LIAM HODGKINSON

PERSONAL INFORMATION

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RESEARCH INTERESTS

- Statistical learning theory for deep neural networks (**deep learning theory**)
- Statistical data analysis for large models and datasets (**randomised linear algebra**)
- Computationally-assisted proofs using machine learning
- Limit theorems and distributional approximations for Markov processes

PROFESSIONAL APPOINTMENTS

Oct 2026 – present **Senior Lecturer (Data Science)**, School of Mathematics and Statistics, University of Melbourne

Jul 2022 – Oct 2026 **Lecturer (Data Science)**, School of Mathematics and Statistics, University of Melbourne

Jan 2020 – Jun 2022 **Research Scholar**, University of California, Berkeley

- Department of Statistics, under Professor Michael W. Mahoney
- Joint appointment with International Computer Science Institute (ICSI).

Aug – Dec 2019 **Postdoctoral Research Fellow**, University of Queensland

EDUCATION

2015–2019 **Doctor of Philosophy** in Mathematics, University of Queensland

- Thesis titled "*Approximations for finite spin systems and occupancy processes*"
- Supervisors: Professor Philip Pollett & Dr. Ross McVinish
- Conferred November, 2019

2012–2015 **Bachelor of Science with Honours**, University of Queensland

- Extended Major in Mathematics
- Received first class honours and eight Dean's Commendations for Academic Excellence

FUNDING

2024–2027 **ARC Discovery Early Career Researcher Award (DECRA)**

(DE240100144): "*Universal Model Selection Criteria for Scientific Machine Learning*" valued at $450K

INVITED TALKS

2025 Workshop on Modern Statistical Perspectives on Machine Learning

2025 MATRIX-MFO Tandem Workshop: Machine Learning and AI for Mathematics

2024 Statistics Seminar, University of New South Wales

2023 NeurIPS Workshop on Heavy Tails in Machine Learning

2022 15th International Conference of the ERCIM WG on Computational and Methodological Statistics (CMStatistics 2022)

2020 Computational Statistics Research Seminar, Lancaster University

2020 Joint Statistics and Engineering Colloquium, Rutgers University

2020 Second Symposium on Machine Learning and Dynamical Systems, Fields Institute

SUPERVISION

PhD (Primary / Cosupervisor)

2026–present Miaoxi Zhu (University of Melbourne; primary supervisor)

2025–present Zach Furman (University of Melbourne; primary supervisor)

2025–present Paul Kerr (University of Melbourne; co-supervisor)

2025–present Ashoka Prabashwara Seelappu Mudiyanselage (University of Melbourne; co-supervisor)

2025–present William Hadden (UNSW; co-supervisor)

2023–present Joseph Wilson (UQ; co-supervisor)

2022–2025 Archer Moore (University of Melbourne; co-supervisor)

2024–2026 Evelyn Mannix (University of Melbourne; co-supervisor)

2023–2025 Kenyon Ng (Monash University; co-supervisor)

2023–2025 Hyunsuk Kim (University of California, Berkeley; co-supervisor)

Masters (Primary)

2022–2023 Paul Kerr (University of Melbourne; MSc)

2024–2025 Qingyi Hu (University of Melbourne; MSc)

2024–2025 Jay Song (University of Melbourne; MSc)

2024–2025 Afiq Effiezal Aswadi (University of Melbourne; MSc)

2024–2025 Thomas Black (University of Melbourne; MDataSci)

TEACHING EXPERIENCE

2023–present **University of Melbourne**, School of Mathematics and Statistics

- Thinking and Reasoning with Data (MAST90044) — course coordinator
  - End of Subject Survey (2023): 4.38/5.0 (department average 3.91/5.0)
- Applied Data Science (MAST30034) — assistant course coordinator
  - End of Subject Survey (2023): 4.16/5.0 (department average 3.92/5.0)
  - End of Subject Survey (2024): 4.33/5.0 (department average 3.94/5.0)
  - End of Subject Survey (2025), reduced load: 3.86/5.0 (department average 4.07)

2015-2017 **University of Queensland**, School of Mathematics and Physics

- Advanced Calculus & Linear Algebra (MATH1071) — lead tutor for 2017
- Mathematical Analysis (MATH2400) — tutor for 2016
- Probability and Statistics (STAT2003) — tutor for 2015–2017
- Probability Models & Stochastic Processes (STAT3004) — tutor for 2015

