Pratik Patil

Contact Information

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University Drive
Berkeley, CA 94720, USA

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Research Interests

- Statistical Machine Learning (primary), Optimization (secondary), Information Theory (tertiary).
- Specific topics: Exact High-Dimensional Asymptotics, Cross-Validation and Model Tuning, Bagging and Ensemble Methods, Sketching and Randomized Algorithms, Random Matrix and Free Probability Theory, Uncertainty Quantification, Constrained Inference, Model Evaluation and Benchmarking.

Academic Positions

University of California — Berkeley
Postdoctoral Researcher, Department of Statistics — current
Host: Prof. Ryan Tibshirani

Education

Carnegie Mellon University — Pittsburgh
Doctor of Philosophy, Statistics and Machine Learning — 2022/12
Master of Science, Machine Learning (GPA: 4/4)
Thesis: Facets of Regularization in High-Dimensional Learning
Advisor: Prof. Ryan Tibshirani

University of Toronto — Toronto
Master of Applied Science, Electrical and Computer Engineering (GPA: 4/4) — 2015/12
Master of Science, Statistics (GPA: 3.9/4)
Thesis: Downlink Transmission Strategies for Cloud Radio Access Networks
Advisor: Prof. Wei Yu

Indian Institute of Technology — Guwahati
Bachelor of Technology, Electronics and Communication Engineering (GPA: 9.8/10) — 2012/05
Thesis: Network Coding for Wireless Networks
Advisors: Prof. Sanjay Bose, Prof. Ratnajit Bhattacharjee

Publications

Links to all papers at: https://pratikpatil.io/research/ and citation profile at: Google Scholar

*: denotes equal contribution; †: denotes alphabetical ordering

Preprints (under review or under submission)

- P. Patil, J. Du, R. J. Tibshirani, "Revisiting Model Optimism and Model Complexity in the Wake of Overparameterized Learning." [paper]
- T. Koriyama*, P. Patil*, J. Du, K. Tan, P. Bellec, "Precise Asymptotics of Subagging of Regularized M-estimators." [paper]
- M. Stanley, P. Batlle, P. Patil, H. Owhadi, M. Kuusela, "Confidence Intervals for Functionals in Constrained Inverse Problems via Data-adaptive Sampling-based Calibration." [paper]
- P. Batlle, P. Patil, M. Stanley, H. Owhadi, M. Kuusela, "Optimization-based Confidence Intervals for Functionals in Constrained Inverse Problems: Resolving the Burrus Conjecture." [paper]
- P. Patil, A. K. Kuchibhotla, Y. Wei, and A. Rinaldo, "Mitigating Multiple Descents: A Model-Agnostic Framework for Risk Monotonization." [paper]

Full Papers (peer reviewed and published)

- J. Du, P. Patil, "Implicit Regularization Paths of Weighted Neural Representations," *Neural Information Processing Systems (NeurIPS)*, 2024. [paper]
- R. Fogliato, P. Patil, M. Monfort, P. Perona, "A Framework for Efficient Model Evaluation through Stratification, Sampling, and Estimation," *European Conference on Computer Vision (ECCV)*, 2024.

[paper]

