# Martin Anthony

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## Employment

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| 2024–2026 | **Director**, LSE Data Science Institute |
| 2019–2022 | **Vice-Chair Academic Board**, LSE |
| 2015–2019 | **Head of Mathematics**, LSE (also 2005–2008 and 2014) |
| 2005– | **Professor of Mathematics**, LSE |
| 1997–2005 | **Reader in Mathematics**, LSE |
| 1990–1997 | **Lecturer in Mathematics**, LSE |

## Education, qualifications and training

### LSE Leadership Development Programme, 2014

(Accredited by the Chartered Management Institute) Leadership, Communication Skills, People and Performance, Strategic Thinking, Managing Change, and a project on institutional decision making.

### MA (with distinction) in Higher and Professional Education, Institute of Education, University of London, 2002

Institutional Management, Understanding Higher and Professional Education, Continuous Quality Improvement in Higher Education, Post-compulsory Education and the Learning Society, Values and Purposes in Post-Compulsory Education, and a report entitled 'The Classification of Undergraduate Degrees in the United Kingdom: An Analysis of Problems with the Honours System'.

### PhD in Mathematics, University of London, 1991

Thesis entitled *Uniform Convergence and Learnability*. Supervisor: Norman Biggs

### BSc Hons (first class) in Mathematics, University of Glasgow, 1988

President of the Maclaurin Society (the Mathematics society).
First class marks in all courses taken and winner of:
Institute of Mathematics and its Applications Prize 1988
McAuley Memorial Prize in Mathematics 1988
Carnegie Vacation Research Scholarship 1987
Laing Scholarship in Mathematics 1987
Cunninghame Medal and Prize in Mathematics 1987
Lorimer Bursary in Mathematics 1986
Kerr Bursary in Natural Philosophy 1985
Matthew A. Muir Bursary in Mathematics 1985
David Johnstone Memorial Bursary and top-placed fifth-year secondary school student in University of Glasgow Bursary Competition Exam 1984.

## Leadership, Management and Service

Current and former leadership/managerial roles and service include the following.

**Selected current and recent roles**

**Director, LSE Data Science Institute**, LSE, Sep 2024–Sep 2026
An interim appointment on secondment. Oversight and leadership of the activities of the DSI (which, broadly speaking, aims to convene, catalyse and communicate all LSE activity in the AI and data science area). Led the Institute through a period of consolidation and growth. Grew the Faculty Affiliate Network from approximately 40 to over 110 members across 27 departments and centres; established a PhD Affiliate Scheme of around 100 doctoral researchers. Made senior academic appointments and strategic visiting appointments.

**Chair, Research Computing Governance Working Group** 2026

**LSE Campaign Ambassador** 2025–

**Member, LSE Campaign Ambassador Subgroup on New Technologies** 2025–

**Member, Data and Technology Services Management Board** 2024–2026

**Member, LSE100 Management Committee** 2018–

**Academic Co-ordinator** for Mathematics subjects on the LSE-led University of London International programmes, c. 2000–

**Chief examiner**, for Mathematics papers on the External Programme, 2003–

**Earlier roles and service**

**VCAB (Vice-Chair Academic Board)**, LSE, Sep 2019–Aug 2022
In this capacity: chair of Agenda Committee of the Academic Board, chair of Academic Nominations Committee; member of Council, Court, Academic Planning and Resources Committee, APRC Agenda Committee, Governance Committee, Strategy 2030 Portfolio Taskforce, Office Holders Group, Department Heads Forum, Executive MSc sub-group

**Head of Department**, Mathematics Department, LSE, 2015–2019, 2014 (Jan-April) and 2005–2008

**Project co-director, International School of Economics and Social Sciences at Kazakh-British Technical University**, 2007–2018
The project involved the development of an institution in Almaty, Kazakhstan, delivering a dual degree programme between the University of London and KBTU.

