

Curriculum Vitae

Alexander Gammerman

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Research Areas

Computer learning; Inductive and transductive Inference; Kolmogorov randomness; applications of computer learning algorithms in bioinformatics, proteomics and genomics, medical diagnostics, forensic science, object recognition, fault diagnosis, anomaly detection.

Personal Information

British citizen. Married with three children.

Education

BSc in Physics (1971); PhD in Physics (1974), St.Peterburg. Scientific supervisors: Academician Boris Moshkov and Dr Leonid Fukshansky.

Employment

1974–1976 Agrophysical Research Institute, St.Peterburg

- Senior Engineer

1976–1980 Regional Research Computer Centre, Academy of Sciences, St.Peterburg

- Senior Research Fellow

1980–1983 Leningrad Health Service Bureau, St.Peterburg

- Fellow

1983–1993 Department of Computer Science, Heriot-Watt University, Edinburgh, UK

- Lecturer in Computer Science 1983–1987
- Senior Lecturer in Computer Science 1987–1990
- Reader 1990–1993

1993-present Department of Computer Science Royal Holloway, University of London

- Professor of Computer Science 1993–present
- Head of Computer Science Department 1995–2005
- Founding Director of Computer Learning Research Centre 1998–present

Research and Expertise

Publications: more than 150 publications including books, journal papers, conference proceedings.

Research Grants: major grants from EPSRC/BBSRC/MRC/EU/UK and industry with overall funding is over £5 millions.

PhD students: over twenty students were supervised and PhD degrees were awarded.

For detailed research programme, grants, publications, and teaching - see <http://clrc.rhul.ac.uk/people/alex>

Awards and Posts Held

- P.W. Allen Prize of Forensic Science Society 1996 for the best paper published in *Science and Justice*

- Transductive Learning. Best paper presentation at SCIS and ISIS *Joint 3rd International Conference on Soft Computing and Intelligent Systems* and 7th International Symposium on Advanced Intelligent Systems, Tokyo, Japan, 2006
- Reliable classification of childhood acute leukaemia from gene expression data using Confidence Machines. Best paper award at *IEEE International Conference on Granular Computing* Atlanta, USA, 2006 (joint work with Z.Luo and A.Bellotti).
- Visiting Professor at School of Telecommunications University Polytechnic de Madrid, Madrid, Spain, 2003.
- Senior Research Scientist, Department of Computer Science and Center Computer Learning Systems, Columbia University New York, USA, 2004.
- Honorary Professor, University College London, from 2006 – present.
- Visiting Professor, University of Paris 9 (Dauphine), 2008.

Professional Activities

- Fellow of the Royal Statistical Society from 1985.
- Chartered Fellow of the British Computer Society from 1990.
- EPSRC College 2004-2006.
- Editorial Board: *The Law, Probability and Risk* journal: 2002 - 2009.
- Editorial Board: *The Computer Journal*: 2005 - 2008.
- Member of the Panel for Fellowship selection for Finnish Academy of Science - 2005.
- Referee for numerous journals and conferences in computer science, pattern recognition and artificial intelligence.
 - *IEEE Transactions on Pattern Recognition and Machine Intelligence*
 - *Mathematics and Artificial Intelligence*
 - *Pattern Recognition Letters*
 - *Computational Statistics and Data Analysis*

Selected Conference Programmes and Organising Committees

- Programming and Organising Committee University of London Lectures, *Kolmogorov Lecture and Medal*; 2003 – present
- Chair, *Artificial Intelligence and Applications AIA 2008 Conference, Innsbruck, Austria, February 2008.*
- Member of Programme Committees *Symposium Statistical Learning and Data Sciences (SLDS), Paris, April 2009. Conference on Intelligent Data Analysis (IDA), Amsterdam, 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009.*
- Member of Programme Committee, *Artificial Intelligence and Applications, Innsbruck, 2005, 2006.*
- Member of Programme Committee, *Knowledge and Data Discovery - 02 Conference, USA, 2002.*
- Member of Programme Committee, *Information, Statistics and Induction in Science, Melbourne, Australia, 1997.*