PROFESSIONAL SERVICE

Governance Engagement and Publicity Committee (Data Science Representative)

Editorial **Area Chair:** *NeurIPS* (2024, 2025), *ICML* (2025, 2026), *ICLR* (2025)

Reviewing *Annals of Statistics* (1), *Journal of Machine Learning Research* (3), *Journal of Royal Statistics Society Series B* (1), *SIAM Journal on Scientific Computing (1)*, *NeurIPS* (16), *ICML* (1), *AISTATS* (4), *UAI* (3), *IJCAI* (4), *ARC* (3 DECRA, 1 Discovery Project, 2 Future Fellowships).

Organisation Host, Melbourne Deep Learning Reading Group (2022–2024, 2026).

RESEARCH OUTPUT

Preprints

[1] Hu, Q. & **Hodgkinson, L.** (2026). *A Regularization-Sharpness Tradeoff for Linear Interpolators*. arXiv:2602.12680.

[2] **Hodgkinson, L.**, van der Heide, C., Salomone, R., Roosta, F., & Mahoney, M. W. (2023). *The Interpolating Information Criterion for Overparameterized Models*. arXiv:2307.07785.

[3] **Hodgkinson, L.**, Salomone, R., & Roosta, F. (2020). *The reproducing Stein kernel approach for post-hoc corrected sampling*. arXiv:2001.09266.

Publications

[4] Buttsworth, T., & **Hodgkinson, L.** (2025). *Computationally-assisted proof of a novel* $\mathrm{O}(3) \times \mathrm{O}(10)$*-invariant Einstein metric on* S^{12}. Journal of the London Mathematical Society 113.2 (2026): e70477.

[5] Daniels, M., **Hodgkinson, L.** & Mahoney, M. W. (2025). *Uncertainty-Aware Diagnostics for Physics-Informed Machine Learning*. Proceedings of the Ninth International Conference on Learning Representations (ICLR 2025).

[6] Ameli, S., van der Heide, C., **Hodgkinson, L.**, & Mahoney, M. W. (2025). *Spectral Estimation with Free Decompression*. Advances in Neural Information Processing Systems, 39.

[7] Wilson, J., van der Heide, C., **Hodgkinson, L.**, & Roosta, F. (2025). *Uncertainty Quantification with the Empirical Neural Tangent Kernel*. Advances in Neural Information Processing Systems, 39.

[8] **Hodgkinson, L.** & Mahoney, M. W. (2025). *Models of Heavy-Tailed Mechanistic Universality*. In International Conference on Machine Learning (ICML 2025) (pp. 23290-23329). PMLR.

[9] Ameli, S., van der Heide, C., **Hodgkinson, L.**, Roosta, F., & Mahoney, M. W. (2025). *Determinant Estimation under Memory Constraints and Neural Scaling Laws*. In International Conference on Machine Learning (ICML 2025) (pp. 1367-1400). PMLR.

[10] Ng, K., van der Heide, C., **Hodgkinson, L.**, & Wei, S. (2025). *Temperature Optimization for Bayesian Deep Learning*. Proceedings of the Forty-First Conference on Uncertainty in Artificial Intelligence (pp. 3155-3181).

[11] Mannix, E. J., **Hodgkinson, L.**, & Bondell, H. (2025). *Preserving Angles Improves Feature Distillation*. Transactions on Machine Learning Research.

[12] Mannix, E. J., **Hodgkinson, L.**, & Bondell, H. (2025). *ComFe: Interpretable Image Classifiers With Foundation Models*. Transactions on Machine Learning Research.

[13] Kim, H., **Hodgkinson, L.**, Theisen, R., & Mahoney, M. W. (2024). *How many classifiers do we need?*. Advances in Neural Information Processing Systems, 37.

[14] Liang, F. T., **Hodgkinson, L.**, & Mahoney, M. W. (2023). *A Heavy–Tailed Algebra for Probabilistic Programming*. Advances in Neural Information Processing Systems, 36.

[15] Theisen, R., Kim, H., Yang, Y., **Hodgkinson, L.**, & Mahoney, M. W. (2023). *When are ensembles really effective?* Advances in Neural Information Processing Systems, 36.

