shay Liu (IU Geology)
2019   Zikun Yang
2019   Xuefu Wang
2018   Robert Lunde (Carnegie Mellon Statistics)
2017   Rong Jin (IU Informatics)
2015   Yupeng Gu (IU Informatics)

MS thesis advisor
2021   Joe Stoica
2020   Haoran Liu
2018   Arash Khodadadi
2017   Jia Wang

PhD exam advisor
2020   Robert Granger
2020   Aaron Cohen
2017   Lei Ding
2017   Raksha Kumaraswamy (IU Computer Science)
2015   Sanna Wager (PhD Informatics)
2014   Zikun Yang

2014	Lijiang Guo

MS thesis committee

2016	Scott Brown
2013	Mikyoung Jun

Undergraduate research

2020	Mackenzie Turner
2018	Michael McBride

Professional service

Associate Editor

Journal of the American Statistical Association

The American Statistician

Conference Program Committee

Neural Information Processing Systems (NeurIPS)

Conference on Uncertainty in Artificial Intelligence (UAI)

International Conference on Artificial Intelligence and Statistics (AISTATS)

International Conference on Machine Learning and Statistics (ICML)

Referee

Electronic Journal of Statistics

IEEE Transactions on Information Theory

International Conference on Learning Theory (COLT)

Journal of the American Statistical Association

Journal of Business and Economic Statistics

Journal of Machine Learning Research

Journal of Optimization Theory and Applications

Journal of Statistical Computation and Simulation

Statistics and Computing

Technometrics

Grant reviewer

Division of Mathematics and Statistics, National Science Foundation

Institute for New Economic Thinking

Student paper competitions

ASA Section on Statistical Learning and Data Science

Society memberships

American Statistical Association

Institute of Mathematical Statistics

Bernoulli Society

University service

2019–	Academic Fairness Committee, *College of Arts and Sciences*
2019–	Center of Excellence for Women & Technology. *REU advisor*
2017–	Center of Excellence for Women & Technology, *Faculty Ally*
2015–	IU CrossFit Club, *Faculty advisor*
2016–2018	Faculty Student Mentoring Initiative, *Office of the Vice President for Diversity Equity and Multicultural Affairs*

2014–2018	Data Science Curriculum Committee, *School of Computing, Informatics, and Engineering + College of Arts and Sciences*

DEPARTMENT SERVICE

2019–	Chair, Executive Committee
2019–	Chair, Teaching-Track Promotion Committee
2019–	Computing Committee
2019–	Committee on Business Statistics
2018–	Teaching-track Promotion Committee
2018–	Faculty Hiring Committee
2018–	Tenure Review Committee
2016–2018	Graduate Studies Committee
2012–2018	Colloquium Committee
2015–2016	Undergraduate Studies Committee
2015–2016	Executive Committee
2012–2015	Graduate Studies Committee
2012–2015	Faculty Hiring Committee
2013–2014	Chair, Colloquium Committee

INDUSTRY EXPERIENCE

2010	**Statistical Consultant**, *Alvarez & Marsal*, New York, New York
2006–2007	**Research Associate**, *Federal Reserve Bank of St. Louis*, St. Louis, Missouri