**Vice-Chair, External Funding Ethical Review Body, LSE** 2022–2023

**Member, Ethics (Grants and Donations) Panel** 2018–2022

**Chair, Mathematics and Statistics Examination Sub-board**, EMFSS University of London International Programmes

**Member, Pro-Director Selection Committees** 2017, 2019, 2021

**Member, LSE TEF Strategy Group** and **cluster coordinator** for Mathematics, Statistics, Economics and Philosophy, Logic and Scientific Method, 2017–2018

**Member of Executive Team**, SEDS: interdepartmental research unit on Social and Economic Data Science, LSE, 2017–2019

**Member, LSE TEF Working Group**, 2016–2018

**Member, LSE Education Strategy Project Board**, 2016–2017

**Member, Department Heads Forum Steering Group** 2015–2019

**Member, Senior Management Review Panel for review of Academic Registrar's Division**, April 2017

**Member, Athena Swan Departmental Self-Assessment Team**, 2016

**Deputy Head (Teaching)**, Mathematics Department, LSE, 2013

**Academic Governor (member of LSE Court)**, 2010–2016, 2019–2022

**Member of LSE Council**, 2010–2013, 2019–2022

**Member, Academic and Student Affairs Committee**, 2013–2015

**Chair of the EMFSS International Programme Board of Examiners**, 2009–2015
This is the main board covering all University of London International Programmes for which LSE is lead college. The Board and its sub-boards oversee the assessment of over 50000 examination scripts in over 100 subjects.

**Member, Gender Equality Charter Mark Self-assessment Team**, 2013–14

**Member, Mid-cycle Review Panel, University of London International Programmes**, 2014

**Member, LSE Audit Committee**, 2010–2013

**Member, LSE Chair and Vice-Chair Selection Committee**, 2011–2013

**Director of Teaching, and Teaching Committee Chair**, Mathematics department

**Chair, Exams Working Group** for LSE-led University of London International Programmes

**Admissions tutor**, Mathematics department

**Chair, Academic Studies Committee**, 1998–2001
This LSE-wide committee was responsible for all undergraduate curricular matters (in all departments). As Chair, I sat ex-officio on other bodies and on a number of ad-hoc working groups considering a wide range of matters related to undergraduate curricula, assessment, and quality assurance, and I had responsibility for taking Chair 's action on many matters (particularly relating to individual students).

**Chair, External Programme Committee**, 1997–2000
This committee was responsible for a wide range of issues, particularly relating to curriculum and quality assurance, on the LSE-led degrees on the University of London External Programme.

**Member, Quality Assurance and Student Lifecycle Working Group**, University of London External System, c.2008–2010.

**Executive Director (Finance)**, LSE Centre for Discrete and Applicable Mathematics

**Chair, LSE International Programme Working Group on Entrance and Exemptions**

**Co-ordinator, Part-time teaching**, Mathematics department

**Member** of numerous other committees and working groups, including the LSE Widening Participation Advisory Group, the LSE Teaching Task Force and Teaching Task Force 2, the LSE International Programme Board, the LSE working groups on degree classification and on the use of contextual data for admissions, the International Foundation Programme Institutions working group, the LSE Colleges Working Group (External Programme), the Academic Support Staff Committee, the LSE Working Group on Academic Career Development, the LSE Committee on Accommodation, the IT cluster steering group, and the South East Asia recruitment group.

## Teaching

**LSE Education Excellence Award 2017**, for 'teaching excellence but more importantly for [my] important contribution to strategic leadership on education'

**LSE Education Excellence Award 2016**, for 'Departmental and School-wide leadership on education'.

**LSE Students' Union Teaching Excellence Award 2014**
Citation: 'students wanted to thank Martin for his enthusiasm, generosity and compassionate approach to teaching complex mathematical concepts. Not only is Martin incredibly knowledgeable, nominations pointed to his ability to share this expertise using clear lectures, excellent additional resources, and a patient and coherent communication technique. Students appreciate his positive attitude to teaching, creating a safe and open classroom environment where no question is too small or silly to ask. Furthermore, many students referenced Martin's skill at making mathematics relevant to the real world, giving background motivation for topics and taking time to approach problems from multiple different angles.'