Invited Participation in Conferences and Seminars

- International Joint Conference on Artificial Intelligence, Stockholm, 1999.
- International School for Synthesis of Expert Knowledge (ISSEK-2000), Udine, Italy, 2000.
- Office for National Statistics, London, 2000.
- A MathFIT Workshop: Application of Multiple-Valued Logic to Artificial Intelligence and to Data Mining, Belfast, April, 2001.
- Escuela Tecnica Superior de Ingenieros de Telecomunicacion, Universidad Politecnica de Madrid, July, 2001.
- DTI/EPSRC workshop Risk Assessment Techniques for Design and Safety Management, London, April, 2001.
- Imputation with Support Vector Machine, EU Conference on Imputation and Editing, Jyvaskyla, Finland, 2002.
- National Statistical Office, Neuchatel, Switzerland, 2003
- Heriot-Watt, School of Mathematical Sciences, 2004.
- Bioinformatics workshop, St. Georges Medical School, 2005.
- Czech Technical University, Prague, 2006.

- 2nd Computer Journal Lecture, British Computer Society, London, 2006.
- German Statistical Society and Free University of Berlin, 2007.
- LEARNING 2007, San Juan, Puerto Rico, March 19-22, 2007
- AIA 2008 conference, Innsbruck, Austria, February, 2008.
- Computer Science at Frederick University, Cyprus, June, 2008.
- Dauphine University, Paris, 2008.
- Multivariate Analysis and Econometrics, invited talk, Tsahkadzor, Armenia, September, 2008.
- Statistical Learning and Data Sciences (SLDS), invited talk, Paris, April 2009.
- Multivariate Statistical Analysis, invited talk, Moscow, June 2009.
- Confidence Machine for Proteomic Pattern Diagnostics. The 57th Session of the International Statistical Institute. Durbin, South Africa, August 2009.
- Machine Learning and Applications: 8th International Conference, Miami, Florida, December 2009.
- Online Machine Learning in Data Analysis, EURATOM-CIEMAT, Madrid, January 2010.

PhD examiner

- University of Edinburgh, Department of Artificial Intelligence, 1996;
- University of Helsinki, Department of Computer Science, 1997.
- University College, London, 1998.
- Birbeck College, London, 1999.
- Imperial College, London, 2002.
- University Polytechnic de Madrid, Madrid, 2004.
- University College, London, 2005.
- Imperial College, London, 2006.
- Brunel University, London, 2007.
- Brunel University, 2008.
- Birbeck College, London, 2008.
- Brunel University, London, Feb 2009.

Member of Selection Panels and Appointments

External member of panel in the selection and appointment of Professors and Readers:

- University of Belfast, 1996.
- Goldsmith College, University of London, 1998.
- Heriot-Watt University, Edinburgh
- Birbeck College, University of London, 2002.
- Royal Holloway, University of London: Professors/Readers in various departments.

Royal Society visits

- Visit to China, 1995: lectures and seminars in Beijing Tsinghua University, Beijing Xi'an Jiao Tong University, Xian; Jilin University, Changchun; the Academy of Science of China, Beijing.
- Professor B.Ryabko of Russian Academy of Science visited CLRC under the Royal Society programme 2003-2005.
- Professor Guang Li, Zhejiang University, Hangzhou, China 2009-2010.
- Visit to China, Zhejiang University, Royal Society, 2010.

Visiting Fellows

- Professor Nobuo Suematsu - Computer Science, Hiroshima University, 2003-2004;
- Professor Hong Zhao - Computer Science from Beijing (China) visited in 2006-07.
- Professor Matilde Santos - Physics Department, University de Madrid, visiting CLRC in 2007-08.

