

Martin Andreas Lotz

Associate Professor of Mathematics, University of Warwick

Coventry, United Kingdom | martin.lotz@warwick.ac.uk

<https://lotzma.github.io/> | Google Scholar

Academic Curriculum Vitae | October 2026

RESEARCH PROFILE

Mathematical Foundations: foundations of computational mathematics, using geometry, topology and probability to study computational complexity, numerical conditioning and machine learning. Current interests include convex and integral geometry, real algebraic and Pfaffian geometry, robustness of neural networks, information estimation, dimensionality reduction and topological data analysis.

Industry Applications: Fintech, AI for lending, agentic workflows, genomic and biomedical data analysis, high-frequency finance.

ACADEMIC APPOINTMENTS

Associate Professor of Mathematics | University of Warwick (*Sep 2018–present*)

Lecturer in Numerical Analysis | University of Manchester (*Oct 2012–Aug 2018*)

Research Fellow | University of Edinburgh (*Oct 2010–Sep 2012*)

- Leverhulme Early Career Fellowship and Seggie Brown Fellowship.

Research Fellow, Computing Laboratory | University of Oxford (*Jul 2008–Sep 2010*)

- Supported by the German Research Foundation, DFG grant LO 1580/1-1.

Research Fellow | City University of Hong Kong (*2005–2008*)

EDUCATION

PhD (Dr. rer. nat.) in Mathematics, University of Paderborn — 2005

Summa cum laude. Supervisor: Peter Bürgisser.

Dissertation: On Numerical Invariants in Algebraic Complexity Theory.

Diploma in Mathematics (Dipl. Math. ETH), ETH Zürich — 2001

Supervisors: János Makowsky and Robert Stärk.

Thesis: On the algebraic complexity of some families of coloured Tutte polynomials.

HONOURS AND FELLOWSHIPS

- Information and Inference Best Paper Prize (2015), with D. Amelunxen, M. B. McCoy and J. A. Tropp, for Living on the edge: Phase transitions in convex programs with random data.
- Faculty prize for the best doctoral dissertation, University of Paderborn.
- Alan Turing Institute Fellow (appointed 2021); Fellow of the Higher Education Academy.

RECENT RESEARCH GRANTS AND FUNDING

Towards Incidence Combinatorics in O-minimal Structures: Theory and Generalizations *(Aug 2025–Jul 2027)*

- Stellenbosch–Warwick Joint Seed Fund; £9,000.

SensorViz *(Jan–Dec 2025)*

- Interdisciplinary Research Spotlights Research Development Fund; £14,515. A visualisation toolbox and gallery for communicating spatial sensor data to planners, policy makers and the public.

Multimodal Catalogue Search for Second Hand Apparel Valuations *(Mar 2024–Mar 2025)*

- Innovate UK Collaborative AI Solutions to improve productivity in key sectors; £1,062,461. With TRUSS / Kelp Technologies and Andreas Kyprianou (CAMaCS, Warwick).

Representation Learning on Graphs at Scale *(Oct 2023–Apr 2025)*

- Alan Turing Institute, University of Oxford and GCHQ; £224,258.

Knowledge Transfer Partnership with SME Analytics and Technology Ltd *(Mar 2023–Mar 2025)*

- Innovate UK; £183,364. With Marya Bazzi.

Stochastic Perturbation Theory in Machine Learning *(2021)*

- EPSRC; £76,216.

KNOWLEDGE EXCHANGE AND INTERDISCIPLINARY RESEARCH

- Academic supervision of the Warwick–SME Analytics and Technology Knowledge Transfer Partnership, applying language models and changepoint detection to credit-risk forecasting and bank-transaction classification.
- Collaboration with TRUSS / Kelp Technologies on multimodal retrieval and second-hand apparel valuation.
- Doctoral supervision with BT Research through the Mathematics of Systems Centre for Doctoral Training; co-supervision of an industrial PhD with Sabisu on time-series analysis and clustering.
- Supervision of an MMath project with SME Capital (2020), and scientific consultancy in fintech and IT security with Roman Consulting, Vincorex and TeRank.
- Interdisciplinary research on melanoma tumour evolution with collaborators in genomic oncology and cancer research.