**Main courses taught at LSE**
- Algebra and Number Theory
- Algebra and its Applications
- Mathematical Methods (First year course, c. 600 students. )
- Introduction to Abstract Mathematics (c. 250 students)
- Real Analysis
- Quantitative Methods (Mathematics)
- Discrete Mathematics
- Advanced Linear Algebra
- Topology
- Computational Learning Theory
- Further Quantitative Methods

**LSE Summer School** Co-leader of ME306 Real Analysis course

**Online course development for LSE Extended Education:**
- Abstract Mathematics
- Further Linear Algebra
- Mathematics 1
- Mathematics 2

**Speaker**, LSE Teaching Day, 2011 (with Janet Hartley): 'Has degree classification had its day?'

**Public lecture** on Student Motivation in Higher Education, St Martin's Institute of Higher Education, Malta, November 2013

**Keynote speaker**, UoLIP/LSE Learning and Teaching Workshop, Malaysia, April 2013.

**Speaker and panel member**, UoLIP/LSE Learning and Teaching Workshop, Istanbul, May 2014.

**External examiner** for several papers for the Hong Kong University School of Professional and Continuing Education and for Singapore Institute of Management, and for Stansfield College, PSB and SAA, in Singapore.

**PhD students** supervised:
- Ben Veal, 'Binary similarity measures and their applications in machine learning'.
- V L R. Chinthalapati, 'Probabilistic learning and optimization applied to quantitative finance'.

## Research

**Editorial board member** of the journal *Discrete Applied Mathematics*

**Referee/reviewer for journals** including: Discrete Mathematics, Discrete Applied Mathematics, Combinatorics, Probability and Computing, Journal of Combinatorial Theory, Journal of Machine Learning Research, Information and Computation, Information Processing Letters, Machine Learning, Neural Networks, SIAM Journal on Discrete Mathematics, SIAM Journal on Computing, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Information Theory, IEEE Transactions on Neural Networks, Journal of Computer and Systems Sciences, Annals of the Institute of Statistical Mathematics, Theoretical Computer Science, Computers and Operations Research, Neurocomputing, LMS Journal of Computation and Mathematics, Discrete Optimization, European Journal of Operational Research, Informatica, Annals of Mathematics and Artificial Intelligence, Discrete Mathematics and Theoretical Computer Science, Annals of Operations Research.

**Reviewer or committee member for conferences** including NIPS (Neural Information Processing Systems), COLT (Computational Learning Theory), Euro-COLT, British Combinatorial Conference, STACS (Symposium on Theoretical Aspects of Computer Science), ALT (Algorithmic Learning Theory), ISAIM (Artificial Intelligence and Mathematics), IEEE FOCI (Foundations of Computational Intelligence), IEEE SSCI.

**Grant reviewer** for the EPSRC and the Hong Kong Science Research Council.

**Fellow** of the Institute of Mathematics and its Applications

**PhD examiner** for University College London, Queen Mary University of London, Southampton University, Flinders University (Australia), the London Business School, Warwick University, and Royal Holloway, University of London

**Grants and project participation** include the following:

- **'Principled algorithmic approaches to big data analytics'**
  STICERD research grant 2014-2016.
- **'PASCAL' and 'PASCAL2'**,
  Pattern Analysis, Statistical Modelling and Computational Learning. An EU-funded Network of Excellence. I was the site manager at LSE. December 2003–December 2013.
- **Centre for Distance Education grant**
  Principal investigator/project manager on an educational research grant from the Centre for Distance Education. This grant funded a study of the design and implementation principles that should underpin the use of 'virtual online tutors' to enable students to learn mathematics. 2007–2008
- **'NeuroCOLT' and 'NeuroCOLT 2'**
  Neural and Computational Learning Theory. EU-funded ESPRIT Working Group Project for collaborative research among 18 partner sites. I was the principal investigator/site manager at LSE. 1994–2002.
- **'The Canonical Metric in Machine Learning: Theory and Applications'**
  Engineering and Physical Sciences Research Council (EPSRC), Mathematics grant. 1995–1997.