- P. Patil, J. Du, R. J. Tibshirani, "Optimal Ridge Regularization for Out-of-Distribution Prediction," *International Conference on Machine Learning (ICML)*, 2024. [spotlight] [paper]
- P. Bellec†, J. Du†, T. Koriyama†, P. Patil†, K. Tan†, "Corrected Generalized Cross-Validation for a Finite Ensemble of Penalized Estimators." *Journal of the Royal Statistical Society: Series B (JRSSB)*, 2024. [paper]
- R. Fogliato⋆, P. Patil⋆, and P. Perona, "Confidence Intervals for Error Rates in 1:1 Matching Tasks: Critical Review and Recommendations," *International Journal of Computer Vision (IJCV)*, 2024. [paper]
- P. Patil⋆, Y. Wu⋆, R. J. Tibshirani, "Failures and Successes of Cross-Validation for Early-Stopped Gradient Descent in High-Dimensional Least Squares," *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024. [oral] [paper]
- P. Patil, D. LeJeune, "Asymptotically Free Sketched Ridge Ensembles: Risks, Cross-Validation, and Tuning," *International Conference on Learning Representations (ICLR)*, 2024. [paper]
- P. Patil and J. Du, "Generalized Equivalences between Subsampling and Ridge Regularization," *Neural Information Processing Systems (NeurIPS)*, 2023. [paper]
- D. LeJeune⋆, P. Patil⋆, H. Javadi, R. G. Baraniuk, and R. J. Tibshirani, "Asymptotics of the Sketched Pseudoinverse," *SIAM Journal on Mathematics of Data Science (SIMODS)*, 2023. [paper]
- P. Patil⋆, J. Du⋆, and A. K. Kuchibhotla, "Bagging in Overparameterized Learning: Risk Characterization and Risk Monotonization," *Journal of Machine Learning Research (JMLR)*, 2023. [paper]
- J. Du⋆, P. Patil⋆, and A. K. Kuchibhotla, "Subsample Ridge Ensembles: Equivalences and Generalized Cross-Validation," *International Conference on Machine Learning (ICML)*, 2023. [oral] [paper]
- J. Du, P. Patil, K. Roeder, and A. K. Kuchibhotla, "Extrapolated Cross-Validation for Randomized Ensembles," Journal of Computational and Graphical Statistics (JCGS), 2023. [paper]
- P. Patil, A. Rinaldo, and R. J. Tibshirani, "Estimating Functionals of the Out-of-Sample Error Distribution in High-Dimensional Ridge Regression," *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2022. [oral] [paper]
- M. Stanley, P. Patil, and M. Kuusela, "Uncertainty Quantification for Wide-Bin Unfolding: One-at-a-Time Strict Bounds and Prior-Optimized Confidence Intervals," *IOP Journal of Instrumentation (JINST)*, 2022. [paper]
- P. Patil, M. Kuusela, and J. Hobbs, "Objective Frequentist Uncertainty Quantification for Atmospheric CO_2 Retrievals," *SIAM-ASA Journal on Uncertainty Quantification (JUQ)*, 2022. [paper]
- P. Patil, Y. Wei, A. Rinaldo, and R. J. Tibshirani, "Uniform Consistency of Cross-Validation Estimators for High-Dimensional Ridge Regression," *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2021. [oral] [paper]
- A. Reinhart, et al., P. Patil, et al., and Ryan J. Tibshirani, "An Open Repository of Real-Time COVID-19 Indicators," *Proceedings of the National Academy of Sciences (PNAS)*, 2021. [paper]
- L. Liu†, Y. Liu†, P. Patil†, and W. Yu†, "Uplink-Downlink Duality Between Multiple-Access and Broadcast Channels with Compressing Relays," *IEEE Transactions on Information Theory (TIT)*, 2021. [paper]
- P. Patil, and W. Yu, "Generalized Compression Strategy for the Downlink Cloud Radio Access Network," *IEEE Transactions on Information Theory (TIT)*, 2019. [paper]
- L. Liu, P. Patil, and W. Yu, "Channel Diagonalization for Cloud Radio Access," *IEEE Wireless Communications Letters (WCL)*, 2018. [paper]
- P. Patil, B. Dai, and W. Yu, "Hybrid Data-Sharing and Compression Strategy for Downlink Cloud Radio Access Network," *IEEE Transactions on Communications (TCOM)*, 2018. [paper]
- A. Badr, P. Patil, A. Khisti, W. Tan, and J. Apostolopoulos, "Layered Constructions for Low-Delay Streaming Codes," *IEEE Transactions on Information Theory (TIT)*, 2016. [paper]

Short Papers (peer reviewed and published)