Selected Publications

Books

- A. Gammerman, (ed.) Probabilistic Reasoning and Bayesian Belief Networks. Alfred Waller, Henley-on-Thames, 1995.
- A. Gammerman, (ed.) Computational Learning and Probabilistic Reasoning. John Wiley & Sons, Chichester, 1996.
- A. Gammerman. Machine Learning: Progress and Prospects. ISBN 0 900145 93 5, 1997.

- A. Gammerman, (ed.) Causal Models and Intelligent Data Management. Springer-Verlag, 1999.
- V.Vovk, A.Gammerman and G.Shafer. Algorithmic learning in a random world. New York: Springer, 2005.
- A.Gammerman, (ed.) Artificial Intelligence and Applications, Proceedings of the Conference, ACTA Press, ISBN: 978-0-88986-709-3, 2008.

Special Issues of Journals

- A.Gammerman and V.Vovk (editors). Special Issue on Kolmogorov Complexity. *The Computer Journal*, vol. 42, no. 4, pp.254-347, (1999).
- C. Aitken, T. Connolly, A. Gammerman, G. Zhang, D. Oldfield. Predicting an Offender's Characteristics: an evaluation of statistical modelling. *Special Interest Series - Paper 4*, Home Office, London, 1995.
- Alex Gammerman, Iliia Nouretdinov, Brian Burford Alexey Chervonenkis, Vladimir Vovk and Zhiyuan Luo. Clinical Mass Spectrometry Proteomic Diagnosis by Conformal Predictors. *Statistical Applications in Genetics and Molecular Biology Journal*, Volume 7, Issue 2 2008 Article 13, 2008.

Refereed Book Chapters, Journal Papers, Conference Proceedings

- On-line predictive linear regression. *Annals of Statistics*, Volume 37, Number 3 (2009), 1566-1590 (with V.Vovk and I.Nouretdinov). Permanent link to this document: <http://projecteuclid.org/euclid.aos/1239369032> Digital Object Identifier: doi:10.1214/08-AOS622
- Conditional prediction intervals for linear regression. 8th International Conference on Machine Learning and Applications - ICMLA 2009, Miami, Florida, 2009, (with V.Vovk, P.McCullagh, I.Nouretdinov and D.Devetyarov).
- Machine Learning classification with confidence: application of transductive conformal predictors to MRI-based diagnostic and prognostic markers in depression. Submitted to *NeuroImage Journal*, (with I.Nouretdinov, S.Costafreda, A.Chervonenkis, V.Vovk, V.Vapnik and C.Fu).
- Application of Inductive Confidence Machine to ICMLA-competition data. 8th International Conference on Machine Learning and Applications - ICMLA 2009, Miami, Florida, 2009, (with I.Nouretdinov and D.Devetyarov).
- Detection and Abundance Estimation of Material Classes from Airborne from LWIR Hyperspectral Data. EMRS DTC 6th Conference, Edinburgh, 2009 (with R.J.Richards and I.Nouretdinov).