## Publications

### Books

(With N. Biggs) *Mathematics for Economics and Finance: Methods and Modelling (Second Edition)*. Cambridge University Press, 2024. (ISBN 1108459439)

(With M. Harvey) *Linear Algebra: Concepts and Methods*. Cambridge University Press, 2012. (ISBN 0521279488 ) Published also as Kindle e-book.

*Discrete Mathematics of Neural Networks: Selected Topics*. SIAM Monographs on Discrete Mathematics and Applications. Society for Industrial and Applied Mathematics, Philadelphia, PA, 2001. (ISBN 0-89871-480-X)

(With P.L. Bartlett) *Neural Network Learning: Theoretical Foundations*. Cambridge University Press, Cambridge UK, 1999. (ISBN 0 521 57353 X). Published in paperback 2009 (ISBN 9780521118620).

(With N. Biggs) *Mathematics for Economics and Finance: Methods and Modelling*. Cambridge University Press, 1996. (ISBN 0 521 55913 8). Reprinted several times, and translated into Japanese, Chinese and Spanish. Published also as Kindle e-book.

(With N. Biggs) *Computational Learning Theory: An Introduction*. Cambridge Tracts in Theoretical Computer Science, 30, 1992. Cambridge University Press, Cambridge, UK (ISBN 0 521 41603 5). Reprinted in paperback, 1997 (ISBN 0 521 59922 9).

### Edited Book

(With J. Shawe-Taylor) *Computational Learning Theory: EUROCOLT'93*. Oxford University Press, 1994. (ISBN 0 19 853492 2)

### Guest-edited journal special editions

(With E. Boros and A. Kogan) *Discrete Mathematics and Data Mining*. Special volume of *Discrete Applied Mathematics*, 2008

(With E. Boros, P.L. Hammer and A. Kogan) *Discrete Mathematics and Data Mining*. Special volume of *Discrete Applied Mathematics*, 2006

(With E. Boros, P.L. Hammer and A. Kogan) *Discrete Mathematics and Data Mining*. Special volume of *Discrete Applied Mathematics*, 2004

### PhD Thesis

Uniform Convergence and Learnability, PhD thesis, University of London, submitted February 1991. (Examined May 1991)

### Articles

Chamber geometry and specification numbers of Boolean threshold functions, arXiv:2606.29477, 2026. (Submitted for journal publication)

(with Kaveh Salehzadeh Nobari) Generalised eigenvalue geometry of semantic adversarial attacks, arXiv:2606.19212, 2026. (Submitted for journal publication)

(with Joel Ratsaby) Large-width (LW) machine learning algorithm. *Progress in Artificial Intelligence* 9: 275-285, 2020.

(with Joel Ratsaby) Large width nearest prototype classification on general distance spaces. *Theoretical Computer Science* 738: 65-79, 2018.

(with Joel Ratsaby) Large-width bounds for learning half-spaces on distance spaces. *Discrete Applied Mathematics* 243: 73-89, 2018.

(with Endre Boros, Yves Crama and Aritanan Gruber) Quadratic reformulations of nonlinear binary optimization problems. *Mathematical Programming (Series A)*, 162 (1), 115–144, 2017.

(with Joel Ratsaby) Classification based on prototypes with spheres of influence. *Information and Computation* 256: 372-380, 2017.

(with Joel Ratsaby) Multi-category classifiers and sample width. *Journal of Computer and System Sciences* 82(8): 1223–1231, 2016.

(with Endre Boros, Yves Crama and Aritanan Gruber) Quadratization of symmetric pseudo-Boolean functions. *Discrete Applied Mathematics* 203: 1–12, 2016.

(with Joel Ratsaby) A probabilistic approach to case-based inference. *Theoretical Computer Science*, 598, 61-75, 2015.

(with Joel Ratsaby) A hybrid classifier based on boxes and nearest neighbors. *Discrete Applied Mathematics* 172, 1-11, 2014.

(with Joel Ratsaby) Learning bounds via sample width for classifiers on a finite metric space. *Theoretical Computer Science* 529, 2–10, 2014.

