

Curriculum Vitae

Tudor A. Manole

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Research Areas

Theory: Statistical optimal transport, latent variable models, statistical machine learning, non-parametric hypothesis testing, distribution-free inference.

Applications: Quantum computing, high energy physics.

Employment

Norbert Wiener Postdoctoral Associate

7/2024–Present

Massachusetts Institute of Technology

Institute for Data, Systems, and Society

Statistics and Data Science Center

Education

Ph.D. Statistics

8/2018–5/2024

Carnegie Mellon University

Advisors: Larry Wasserman & Sivaraman Balakrishnan

M.Sc. Statistics

8/2018–5/2019

Carnegie Mellon University

B.Sc. Honours Mathematics

9/2014–5/2018

McGill University

Minor Computer Science

Distinction, First Class Honours in Mathematics

Awards

Umesh K. Gavaskar Memorial PhD Thesis Award, *Carnegie Mellon University* 2024

ASA Student of the Year, *American Stat. Assoc., Pittsburgh Chapter* 2024

Lawrence D. Brown Ph.D. Student Award, *Institute of Mathematical Statistics* 2023

Hannan Graduate Student Travel Award, *Institute of Mathematical Statistics* 2022

Statistical Learning and Data Science Student Paper Award, *American Stat. Assoc.* 2021

Student Presentation Award, *Statistical Society of Canada* 2021

Ph.D. Research Fellowship Runner-Up, *Two Sigma* 2021

Graduate Presidential Fellowship, *Carnegie Mellon University* 2020

Canadian Postgraduate Scholarship, *NSERC* 2020

Undergraduate Research Award, *NSERC* 2017

Undergraduate Research Award, *NSERC* 2016

Publications

(*Equal contribution.)

Journal Publications

1. Ramdas, A., T. **Manole**. (2025). Randomized and Exchangeable Improvements of Markov's, Chebyshev's and Chernoff's Inequalities. *Statistical Science*. (To appear.)
2. **Manole**, T., P. Bryant, J. Alison, M. Kuusela, L. Wasserman. (2024). Background Modeling for Double Higgs Boson Production: Density Ratios and Optimal Transport. *The Annals of Applied Statistics* 18(4), 2950-2978.
3. **Manole**, T., S. Balakrishnan, J. Niles-Weed, L. Wasserman. (2024). Plugin Estimation of Smooth Optimal Transport Maps. *The Annals of Statistics* 52(3), 966-998.
4. **Manole**, T., J. Niles-Weed. (2024). Sharp Convergence Rates for Empirical Optimal Transport with Smooth Costs. *The Annals of Applied Probability* 34(1), 1108-1135.
5. **Manole**, T., A. Ramdas. (2023). Sequential Estimation of Convex Functionals and Divergences. *IEEE Transactions on Information Theory* 69(7), 4641-4658.
6. **Manole**, T., S. Balakrishnan, L. Wasserman. (2022). Minimax Confidence Intervals for the Sliced Wasserstein Distance. *Electronic Journal of Statistics* 16(1), 2252-2345.
7. **Manole**, T., A. Khalili. (2021). Estimating the Number of Components in Finite Mixture Models via the Group-Sort-Fuse Procedure. *The Annals of Statistics* 49(6), 3043-3069.

Peer-Reviewed Conference Publications

8. **Manole**, T., N. Ho. (2022). Refined Convergence Rates for Maximum Likelihood Estimation in Finite Mixtures Models. *Proceedings of the 39th International Conference on Machine Learning, PMLR 162:14979-15006*. (Selected for Long Presentation.)

Papers Under Revision

9. **Manole**, T., S. Balakrishnan, J. Niles-Weed, L. Wasserman. (2023+). Central Limit Theorems for Smooth Optimal Transport Maps. *Major Revision, The Annals of Applied Probability*. *arXiv:2312.12407*.
10. Balakrishnan, S., T. **Manole**, L. Wasserman. (2025+). Statistical Inference for Optimal Transport Maps: Recent Advances and Perspectives. *Minor Revision, Statistical Science*. *arXiv:2506.19025*.
11. Balakrishnan, S., T. **Manole**. (2025+). Stability Bounds for Smooth Optimal Transport Maps and their Statistical Implications. *Major Revision, Electronic Journal of Statistics*. *arXiv:2502.12326*.

Preprints

12. **Manole***, T., D. Mark*, W. Gong, B. Ye, Y. Polyanskiy, S. Choi. (2025+). How Much Can We Learn from Quantum Random Circuit Sampling? *arXiv:2510.09919*.
13. Kania, L., T. **Manole**, L. Wasserman, S. Balakrishnan. (2025+). Testing Imprecise Hypotheses. *arXiv:2510.20717*.
14. Hundrieser*, S., T. **Manole***, D. Litskevich, A. Munk. (2025+). Local Poisson Deconvolution for Discrete Signals. *arXiv:2508.00824*.
15. **Manole***, T., N. Ho*. (2020+). "Uniform Convergence Rates for Maximum Likelihood Estimation under Two-Component Finite Mixture Models". *arXiv:2006.00704*.