PUBLICATIONS

Preprints

- *Hadwiger's classification theorem on the sphere via signed orthoscheme decompositions.*
M. Lotz. arXiv:2609.17437 (2026).
- *Monotone invariant valuations on convex cones.*
M. Lotz. arXiv:2609.09335 (2026).
- *Khovanskii's Bezout-type Theorem for Pfaffian Functions: A Self-Contained Proof, and Applications.*
M. Lotz and A. Natarajan. arXiv:2607.29267 (2026).
- *Tubular Neighbourhoods of Pfaffian Sets and Applications to Neural Networks.*
P. Lezeau and M. Lotz. arXiv:2607.08370 (2026).
- *Counterfactual Generation from Audit Trails in Multi-Agent Negotiation Systems.*
M. Lotz, P. Aluffi, M. Bazzi. Preprint (2026).

Journal and conference publications and book chapters

- *Partitioning theorems for sets of semi-Pfaffian sets, with applications.*
M. Lotz, A. Natarajan and N. Vorobjov. Forum of Mathematics, Sigma 14, e5 (2026).
- *Sharp phase transitions in Euclidean integral geometry.*
M. Lotz and J. A. Tropp. In High Dimensional Probability X: The Będlewo Volume, Progress in Probability 82, pp. 187–258. Birkhäuser (2026).
- *Performance-Efficiency Trade-off for Fashion Image Retrieval.*
J. Hurtado, H. Ni, D. Sap, C. Mattinson and M. Lotz. ECAI 2025, pp. 5264–5271 (2025).
- *A Neural Difference-of-Entropies Estimator for Mutual Information.*
H. Ni and M. Lotz. ECAI 2025, pp. 2243–2250 (2025).
- *Dimensionality reduction for k -distance applied to persistent homology.*
S. Arya, J.-D. Boissonnat, K. Dutta and M. Lotz. Journal of Applied and Computational Topology 5(4), 671–691 (2021).
- *Molecular subtype, biological sex and age shape melanoma tumour evolution.*
M. Lotz, T. Budden, S. J. Furney and A. Virós. British Journal of Dermatology 184(2), 328–337 (2021).
- *Wilkinson's bus: Weak condition numbers, with an application to singular polynomial eigenproblems.*
M. Lotz and V. Noferini. Foundations of Computational Mathematics 20(6), 1439–1473 (2020).
- *Effective condition number bounds for convex regularization.*
D. Amelunxen, M. Lotz and J. Walvin. IEEE Transactions on Information Theory 66(4), 2501–2516 (2020).
- *Concentration of the intrinsic volumes of a convex body.*
M. Lotz, M. B. McCoy, I. Nourdin, G. Peccati and J. A. Tropp. In Geometric Aspects of Functional Analysis, Israel Seminar 2017–2019, Vol. II, Lecture Notes in Mathematics 2266, pp. 139–167. Springer (2020).
- *Dimensionality reduction for k -distance applied to persistent homology.*
S. Arya, J.-D. Boissonnat, K. Dutta and M. Lotz. 36th International Symposium on Computational Geometry (SoCG 2020), LIPIcs 164, 10:1–10:15 (2020).
- *Persistent homology for low-complexity models.*
M. Lotz. Proceedings of the Royal Society A 475(2230), 20190081 (2019).
- *On the error in phase transition computations for compressed sensing.*
S. Daei, F. Haddadi, A. Amini and M. Lotz. IEEE Transactions on Information Theory 65(10), 6620–6632 (2019).
- *Intrinsic volumes of polyhedral cones: a combinatorial perspective.*
D. Amelunxen and M. Lotz. Discrete & Computational Geometry 58(2), 371–409 (2017).
- *Average-case complexity without the black swans.*
D. Amelunxen and M. Lotz. Journal of Complexity 41, 82–101 (2017).