(with Joel Ratsaby) Maximal margin case-based inference. In: Jin, Yaochu and Thomas, Spencer Angus, (eds.) 2013 13th UK Workshop on Computational Intelligence (UKCI). IEEE Conference Publications. Institute of Electrical and Electronic Engineers, New York, USA, 112-119, 2013

(with Joel Ratsaby) Quantifying accuracy of learning via sample width. *Proceedings of the 2013 IEEE Symposium on Foundations of Computational Intelligence (FOCI), IEEE Symposium Series on Computational Intelligence*, 84-90, 2013. Nominated for SSCI best paper prize.

(with Joel Ratsaby) Analysis of a multi-category classifier. *Discrete Applied Mathematics* 160 (16-17): 2329–2338, 2012.

(with Joel Ratsaby) The performance of a new hybrid classifier based on boxes and nearest neighbors. *International Symposium on Artificial Intelligence and Mathematics*, January 2012.

(with Munnever Mine Subasi, Ersoy Subasi and Peter L. Hammer) A new imputation method for incomplete binary data. *International Symposium on Artificial Inteligence and Mathematics*, January 2012.

Probability Theory in Machine Learning. In *Encyclopedia of the Sciences of Learning* (ed. Nobert M. Seel), Springer 2012.

Generalization Error Bounds for Logical Analysis of Data. *Discrete Applied Mathematics* 160, 1407–1415, 2012.

(with Joel Ratsaby) Robust Cutpoints in the Logical Analysis of Numerical Data. *Discrete Applied Mathematics* 160, 355–364, 2012.

(with Mine Subasi, Ersoy Subasi, and Peter L. Hammer) A new imputation method for incomplete binary data. *Discrete Applied Mathematics* 159 (10): 1040-1047, 2011.

The Beauty of Maths, *LSE Connect* (An expository article for non-mathematicians), 2011

Decision Lists and Related Classes of Boolean Functions. In *Boolean Functions: Boolean Models and Methods in Mathematics, Computer Science, and Engineering* (ed. Y. Crama and P.L. Hammer). Cambridge University Press, 2010. ISBN 9780521847520

Probabilistic Learning of Boolean Functions. In *Boolean Functions: Boolean Models and Methods in Mathematics, Computer Science, and Engineering* (ed. Y. Crama and P.L. Hammer). Cambridge University Press, 2010. ISBN 9780521847520

Neural Networks and Boolean Functions. In *Boolean Functions: Boolean Models and Methods in Mathematics, Computer Science, and Engineering* (ed. Y. Crama and P.L. Hammer). Cambridge University Press, 2010. ISBN 9780521847520

(with Joel Ratsaby) Maximal width learning of binary functions. *Theoretical Computer Science*, 411 (2010): 138-147.

On constructing threshold networks for pattern classification. In *Constructive Neural Network Algorithms* (eds. Leonardo Franco, David Elizondo, Jose Jerez), Springer Studies in Computational Intelligence Vol. 258, Springer, 2009.

(with Mine Subasi, Ersoy Subasi, and Peter L. Hammer) Using a similarity measure for credible classification. *Discrete Applied Mathematics* 157(5, 6), 1104-1112, 2009.

Aspects of discrete mathematics and probability in the theory of machine learning. *Discrete Applied Mathematics* 156 (6), 2008: 883-902.

On the generalization error of fixed combinations of classifiers. *Journal of Computer and System Sciences* 73 (5), 725-734, 2007.

(With Peter L. Hammer) A Boolean measure of similarity. *Discrete Applied Mathematics* 154 (16), 2006.

(With Leonardo Franco, Jose Luis Subirats and Jose Jerez) A new constructive approach for creating all linearly separable (threshold) functions. *Proceedings IEEE Joint Conference on Neural Networks 2006*.

(With Leonardo Franco) The influence of oppositely classified examples on the generalization complexity of Boolean functions. *IEEE Transactions on Neural Networks*, 17 (3), 2006, 578-590.

Some Connections Between Learning and Optimization. *Discrete Applied Mathematics* 144 (1-2), 17-26, 2004.