- Confidence Machine and its application to Medical Diagnosis; Int.Conf.on Biological Computing (BioComp09), (with D.Devetyarov and I. Nouretdinov). July 2009, USA.
- Proteomics analysis of ovarian cancer serum samples (Part 1): Peptides generated ex vivo from abundant serum proteins by tumour-specific exopeptidases are not useful biomarkers in ovarian cancer. Ali Tiss, Celia Smith, Dmitry Devetyarov, Aleksandra Gentry-Maharaj, Stephane Camuzeaux, Brian Burford, Ilia Nouretdinov, Jeremy Ford, Zhiyuan Luo, John F. Timms, Ian Jacobs, Usha Menon and Rainer Cramer. Submitted to Clinical Chemistry.
- Proteomics analysis of ovarian cancer serum samples (Part 2): Serum MALDI-TOF MS profiling and CA125 immunoassay as diagnostic tools. John F. Timms¹, Rainer Cramer, Stephane Camuzeaux, Ali Tiss, Celia Smith, Brian Burford, Ilia Nouretdinov, Musarat Kabir, Aleksandra Gentry-Maharaj, Jeremy Ford, Zhiyuan Luo, Alex Gammerman, Usha Menon¹ and Ian Jacobs. Submitted to Clinical Chemistry.
- Online Prediction of Ovarian Cancer. Fedor Zhdanov, Vladimir Vovk, Brian Burford, Dmitry Devetyarov, Ilia Nouretdinov and Alex Gammerman. Lecture Notes in Computer Science Volume 5651/2009 Artificial Intelligence in Medicine DOI 10.1007/978-3-642-02976-9; 2009.
- Cancer informatics by prototype networks in mass spectrometry. Artificial Intelligence in Medicine 45(2-3): 215-228, 2009, (with F- M. Schleif, T. Willmann, M. Kostrzewa, B. Hammer).
- Confidence Predictions for the Diagnosis of Acute Abdominal Pain. In L. Iliadis, I. Vlahavas and M. Bramer (Eds.), Artificial Intelligence Applications & Innovations III, Volume 296 of IFIP International Federation for Information Processing, 175 - 184. Springer, 2009 (with H.Papadopoulos and V.Vovk).
- Serum proteomic abnormality predating screen detection of ovarian cancer (with V.Vovk, B.Burford, I.Nouretdinov, Z.Luo, A.Chervonenkis, M.Waterfield, R.Cramer, P.Tempst, J.Villanueva, M.Kabir, S.Camuzeaux, J.Timms, U.Menon and I.Jacobs). The Computer Journal Advance Access first published online on April 4, 2008 This version published online on April 9, 2008. The Computer Journal, doi:10.1093/comjnl/bxn021
- Predicting clinical outcome in patients diagnosed with synchronous ovarian and endometrial cancer. Ramus SJ, Elmasry K, Luo Z, Gammerman A, Lu K, Ayhan A, Singh N, McCluggage WG, Jacobs IJ, Whittaker JC, and Gayther SA Clinical cancer research : an official journal of the American Association for Cancer Research 14(18):5840-8, 2008 Sep 15
- Adaptive Coding and Prediction of Sources with Large and Infinite Alphabets, IEEE Transaction on Information Theory, v.54, No.8, pp.3808-3813, August 2008 (with B.Ryabko and J.Astola).

- The Kernel Aggregating Algorithm for Regression. Submitted to Machine Learning journal (with S.Busutill, Y.Kalnishkan and V.Vovk)
- Normalized Nonconformity Measures for Regression Conformal Prediction. Artificial Intelligence and Applications - AIA 2008 Conference, Innsbruck, Austria, pp.64-69, 2008. (with H. Papadopoulos and V. Vovk).
- H. Papadopoulos, V. Vovk and A. Gammerman. Regression Conformal Prediction with Nearest Neighbours. Submitted to the Journal of Artificial Intelligence Research.
- A. Lambrou, H. Papadopoulos and A. Gammerman. Evolutionary Conformal Prediction for Breast Cancer Diagnosis. Submitted to the 9th International Conference on Information Technology and Applications in Biomedicine (ITAB'09).
- Hedging Predictions in Machine Learning. *The Computer Journal*, v.50, No.2, 151-163, March 2007 (with V.Vovk). The same journal also published:
 - i) Discussion on Hedging Predictions in Machine Learning by A. Gammerman and V. Vovk. *The Computer Journal*, 2007, 50: 164-172;
 - ii) Rejoinder Hedging Predictions in Machine Learning. *The Computer Journal*, 2007, 50: 173-177.
- H. Papadopoulos, V. Vovk and A. Gammerman. Conformal Prediction with Neural Networks. In Proceedings of the 19th IEEE International Conference on Tools with Artificial Intelligence (ICTAI'07), Volume 2, 388 - 395. IEEE Computer Society, 2007.
- Improving the Aggregating Algorithm for Regression. *Artificial Intelligence and Applications*, In Proceedings of the 25th IASTED Conference Artificial Intelligence and Applications (AIA 2007), pp.347-352, Innsbruck, Austria, (2007), Editor: V.Devedzic (with S.Busutill and Y.Kalnishkan).
- Preanalytic Influence of Sample Handling on SELDI-TOF Serum Protein Profiles *Clinical Chemistry*, **53**, 645-656, April 2007, (with John F. Timms, Elif Arslan-Low, Aleksandra Gentry-Maharaj, Zhiyuan Luo, Davy T.Jampens, Vladimir N. Podust, Jeremy Ford, Eric T. Fung, Ian Jacobs, and Usha Menon).
- Application of Kolmogorov complexity and universal codes to identity testing and nonparametric testing of serial independence for time series. *Theoretical Computer Science*, v.359, No.1-3, August 2006; also in e-print archive, 2005, <http://arxiv.org/abs/cs/0505079> (with B.Ryabko and J.Astola).
- Transductive Learning. *Joint 3rd International Conference on Soft Computing and Intelligent Systems and 7th International Symposium on Advanced Intelligent Systems*, CD, Tokyo, Japan, 2006.