- R. Fogliato, P. Patil, N. Akpinar, and M. Monfort, "Precise Model Benchmarking with Only a Few Observations," *Empirical Methods in Natural Language Processing (EMNLP)*, 2024. [paper]
- P. Patil, and R. J. Tibshirani, "Revisiting Model Complexity in the Wake of Overparameterized Learning," *Theory of Overparameterized Learning (TOPML)*, 2022. [spotlight] [paper]
- P. Patil, A. K. Kuchibhotla, Y. Wei, and A. Rinaldo, "Mitigating Multiple Descents: Model-Agnostic Risk Monotonization in High-Dimensional Learning," *Theory of Overparameterized Learning (TOPML)*, 2021. [lighting] [paper]
- L. Liu, P. Patil, and W. Yu, "An Uplink-Downlink Duality for Cloud Radio Access Network," *International Symposium on Information Theory (ISIT)*, 2016. [paper]
- P. Patil, B. Dai, and W. Yu, "Performance Comparison of Data-Sharing and Compression Strategies for Cloud Radio Access Networks," *European Signal Processing Conference (EUSIPCO)*, 2015. [invited] [paper]
- P. Patil, and W. Yu, "Hybrid Compression and Message-Sharing Strategy for the Downlink Cloud Radio Access Network," *Information Theory and Application Workshop (ITA)*, 2014. [invited] [paper]
- P. Patil, M. W. Khan, R. Bhattacharjee, and S. Bose, "Network Coding Design for Multi-Source Multi-Relay Cooperative Wireless Networks," *IEEE Region Ten Conference (Tencon)*, 2013. [paper]
- P. Patil, A. Badr, A. Khisti, and W. Tan, "Delay-Optimal Streaming Codes under Source-Channel Rate Mismatch," *Asilomar Conference on Signals, Systems, and Computers (Asilomar)*, 2013. [oral, best student paper award] [paper]
- P. Patil, A. Badr, and A. Khisti, "Streaming Erasure Codes under Mismatched Source-Channel Frame Rates," *Canadian Workshop on Information Theory (CWIT)*, 2013. [paper]

Book Chapters

- W. Yu, P. Patil, B. Dai, and Y. Zhou, "Cooperative Beamforming and Resource Optimization in C-RAN," *Cloud Radio Access Networks Principles, Technologies, and Applications*, Cambridge University Press, 2017. [chapter]

Patents

- W. Yu, P. Patil, and M. Baligh, "Method and Apparatus for Downlink Transmission in a Cloud Radio Access Network," United States Patent 14555249, 2015. [patent]

Theses

- P. Patil, "Facets of Regularization in High-Dimensional Learning: Cross-Validation, Risk Monotonization, and Model Complexity," *Ph.D. Thesis*, Department of Statistics and Data Science and Machine Learning Department, Carnegie Mellon University, 2022. [thesis]
- P. Patil, "Downlink Transmission Strategies for Cloud Radio-Access Networks," *M.A.Sc. Thesis*, Department of Electrical and Computer Engineering, University of Toronto, 2015. [thesis]

Mentorship and Teaching

Bootcamps and workshops taught, co-taught, and advised at Carnegie Mellon University

- Math and Probability Refresher Bootcamp [graduate level, sole instructor] [bootcamp] Summer 2022
  Designed and taught a bootcamp for incoming Ph.D. students in Statistics and Machine Learning
  Math lectures: real analysis, linear algebra, vector and matrix calculus, continuous optimization
  Probability lectures: basic probability, distributions, probabilistic inequalities, modes of convergences
- Carnegie Mellon Sports Analytics Camp (CMSACamp) [undergrad level, co-instructor] Summer 2020
  Primary instructor: Prof. Ron Yurko. Program theme: Sports Analytics. [program]
  Taught summer undergraduate students statistical and data science techniques in `R`
  Advised a team of undergraduate students on Sports Analytics projects
- Statistical Learning Summer Workshop (SLSW) [graduate level, co-instructor] Summer 2019
  Primary instructor: Prof. Peter Freeman. Program theme: Data Science for Social Good. [workshop]