On Data Classification by Iterative Linear Partitioning, *Discrete Applied Mathematics* 144 (1-2), 2-16, 2004.

(with Leonardo Franco) On a generalization complexity measure for Boolean functions. In *Proceedings of the 2004 IEEE International Joint Conference on Neural Networks*, IEEE Press, July 2004, 973-978.

On learning a function of perceptrons. In *Proceedings of the IEEE 2004 International Joint Conference on Neural Networks*, IEEE Press, July 2004, 967–972.

Partitioning points by parallel planes, *Discrete Mathematics* Vol 282 (1-3), 2004: 17–21.

Generalization error bounds for threshold decision lists. *Journal of Machine Learning Research* 5, 2004, 189–217.

Data Classification by Multithreshold Functions. Workshop on Discrete Mathematics and Data Mining, 3rd SIAM Conference on Data Mining, San Francisco, May 2003.

Accuracy of Classification by Iterative Linear Thresholding. Workshop on Discrete Mathematics and Data Mining, 3rd SIAM Conference on Data Mining, San Francisco, May 2003.

(With N. Biggs) Pac learning and artificial neural networks. In *The Handbook of Brain Theory and Neural Networks, Second edition*, (ed. Michael A. Arbib), Bradford Books/MIT Press, November 2002.

Mathematical Modelling of Generalization. In M. Marinaro, R. Tagliaferri (eds.),*Neural Nets: 13th ItalianWorkshop on Neural Nets, WIRN VIETRI 2002 Vietri sul Mare, Italy, May 30 - June 1, 2002*. Springer LNCS 2486, 2002.

(With P. Bartlett) Function learning from interpolation. *Combinatorics, Probability and Computing*, 9, 213–225, 2000.

Accuracy of techniques for the logical analysis of data. *Discrete Applied Mathematics* 96, 247–257, 1999.

(with S.B. Holden) Cross-validation for binary classification by real-valued functions. In *Proceedings of the 1998 Annual Workshop on Computational Learning Theory*, Madison, Wisconsin, 1998, 218–229. ACM Press.

(With P. Bartlett, J. Shawe-Taylor and R.C. Williamson) Structural risk minimisation over data-dependent hierarchies. *IEEE Transactions on Information Theory*, 44(5):1926-1940, 1998.

Probabilistic 'generalization' of functions and dimension-based uniform convergence results. *Statistics and Computing*, 8(1), 5–14, 1998.

Graphs and artificial neural networks. In *Graph Connections*, 247–260, edited by Lowell Beineke and Robin Wilson. Oxford University Press, 1997.

(With J. Shawe-Taylor) A sufficient condition for polynomial distribution-dependent learnability. *Discrete Applied Mathematics* 77(1), 1–12, 1997.

Probabilistic analysis of learning in artificial neural networks: the PAC model and its variants. *Neural Computing Surveys*, 1, 1-47, 1997.

(With P. Bartlett, Y. Ishai and J. Shawe-Taylor) Valid generalisation from approximate interpolation. *Combinatorics, Probability and Computing*, Volume 5 191–214 (1996).

(With P. Bartlett, J. Shawe-Taylor and R.C. Williamson) A framework for structural risk minimisation. In *Proceedings COLT'96*, 68–76. ACM Press, 1996.

(With G. Brightwell and C. Cooper) On the Vapnik-Chervonenkis dimension of a random graph. *Discrete Mathematics* 138 (1995): 43–56.

Classification by polynomial surfaces. *Discrete Applied Mathematics*, 61 (1995): 91–103.

(With G. Brightwell and J. Shawe-Taylor) On specifying boolean functions by labelled examples. *Discrete Applied Mathematics*, 61 (1995): 1–25.

(With P. Bartlett) Function learning from interpolation (extended abstract). Proceedings EuroCOLT'95, Springer-Verlag, 1995: 211–221.

(With N. Biggs) A computational learning theory view of economic forecasting with neural nets. In *Neural Networks in the Capital Markets*, (ed. AN Refenes), Wiley, 1995.