Patents

1. Advanced Methods to Benchmark Noisy Quantum Devices.
Inventors: Manole, T., D. Mark, W. Gong, B. Ye, Y. Polyanskiy, S. Choi.
United States Provisional Patent Application No. 63/866,172. *Filed 8/2025.*

Presentations

Invited Talks at International Conferences and Workshops

1. Sharp Recovery of Optimal Matchings. 12/2025
IMS International Conference on Statistics and Data Science, Seville, Spain
2. Stability and Limit Laws of Stochastic Optimal Transport Maps. 11/2025
Workshop on Optimal Transport, Fields Institute, Toronto, Canada
3. Statistical Methods for Benchmarking Quantum Random Circuits. 10/2025
INFORMS Annual Meeting, Atlanta, GA.
4. How Much Can We Learn from Quantum Random Circuit Sampling? 10/2025
Math. of Computation and Algorithms Workshop, IBM Research, Cambridge, MA.
(Co-speaker: Daniel K. Mark.)
5. Sharp Deconvolution of Optimal Transport Matchings. 8/2025
Joint Statistical Meetings, Nashville, TN.
6. Sharp Deconvolution of Optimal Transport Matchings. 7/2025
SIAM Annual Meeting, Montreal, Canada.
(Canceled due to visa travel restriction.)
7. Sharp Deconvolution of Optimal Transport Matchings. 5/2025
Institute for Pure & Applied Mathematics, Los Angeles, CA.
8. Sharp Deconvolution of Optimal Transport Matchings. 3/2025
Statistics and Optimal Transport Workshop, Columbia University.
9. Central Limit Theorems for Smooth Optimal Transport Maps. 11/2024
NA-NM-AT Conference, Tiberiu Popoviciu Institute of Numerical Analysis, Virtual.
10. Efficient Inference for the Quadratic Wasserstein Distance. 8/2024
11th World Congress in Probability and Statistics, Bochum, Germany.
11. Central Limit Theorems for Smooth Optimal Transport Maps. 7/2024
International Conference on Robust Statistics, Fairfax VA, United States.
12. Central Limit Theorems for Smooth Optimal Transport Maps. 6/2024
Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany.
13. Central Limit Theorems for Smooth Optimal Transport Maps. 12/2023
IMS International Conference on Statistics and Data Science, Lisbon, Portugal.
14. Central Limit Theorems for Smooth Optimal Transport Maps. 12/2023
CMStatistics Conference, Berlin, Germany.
15. Plugin Estimation of Smooth Optimal Transport Maps. 8/2023
Joint Statistical Meetings, Toronto, Canada.
16. Homogeneity Testing in the Search for Pairs of Higgs Bosons at the LHC. 5/2023
Statistical Society of Canada Annual Meeting, Ottawa, Canada.

17. Optimal Transport in High-Energy Physics. 4/2023
Banff International Research Station, Banff, Canada.
 (Co-speaker: Philipp Windischhofer.)
18. Order Selection for Finite Mixture of Regression Models. 5/2022
Statistical Society of Canada Annual Meeting, Virtual.
19. Transfer Learning for Data-Driven Background Modelling. 11/2021
PhyStat-Systematics Workshop, Virtual.
20. Uniform Convergence Rates for the MLE under Two-Component Gaussian Mixtures. 5/2021
Fourth International Conference of Econometrics and Statistics, Virtual.

Invited Talks at University Seminars

21. How much can we learn from quantum random circuit sampling? 12/2025
Probabilitas Seminar, Harvard University.
22. How much can we learn from quantum random circuit sampling? 12/2025
Stochastics Colloquium, University of Göttingen, Germany.
23. How much can we learn from quantum random circuit sampling? 10/2025
Penn State-Purdue-Maryland Mathematical Data Science Seminar.
24. Central Limit Theorems for Smooth Optimal Transport Maps. 3/2025
Computational and Applied Mathematics Seminar, Tufts University.
25. Central Limit Theorems for Smooth Optimal Transport Maps. 10/2024
Statistics and Stochastics Seminar, Massachusetts Institute of Technology.
26. Central Limit Theorems for Smooth Optimal Transport Maps. 9/2024
CRM Applied Mathematics Seminar, McGill University, Canada.
27. Central Limit Theorems for Smooth Optimal Transport Maps. 9/2024
Statistics Seminar, Cornell University.
28. Minimax Nonparametric Testing in Wasserstein Distance. 6/2024
Stochastics Colloquium, University of Göttingen, Germany.
29. Statistical Inference for Multivariate Optimal Transport. 1/2024
Monthly Seminar of the University of Freiburg Research Unit “Mathematical Statistics in the Information Age—Statistical Efficiency and Computational Tractability”.
30. Statistical Inference for Multivariate Optimal Transport. 1/2024
Institute for Foundations of Data Science Seminar Series, Yale University.
 (Postdoc job talk.)
31. Optimal Transport with Applications to Data-Driven Background Modeling. 2/2023
McWilliams Center for Cosmology, Carnegie Mellon University.
32. Statistical Inference for Optimal Transport via Density Estimation. 11/2022
Stochastics Colloquium, University of Göttingen, Germany.
33. Order Selection in Multidimensional Finite Mixture Models. 1/2017
Statistics Seminar, McGill University, Canada.