PUBLICATIONS CONTINUED

- *On the volume of tubular neighborhoods of real algebraic varieties.*
M. Lotz. Proceedings of the American Mathematical Society 143(5), 1875–1889 (2015).
- *Living on the edge: Phase transitions in convex programs with random data.*
D. Amelunxen, M. Lotz, M. B. McCoy and J. A. Tropp. Information and Inference 3(3), 224–294 (2014).
- *Coverage processes on spheres and condition numbers for linear programming.*
P. Bürgisser, F. Cucker and M. Lotz. The Annals of Probability 38(2), 570–604 (2010).
- *Adversarial smoothed analysis.*
F. Cucker, R. Hauser and M. Lotz. Journal of Complexity 26(3), 255–262 (2010).
- *The probability that a slightly perturbed numerical analysis problem is difficult.*
P. Bürgisser, F. Cucker and M. Lotz. Mathematics of Computation 77(263), 1559–1583 (2008).
- *The complexity of computing the Hilbert polynomial of smooth equidimensional complex projective varieties.*
P. Bürgisser and M. Lotz. Foundations of Computational Mathematics 7(1), 59–86 (2007).
- *Smoothed analysis of complex conic condition numbers.*
P. Bürgisser, F. Cucker and M. Lotz. Journal de Mathématiques Pures et Appliquées 86(4), 293–309 (2006).
- *General formulas for the smoothed analysis of condition numbers.*
P. Bürgisser, F. Cucker and M. Lotz. Comptes Rendus Mathématique 343(2), 145–150 (2006).
- *Counting Complexity Classes for Numeric Computations. III: Complex Projective Sets.*
P. Bürgisser, F. Cucker and M. Lotz. Foundations of Computational Mathematics 5(4), 351–387 (2005).
- *The complexity to compute the Euler characteristic of complex varieties.*
P. Bürgisser, F. Cucker and M. Lotz. Comptes Rendus Mathématique 339(5), 371–376 (2004).
- *Lower bounds on the bounded coefficient complexity of bilinear maps.*
P. Bürgisser and M. Lotz. Journal of the ACM 51(3), 464–482 (2004).
- *On the algebraic complexity of some families of coloured Tutte polynomials.*
M. Lotz and J. A. Makowsky. Advances in Applied Mathematics 32(1–2), 327–349 (2004).
- *Lower bounds on the bounded coefficient complexity of bilinear maps.*
P. Bürgisser and M. Lotz. 43rd IEEE Symposium on Foundations of Computer Science (FOCS), pp. 658–668 (2002).

PUBLISHED CONFERENCE ABSTRACT

- *Chronic UV damage of the stroma improves melanoma survival.*
E. Nagore, K. Roock, T. Budden, S. P. Smith, S. Craig, J. Krutmann, M. Lotz, S. J. Furney and A. Virós. Cancer Research 79(13 Supplement), abstract 2022 (2019).

UNPUBLISHED MANUSCRIPTS

- *Categorising SME Bank Transactions with Machine Learning and Synthetic Data Generation.*
P. A. Aluffi, B. Jess, M. Bazzi, K. Kennedy, M. Arderne, D. Rodrigues and M. Lotz. arXiv:2508.05425 (2025).
- *Representation Learning on Graphs at Scale via Geometric Patch Alignment.*
With M. La Vecchia and M. Cucuringu. Manuscript (2025).
- *CL-FinTrans: A Hierarchical Contrastive Learning Framework for Multi-Modal Financial Transaction Representation.*
With P. Aluffi and M. Bazzi. Manuscript (2025).
- *The dynamics of mutation rate, aging and extrinsic risk in melanoma development.*
M. Lotz, S. J. Furney and A. Virós. Manuscript (2018).
- *Gordon's inequality and condition numbers in conic optimization.*
D. Amelunxen and M. Lotz. arXiv:1408.3016 (2014).

INVITED RESEARCH PROGRAMMES AND VISITS

- Alan Turing Institute interest group, Low-dimensional structure in data and graphs: models, analysis, and algorithms (2020–2022).
- Isaac Newton Institute, Cambridge: Approximation, sampling and compression in data science (Jan–Jul 2019).
- Hausdorff Research Institute for Mathematics, Bonn: Mathematics of Signal Processing (Jan–Apr 2016).
- Externally funded visits to Hong Kong (2011, 2014, 2015, 2016), RWTH Aachen (2015), TU Berlin (2014) and Caltech (2013).

TEACHING AND CURRICULUM DEVELOPMENT

University of Warwick

- Theory of ODEs (MA254/354), 2026.
- Mathematics of Machine Learning, 2019–2023. Designed, developed and delivered the course, covering statistical learning theory, optimization and deep learning; authored extensive lecture notes.
- Simulation and Machine Learning in Finance, Warwick Business School, 2023.
- Methods of Mathematical Modelling 3, 2023. New module covering continuous optimization and elements of machine learning.
- Topology of Data, 2020–2021; Introduction to Topology, 2018 and 2019.

University of Manchester 2012–2018

- Designed, developed and delivered Convex Optimization, a third-year course with applications to machine learning, using Jupyter notebooks combining theory and Python code.
- Numerical Analysis I; MSc Scientific Computing, including project-based C++ programming; tutorials, laboratories and project supervision.

University of Edinburgh and earlier teaching

- Differential Equations and Modeling, Edinburgh (2010–2012); supervision of three MSc Operations Research students. Additional teaching and supervision at Oxford, Paderborn and ETH Zürich.