Guided lessons in learning to code in R, exploratory data analysis, and statistical learning methods
Advised groups of non-statistics graduate students on data analysis projects

- Summer Undergraduate Research Experience (SURE) [undergrad level, co-instructor] Summer 2018
  Primary instructor: Prof. Chad Schafer. Program theme: Data Science for Social Justice. [program]
  Taught summer undergraduate students statistical and data science techniques in `R`
  Advised a team of undergraduate students on Forensic Science projects

Courses served as a teaching assistant at Carnegie Mellon University
Codes: 36: Statistics and Data Science, 10: Machine Learning

- 36-752: Advanced Probability Theory [graduate level, sole TA] [course] Fall 2020
- 36-708: Statistical Methods in Machine Learning [graduate level, sole TA] [course] Spring 2020
- 36-462: Data Mining [graduate level] [course] Spring 2019
- 10-725: Convex Optimization [graduate level, half TA] [course] Fall 2018
- 36-401: Modern Regression [undergraduate level, half TA] [catalog] Fall 2018
- 36-207: Probability and Statistics for Business [undergraduate level, head TA] [catalog] Spring 2018
- 36-350: Statistical Computing [undergraduate level] [catalog] Fall 2017

Courses served as a teaching assistant or grader at the University of Toronto
Codes: APS: Applied Science, STA: Statistics, ECE: Electrical and Computer Engineering

- APS105: Computer Fundamentals [undergraduate level] [catalog] Fall 2015
- STA247: Probability with Computer Applications II [undergraduate level] [catalog] Winter 2015
- STA247: Probability with Computer Applications I [undergraduate level] [catalog] Fall 2014
- ECE216: Signal and Systems [undergraduate level] [catalog] Winter 2014

Presentations and Posters

Links to all the presentations and posters at: `https://pratikpatil.io/research/`

Presentations

- Optimal Ridge Regularization for Out-of-Distribution Prediction [slides]
  Conference on Mathematics of Data Science (MDS), Atlanta, Georgia, USA [invited] 2024/10
- Revisiting Model Optimism and Model Complexity in the Wake of Overparameterized Learning [slides]
  Conference on Mathematics of Data Science (MDS), Atlanta, Georgia, USA [invited] 2024/10
- Asymptotically Free Sketching and Applications in Ridge Regression [slides]
  Conference on Mathematics of Data Science (MDS), Atlanta, Georgia, USA [invited] 2024/10
- Revisiting Optimism and Model Complexity in the Wake of Overparameterized Learning [slides]
  One World Math of Information, Data, and Signals (1W-MINDS) Seminar, Virtual [invited] 2024/10
- Optimal Ridge Regularization for Out-of-Distribution Prediction [slides]
  Joint Statistical Meeting (JSM), Portland, USA 2024/08
- Mitigating Multiple Descents: A Model-Agnostic Framework for Risk Monotonization [slides]
  Biostatistics Seminar, University of California, Berkeley [invited] 2024/02
- Generalized Equivalences between Subsampling and Ridge Regularization [slides]
  Neural Information Processing Systems (NeurIPS) 2023, Virtual 2023/12
- Subsampling, Ensembling, and Ridge Regression [slides]
  Statistics Seminar, Rutgers University, New Brunswick, NJ [invited] 2023/11
- Asymptotics of the Sketched Pseudoinverse [slides]
  Sketching and Algorithm Design Program, Simons Institute, Berkeley, USA 2023/10
- On Structural Equivalences and Cross-Validation Consistencies for Overparameterized Ridge Regression
  Joint Statistical Meeting (JSM), Toronto, USA (non-attendance due to travel issues) 2023/08
- Revisiting Model Complexity in the Wake of Overparameterized Learning [slides]
  Workshop on Theory of Overparameterized Learning (TOPML), Virtual [spotlight] 2022/04