Interpolation and learning in artificial neural networks. In Proceedings of the 1995 IEEE International Conference on Neural Networks, Perth, Western Australia. IEEE Press.

On the mean chromatic number, *Discrete Mathematics*, Volume 125 (1994): 11–14.

(With S.B. Holden) Quantifying generalisation in linearly weighted neural networks. *Complex Systems* 8, (1994), 91–114.

(With J. Shawe-Taylor) Valid generalisation of functions from close approximations on a sample. In *Computational Learning Theory: EuroCOLT'93*, 95–108, Oxford University Press 1994.

(With N. Biggs) The mean chromatic number of paths and cycles, *Discrete Mathematics* 120 (1993) 227–231.

(With N. Biggs) Computational learning theory for artificial neural networks. *Mathematical Approaches to Neural Networks* (ed. J.G. Taylor), North-Holland Mathematical Library, North-Holland (Elsevier), 1993, 25–63.

(With J. Shawe-Taylor) A result of Vapnik with applications, *Discrete Applied Mathematics*, 47 (1993): 207–217.

(With S.B. Holden) On the power of polynomial discriminators and radial basis function networks. In *Proceedings of the Sixth Annual Workshop on Computational Learning Theory*, Santa Cruz, CA, 1993, 158–164, ACM Press.

(With J. Shawe-Taylor) Using the perceptron algorithm to find consistent hypotheses. *Combinatorics, Probability and Computing*, 4(2) (1993): 385–387.

(With S.B. Holden) On the power of linearly weighted neural networks. In *ICANN'93: Proceedings of the International Conference on Artificial Neural Networks, 1993*. Springer-Verlag.

(With J. Shawe-Taylor) Bounds on the complexity of testing and loading neurons. In *ICANN'93: Proceedings of the International Conference on Artificial Neural Networks, 1993*. Springer-Verlag.

(With J. Shawe-Taylor and N. Biggs) Bounding sample-size with the Vapnik Chervonenkis dimension, *Discrete Applied Mathematics*, 42 (1), 1993, 65–73.

(With G. Brightwell, D. Cohen and J. Shawe-Taylor) On exact specification by examples, in *COLT92, Proceedings of the Fifth Annual Workshop on Computational Learning Theory*, Pittsburgh, PA, 1992, 311–318. Published by ACM Press.

(With J. Shawe-Taylor and W. Kern) Classes of feedforward neural networks and their circuit complexity, *Neural Networks* 5 (6), 1992: 971–977.

(With J. Shawe-Taylor) Sample sizes for multiple output threshold networks, *Network: Computation in Neural Systems* 2 (1991): 107–117.

(With N. Biggs and J. Shawe-Taylor) The learnability of formal concepts, in *COLT 90, Proceedings of the Third Annual Workshop on Computational Learning Theory*, Rochester NY, August 1990, 246–257. Published by Morgan Kauffman.

(With K. Martin, J. Seberry and P. Wild) Some remarks on authentication systems, in *Proceedings Auscrypt 90*, Springer-Verlag Lecture Notes in Computer Science, 1990, Vol. 453, 122–139.

Computing chromatic polynomials, *Ars Combinatoria* 90 (1990), 216-220.

**Educational writings**

(With Michele Harvey) *Further Linear Algebra*, University of London, 2012

(With Michele Harvey) *Algebra*, University of London, 2011

*Advanced Mathematical Analysis*, University of London, 2007.

*Abstract Mathematics*, University of London, 2006.

(With Michele Harvey) *Advanced Linear Algebra*, University of London, 2006.

*The Classification of Undergraduate Degrees in the United Kingdom: An Analysis of Problems with the Honours System*. MA Report, Institute of Education, 2002

*Mathematics 2*, University of London, 2002.

*Mathematics 1*, University of London, 2002.

*Further Mathematics for Economists*, University of London, 1999.

*Mathematics for Economists*, University of London, 1997.

*Mathematics*, University of London 1996. (ISBN 0718713508)

(With R. Hewins and C. Phillips) *Quantitative Methods*, University of London 1994.