RESEARCH SUPERVISION AND MENTORING

Doctoral students

- Pietro Aluffi — PhD supervision, started 2025.
- Tsz Fung Yu — PhD in Mathematics, started 2022; deep learning for the numerical solution of partial differential equations.
- Haoran Ni — MathSys CDT PhD, 2020–2024; numerical estimation of information measures.
- Amit Arfan — co-supervision, 2017–2021; reinforcement learning and Markov processes.
- Stephen Elsworth — co-supervision with Sabisu, 2016–2019; analysis and clustering of industrial time series.
- Jake Walvin — Manchester, 2013–2018; phase transitions for general convex regularization.

Postdoctoral researchers and research associates

- Marco La Vecchia, postdoctoral researcher (2023–2025); Brandi Jess, KTP Associate (2023–2025); Abhiram Natarajan, EPSRC-funded postdoctoral researcher (2021–2026); Dennis Amelunxen, postdoctoral researcher (Aug 2013–Jul 2014).

Visiting students and project supervision

- Joannés Chambon, ENSTA ParisTech (May–Aug 2017), GPU-accelerated algorithms for cospase signal recovery; Elliot Brendel, ENSTA ParisTech (May–Aug 2016), randomized linear algebra.
- Third-year, MMath and MSc projects at Warwick, Manchester, Edinburgh and Oxford, including protein folding, topology of data, matrix completion, tensor computations, compressed sensing, portfolio optimization and financial volatility. Supervision of LMS-funded summer research projects.

ACADEMIC SERVICE AND LEADERSHIP

- Executive Committee member, Centre for Applications of Mathematical and Computing Sciences (CAMAcs), University of Warwick.
- Editorial Board, Information and Inference (Oxford University Press), appointed 2021.
- Warwick Mathematics Institute Advisory Board, appointed 2020; faculty advisor to the Warwick SIAM Student Chapter, appointed 2019.
- External examiner, University of Birmingham (from 2019); Secretary to the Second Year Exam Board, Warwick (from 2019); responsibility for academic aspects of departmental computing, Warwick (from 2018).
- Year 4 Senior Tutor, Manchester (2017–2018); Programme Director, Computer Science with Mathematics joint honours programme, Manchester (2015–2017).
- Internal and external PhD examining at Warwick, Oxford, Manchester, SUNY and in Bogotá; academic advising and tutoring of more than 50 students.
- Refereeing for Foundations of Computational Mathematics, Annals of Statistics, Information and Inference, SIAM Journal on Optimization and Mathematical Programming, among other journals.
- Research-proposal reviewing for funding councils in Portugal, Ireland, Hong Kong and Poland.

CONFERENCE AND WORKSHOP ORGANISATION

- Warwick–Alan Turing Institute MIRaW days, Warwick (2020); sessions at the International Conference on Continuous Optimization, Tokyo (2016).
- Compressive Sensing in Tomography workshop, Manchester (Nov 2015); session at Stochastic Processes and Applications, Oxford (Jul 2015); Complexity Questions in Optimization, Edinburgh (Apr 2011).

SELECTED INVITED TALKS

- Invited speaker at Foundations of Computational Mathematics conferences from 2002, in workshops on complexity theory, computational algebraic geometry and optimization; also at SIAM Annual Meetings, SIAM Optimization and the Strathclyde Numerical Analysis Biennale.
- Geometric Probability in Optimization and Complexity — Geometry in Complexity and Computations, Konstanz (2022).
- Wilkinson’s Bus: weak condition numbers — SIAM Algebraic Geometry, Bern (2019).
- Average-case analysis without the black swan — Discretization in Geometry and Dynamics, Döllnsee-Schorfheide (2018).
- Effective condition number bounds in convex regularization — Algebra meets numerics: condition and complexity, TU Berlin (2017).
- Seminar and colloquium talks include Konstanz (2022), SISSA Trieste (2021), TU Berlin (2014, 2019, 2020), Cambridge (2017, 2019), Oxford (2013, 2018), Cardiff and Sheffield (2017), Hong Kong (2016), RWTH Aachen (2015), Paris-Sud (2014) and Tokyo (2013).

OUTREACH AND PROFESSIONAL ACTIVITIES

- Co-organisation of Maths and Chess Clubs at St Augustine’s Primary School, Kenilworth (from 2022); talks to Warwick AI Society on deep learning for protein folding and to Warwick Maths Society (2018–2019) and Manchester’s Galois Group (2017) on Surprises in High Dimensions; Big Bang Fair, Birmingham (2017).
- American Mathematical Society; German Mathematical Society (DMV); Society for Industrial and Applied Mathematics (SIAM).
- **Scientific computing:** Python, C++, R, MATLAB, Julia, Rust and Sage; PyTorch and TensorFlow; CUDA and GPU computing.
- **Languages:** English (fluent at native level); German and Spanish (native).