[16] **Hodgkinson, L.**, van der Heide, C., Salomone, R., Roosta, F., & Mahoney, M. W. (2023). *A PAC–Bayesian Perspective on the Interpolating Information Criterion*. NeurIPS Workshop on the Mathematics of Modern Machine Learning (M3L).

[17] Yang, Y., Theisen, R., **Hodgkinson, L.**, Gonzalez, J. E., Ramchandran, K., Martin, C. H., & Mahoney, M. W. (2023). *Test accuracy vs. generalization gap: Model selection in NLP without accessing training or testing data*. Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (pp. 3011–3021).

[18] Sachs, S., van Erven, T., **Hodgkinson, L.**, Khanna, R., & Şimşekli, U. (2023). *Generalization Guarantees via Algorithm-dependent Rademacher Complexity*. In the 36th Annual Conference on Learning Theory (pp. 4863–4880). PMLR.

[19] **Hodgkinson, L.**, van der Heide, C., Roosta, F., & Mahoney, M. W. (2023). *Monotonicity and Double Descent in Uncertainty Estimation with Gaussian Processes*. In International Conference on Machine Learning (pp. 13085–13117). PMLR.

[20] **Hodgkinson, L.**, Simsekli, U., Khanna, R., & Mahoney, M. (2022). *Generalization Bounds using Lower Tail Exponents in Stochastic Optimizers*. In International Conference on Machine Learning (pp. 8774-8795). PMLR.

[21] Liang, F., **Hodgkinson, L.** & Mahoney, M. (2022). *Fat-Tailed Variational Inference with Anisotropic Tail Adaptive Flows*. In International Conference on Machine Learning (pp. 13257-13270). PMLR.

[22] Queiruga, A., Erichson, N. B., **Hodgkinson, L.** & Mahoney, M. W. (2021). *Compressing Deep ODE-Nets using Basis Function Expansions.* Advances in Neural Information Processing Systems, 34.

[23] Yang, Y., **Hodgkinson, L.**, Theisen, R., Zou, J., Gonzalez, J. E., Ramchandran, K., & Mahoney, M. W. (2021). *Taxonomizing local versus global structure in neural network loss landscapes*. Advances in Neural Information Processing Systems, 34, 18722-18733.

[24] Lim, S. H., Erichson, N. B., **Hodgkinson, L.**, & Mahoney, M. W. (2021). *Noisy recurrent neural networks*. Advances in Neural Information Processing Systems, 34, 5124-5137.

[25] McVinish, R., & **Hodgkinson, L.** (2021). *Fast approximate simulation of finite long-range spin systems*. The Annals of Applied Probability, 31(3), 1443-1473.

[26] **Hodgkinson, L.**, van der Heide, C., Roosta, F., & Mahoney, M. W. (2021). *Stochastic Continuous Normalizing Flows: Training SDEs as ODEs.* Proceedings of the 37th Conference on Uncertainty in Artifical Intelligence (UAI 2021).

[27] Khanna, R., **Hodgkinson, L.**, & Mahoney, M. W. (2021). *Geometric Rates of Convergence for Kernel-based Sampling Algorithms.* Proceedings of the 37th Conference on Uncertainty in Artifical Intelligence (UAI 2021).

[28] **Hodgkinson, L.**, & Mahoney, M. W. (2021). *Multiplicative noise and heavy tails in stochastic optimization.* Proceedings of the 38th International Conference on Machine Learning (ICML 2021), PMLR 139:4262-4274.

[29] van der Heide, C., **Hodgkinson, L.**, Roosta, F., & Kroese, D. (2021). *Shadow Manifold Hamiltonian Monte Carlo.* Proceedings of The 24th International Conference on Artificial Intelligence and Statistics (AISTATS 2021), PMLR 130:1477-1485.

[30] Erichson, N. B., Azencot, O., Queiruga, A., **Hodgkinson, L.**, & Mahoney, M. W. (2021). *Lipschitz recurrent neural networks.* Proceedings of the Ninth International Conference on Learning Representations (ICLR 2021).

[31] **Hodgkinson, L.**, Salomone, R., & Roosta, F. (2021). *Implicit Langevin algorithms for sampling from log-concave densities*. Journal of Machine Learning Research (JMLR), 22(136):130.

[32] **Hodgkinson, L.**, McVinish, R., & Pollett, P. K. (2020). *Normal approximations for discrete-time occupancy processes*. Stochastic Processes and their Applications, 130(10), 6414-6444.

References are available upon request.

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