- Estimating Functionals of the Out-of-Sample Error Distribution in High-Dimensional Ridge Regression [slides]
  Conference on Artificial Intelligence and Statistics (AISTATS), Virtual 2022/03
- Overparameterization in Linear Models, and Uniform Consistency of Cross-Validation for Ridge Regression [slides]
  Joint Statistical Meetings (JSM), Virtual [invited] 2021/08
- Mitigating Multiple Descents: Model-Agnostic Risk Monotonization in High-Dimensional Learning [slides]
  Workshop on Theory of Overparameterized Learning (TOPML), Virtual [lighting] 2021/04
- Uniform Consistency of Cross-Validation Estimators for High-Dimensional Ridge Regression [slides]
  Conference on Artificial Intelligence and Statistics (AISTATS), Virtual 2021/04
- Objective Frequentist Uncertainty Quantification for Atmospheric CO2 Retrievals
  SIAM Conference on Uncertainty Quantification (UQ) 2020 (canceled due to COVID) [invited] 2020/03
- Uncertainty Quantification in Direct XCO_2 Retrievals [slides]
  Jet Propulsion Laboratory, Pasadena, USA [invited] 2019/10
- Accelerated and Adaptive Federated Multi-task Learning [spotlight] [slides]
  CMU Optimization Symposium (COPTS), Pittsburgh, USA 2018/12
- Cloud Radio Access Networks: Capacity and Duality [slides]
  Information Theory Seminar Series (IT@UofT), Toronto, Canada 2016/02
- An Uplink-Downlink Duality for Cloud Radio Access Network [slides]
  International Symposium on Information Theory (ISIT), Barcelona, Spain 2016/06
- An Uplink-Downlink Duality for Cloud Radio Access Network [slides]
  Information Theory and Applications (ITA) Workshop, San Diego, CA [invited] 2016/02
- Comparison of Data-Sharing and Compression Strategies for Cloud Radio-Access Networks [slides]
  European Signal Processing Conference (EUSIPCO), Rome, Italy 2015/09
- Hybrid Data-Sharing and Compression Strategy for Downlink Cloud Radio Access Network [slides]
  Information Theory and Applications Workshop (ITA), San Diego, California, USA [invited] 2014/02
- Delay-Optimal Streaming Codes under Source-Channel Rate Mismatch [slides]
  Asilomar Conference on Signals, Systems, and Computers (Asilomar), Pacific Grove, USA 2013/11
- Streaming Erasure Codes under Mismatched Source-Channel Frame Rates [slides]
  Canadian Workshop on Information Theory (CWIT), Toronto, Canada 2013/06

Posters

- Implicit Regularization Paths of Weighted Neural Representations
  Neural Information Processing Systems (NeurIPS) 2024/12
- Asymptotically Free Ridge Ensembles: Risks, Cross-Validation, and Tuning [poster]
  International Conference on Learning Representations (ICLR), Virtual 2024/05
- Optimal Ridge Regularization for Out-of-Distribution Prediction [poster]
  Berkeley Annual Research Symposium (BSTARS), Berkeley, USA 2024/04
- Generalized Equivalences between Subsampling and Ridge Regularization [poster]
  Neural Information Processing Systems (NeurIPS) 2023, Virtual 2023/12
- Asymptotics of the Sketched Pseudoinverse [poster]
  Sketching and Algorithm Design Program, Simons Institute, Berkeley, USA 2023/10
- Estimating Functionals of the Out-of-Sample Error Distribution in High-Dimensional Ridge Regression [poster]
  Conference on Artificial Intelligence and Statistics (AISTATS), Virtual 2022/03
- Uniform Consistency of Cross-Validation Estimators for High-Dimensional Ridge Regression [poster]
  Conference on Artificial Intelligence and Statistics (AISTATS), Virtual 2021/04
- Uncertainty Quantification in Direct XCO_2 Retrievals [poster]
  Jet Propulsion Laboratory, Pasadena, USA 2019/10
- An Uplink-Downlink Duality for Cloud Radio Access Network [poster]