- Reliable classification of childhood acute leukaemia from gene expression data using Confidence Machines. *IEEE International Conference on Granular Computing*, Atlanta, USA, 2006 (with Z.Luo and A.Bellotti).
- Qualified Predictions for Microarray and Proteomics Pattern Diagnostics with Confidence Machines, *International Journal of Neural Systems* vol.15, No.4, pp.247-258, 2005 (with A.Bellotti, Z.Luo, F.van Delft and V.Saha).
- Perspective gene expression analysis accurately subtypes acute Leukaemia in children and establishes a commonality between hyperdiploidy and t(12;21) in acute lymphoblastic leukaemia, *British Journal of Haematology*, Issue 1, pp. 26-35, July 2005 (with F. van Delft, T. Bellotti, Z. Luo, L. Jones, N. Patel, O.Yiannikouris, A. Hill, M. Hubank, H. Kempfski, D. Fletcher, T.Chaplin, N. Foot, B. Young, I. Hann, and V. Saha).
- Qualified Probabilistic Predictions using Graphical Models, In L. Godo (eds) *ECSQARU 2005, Lecture Notes in Artificial Intelligence 3571*, pp. 111-122, Springer-Verlag Berlin Heidelberg, August 2005 (with Z.Luo).
- Plant Promoter Prediction with Confidence Estimation. *Nucleic Acids Research*, 33(3), pp. 1069-1076, 2005 (with I Shahmuradov and V.V. Solovyev).
- Qualified Predictions for Proteomics Pattern Diagnostics with Confidence Machines. In: *Intelligent Data Engineering and Automated Learning - IDEAL 2004 Lecture Notes in Computer Science 3177*, pp 46-51, Springer, 2004
- On-line Predictions with Kernels and the Complexity Approximation *Proceedings of the Twentieth Conference on Uncertainty in Artificial Intelligence (UAI - 04)*, 2004, pp. 170-176, AUAJ Press (with Yuri Kalnishkan, and Vladimir Vovk)
- Testing exchangeability on-line. *Proceedings of the 20th International Conference on Machine Learning* (ed. by T Fawcett and N. Mishra), 2003, pp. 768-775, Menlo Park, CA, A AAJ Press (with I.Nouretdinov and V.Vovk)
- PlantProm: a database of plant promoter sequences. *Nuclear. Acids. Res.* 31, 2003, pp.114-117 (with Shahmuradov I.A., Hancock J.M., Bramley P.M. and Solovyev V.V.).
- Sequence alignment kernel for recognition of promoter regions. *Bioinformatics*, 19, 2003, 1964-1971 (with Gordon L., Chervonenkis A.Ya., Shahmuradov I.A. and Solovyev V.V.).
- Plastid DNA splinters in nuclear genomes of rice and Arabidopsis. In: *European Journal of Biochemistry*, 269, Supplement 1, p. 51 (with Shahmuradov I.A., Akbarova Y. Yu. and Solovyev V.V)