Invited Lectures

- 34. Three Lectures on Estimating the Wasserstein Distance. 7/2025
Summer School on Optimal Transport (invited by Katy Craig), UC Santa Barbara.
- 35. Plugin Estimation of Smooth Optimal Transport Maps. 4/2025
Guest Lecture (invited by Andrew Nobel), UNC Chapel Hill.
- 36. Statistical Inference for Optimal Transport. 3/2024
Guest Lecture (invited by Johannes Wiesel), Carnegie Mellon University.
- 37. Inference for Optimal Transport via Linearization of Monge-Ampère. 12/2024
Guest Lecture (invited by Axel Munk), University of Göttingen, Germany.
- 38. Reverse Martingales and their uses in Sequential Analysis. 5/2021
Three-Hour Guest Lecture (invited by Aaditya Ramdas), Carnegie Mellon University.

Invited Talks at Peer-Reviewed Conferences

- 39. Refined Convergence Rates for the MLE under Finite Mixture Models. 7/2022
Long Presentation, International Conference on Machine Learning, Virtual.
- 40. Minimax Confidence Intervals for the Sliced Wasserstein Distance. 12/2019
Spotlight, Optimal Transport and ML Workshop, NeurIPS, Vancouver, Canada.

Contributed Talks at International Conferences

- 41. Plugin Estimation of Smooth Optimal Transport Maps and Wasserstein Distances. 8/2022
Joint Statistical Meetings, Washington, DC.
- 42. Plugin Estimation of Smooth Optimal Transport Maps. 6/2022
Institute of Mathematical Statistics Annual Meeting, London, UK.
- 43. Order Estimation in Finite Mixture Models via the Group-Sort-Fuse Procedure. 8/2021
Joint Statistical Meetings, Virtual.
- 44. Sequential Estimation of Convex Divergences. 6/2021
Statistical Society of Canada Annual Meeting, Virtual.

Poster Presentations

- 45. Sample Complexity of Error Characterization in Quantum Random Circuit Sampling. 1/2025
QSEC Annual Research Conference, Carroll, NH.

Short-Term Research Visits

- 1. Institute for Mathematical Stochastics, Georg August University of Göttingen.
Hosted by Axel Munk, 11/7–20/2022; 12/4–15/2023; 6/9–23/2024; 12/18–23/2025.
- 2. Department of Statistics and Data Science, Cornell University.
Hosted by Florentina Bunea, 9/24–27/2024.
- 3. Department of Statistics and Operations Research, UNC Chapel Hill.
Hosted by Andrew Nobel, 4/23–25/2025.

Professional Service

Journal Reviewing

Annals of Applied Probability, Annals of Statistics (x10), Bayesian Analysis, Bernoulli, Biometrika, Electronic Communications in Probability, Electronic Journal of Statistics (x2), Information and Inference, Journal of Applied Probability, Journal of Machine Learning Research (x2), Journal of the American Statistical Association, Journal of the Royal Statistical Society, Series B (x2), IEEE Transactions on Pattern Analysis and Machine Intelligence, Statistica Sinica, Statistical Science, Statistical Theory and Related Fields, Transactions on Machine Learning Research.

Conference Reviewing

International Conference on Machine Learning (2020; Top 33% Reviewer), Neural Information Processing Systems (2020; Top 10% Reviewer), NeurIPS Optimal Transport and Machine Learning Workshop (2023), Conference on Learning Theory (2025)

Miscellaneous

Co-organizer of the Statistical Machine Learning Reading Group 9/2022–8/2023
Carnegie Mellon University

Volunteer for the McGill STEM Support Committee 9/2017–4/2018
McGill University

Teaching Experience

Teaching (as Sole Instructor)

Carnegie Mellon University, Department of Statistics and Data Science
36-225 Introduction to Probability Theory (Undergraduate, 47 students) Summer 2023

Teaching Assistantships

Carnegie Mellon University, Department of Statistics and Data Science

36-709	Advanced Statistical Theory I (Graduate)	<i>Spring 2024</i>
36-705	Intermediate Statistics (Graduate)	<i>Fall 2021</i>
36-219	Probability Theory and Random Processes (Undergraduate)	<i>Spring 2021</i>
36-705	Intermediate Statistics (Graduate)	<i>Fall 2020</i>
36-662	Data Mining (Undergraduate/Graduate)	<i>Spring 2020</i>
36-700	Probability and Mathematical Statistics (Graduate)	<i>Fall 2019</i>
36-350	Statistical Computing (Undergraduate)	<i>Summer 2019</i>
36-217	Probability Theory and Random Processes (Undergraduate)	<i>Fall 2018–Spring 2019</i>

Professional Memberships

Institute of Mathematical Statistics
American Statistical Association
Institute for Operations Research and the Management Sciences