International Symposium on Information Theory (ISIT), Barcelona, Spain 2016/06

- Hybrid Data-Sharing and Compression Strategy for Downlink Cloud Radio Access Network [poster]
  North American School on Information Theory (NASIT), Montreal, Canada 2015/06
- Delay-Optimal Streaming Codes under Source-Channel Rate Mismatch [poster]
  Asilomar Conference on Signals, Systems, and Computers (Asilomar), Pacific Grove, USA 2013/11
- Layered Constructions for Low-Delay Steaming Codes [poster]
  Canadian Workshop on Information Theory (CWIT), Toronto, Canada 2013/06

Awards and Scholarships

- Umesh K. Gavasakar Best Dissertation Award Nomination (2022) from the Department of Statistics and Data Science, Carnegie Mellon University.
- Best TA of the Year Nomination (2020) from the Department of Statistics and Data Science, Carnegie Mellon University.
- Graduate Student Assembly Travel Grant (2019), Carnegie Mellon University.
- Departmental Scholarship Award (2014–15) from Statistical Sciences Department, University of Toronto (2014–2015).
- Dean's Graduate Fellowship and Mitacs Globalink Fellowship (2012–14) from Faculty of Applied Science and Engineering, University of Toronto and Mitacs.
- Best Student Paper Award (2013) at 47-th Asilomar Conference on Signals, Systems and Computers, IEEE Signal Processing Society.
- President of India Gold Medal (2012) from Indian Institute of Technology, Guwahati for the highest graduating grades across the Institute (all disciplines, all levels) (GPA: 9.8/10).
- Mitacs Globalink Award (2011) from Mitacs for undergraduate exchange at the University of Toronto.
- Undergraduate Scholarship (2008–2012) from Dhirubhai Ambani Foundation.
- Merit Scholarship (2008–12) from the Government of Maharashtra for the highest grades across the State Board (all disciplines) at Higher Secondary School Certificate Examination (GPA: 96.2/100).
- National Talent Search Examination (NTSE) Scholarship (2006–12) from National Council of Educational Research and Training, Government of India.
- Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship (2006–08) from the Department of Science and Technology, Government of India.
- Dhirubhai Ambani College Merit Award (2008) from Dhirubhai Ambani Foundation.
- Merit Scholarship (2006) from the Government of Maharashtra for the highest grades across the State Board (all disciplines) at Secondary School Certificate Examination (GPA: 93.8/100).

Professional Service

- Reviewer for the following journals: Annals of Statistics (AoS), Journal of the American Statistical Association (JASA), Journal of the Royal Statistical Society: Series B (JRSSB), Electronic Journal of Statistics (EJS), Journal of Machine Learning Research (JMLR), Bernoulli, Transactions on Information Theory (TIT), Transactions on Communications (TCOM), Transactions on Wireless Communications (TWC), Transactions on Signal Processing (TSP)
- Reviewer for the following conferences: NeurIPS (Neural Information Processing Systems), ICML (International Conference on Machine Learning), ICLR (International Conference on Learning Representations), AISTATS (International Conference on Artificial Intelligence and Statistics), TOPML (Workshop on the Theory of Overparameterized Learning), ISIT (International Symposium on Information Theory), ICASSP (International Conference on Acoustics, Speech, and Signal Processing), EUSIPCO (European Signal Processing Conference), SPAWC (International Workshop on Signal Processing Advances in Wireless Communications), Globecom (Global Communications Conference), ICC (International Conference on Communications)
- Organizer, Online Multi-University Research Initiative (MURI) Seminar Series (Spring and Fall 2023)
- Mentor, Statistics Ph.D. Student Mentorship Program, Carnegie Mellon University (Fall 2020)
- Organizer, Statistical Machine Learning Reading Group (SMLRG) Seminar Series, Carnegie Mellon University (Spring and Fall 2019)
- Mentor, Statistics Matched Pairs Mentorship Program, Carnegie Mellon University (Fall 2019)
- Co-organizer, Information Theory Seminar Series (IT@UofT), University of Toronto (Winter 2016)