- Genome-wide prokaryotic recognition based on sequence alignment kernel. In: *Advances in Intelligent Data Analysis*, (ed. by Berthold, Lenz, Bradley, Kruse and Borgelt), 2003, pp.386-396, Springer Verlag (with L. Gordon, Chervonenkis A.Ya. and Shahmuradov I.A.)
- Prediction algorithms and confidence measures based on algorithmic randomness theory, *Theoretical Computer Science*, 287 (2002) 209-217 (with V.Vovk).
- Qualified Predictions for Large Data Sets in the Case of Pattern Recognition. In: *Proceedings of the International Conference on Machine Learning and Applications (ICMLA'02)*, 2002, pp.159-163, CSREA Press (with Harris Papadopoulos, Kostas Proedrou and Volodya Vovk).
- Transductive Confidence Machines for Pattern Recognition, *European Conference on Machine Learning, Lecture Notes in Artificial Intelligence*, pp. 381-390, 2002 (with Kostas Proedrou, Ilia Nouretdinov and Volodya Vovk).
- Inductive Confidence Machines for Regression, *European Conference on Machine Learning, Lecture Notes in Artificial Intelligence*, pp.345-356, 2002 (with Harris Papadopoulos, Kostas Proedrou and Volodya Vovk).
- A combined Bayes-maximum likelihood method for regression. *Data Fusion and Perception*, Riccia, Lenz, Kruse eds, Springer-Verlag Wein New York, 2001 (with A. Chervonenkis and M. Herbster).
- Pattern Recognition and density estimation under the general i.i.d. assumption, *Proceedings of Computational Learning Theory (COLT)*, Amsterdam, 2001 (with I. Nouretdinov, M. V'yugin and V. Vovk)
- Support Vector Machine Learning Algorithm and Transduction. In: *Computational Statistics*, v.15, pp.31-39, 2000.
- N. Gilardi, A. Gammerman, M. Kanevski, M. Maignan, T. Melluish, C. Saunders, and V. Vovk. Application des methodes d'apprentissage pour l'etude des risques de pollution dans le lac leman. Colloque CLUSE sur les Risques Majeurs, 2000. (In French).
- Application of Support Vector Machines to Fault Diagnosis, In: *Proceedings of the Eleventh International Workshop on the Principles of Design (DX'00)*, 2000 (with C. Saunders, H. Brown, and G. Donald).
- Computationally Efficient Transductive Machines, In: *Proceedings of the Eleventh International Conference on Algorithmic Information Theory (ALT 2000)*, *Lecture Notes in Computer Science*, Springer-Verlag, pp.325-333, 2000 (with C. Saunders and V. Vovk).

- Preoperative Differentiation of Ovarian Tumours using Support Vector Machine and Risk Malignancy Index, In: *Proceedings of the International Federation of Obstetrics and Gynaecology (FIGO) Conference*, Washington, 2000 (with P. van Trappen, M. Stitson, R. Wools, S. Barnhill, V. Vapnik and I. Jacobs).
- Statistical applications of algorithmic randomness. *International Statistics Institute*, 52nd Session, Helsinki, 1999 (with V.Vovk).
- Machine Learning Applications of Algorithmic Randomness. *Machine Learning, Proceedings of the Sixteen International Conference (ICML'99)*, 1999 (with V.Vovk and C.Saunders).
- Transduction with Confidence and Credibility. *Proceedings of the International Joint Conference on Artificial Intelligence*, Stockholm, Sweden, 1999 (with V.Vovk and C.Saunders). (Postscript)
- Support Vector Regression with ANOVA Decomposition Kernels, In Scholkopf B., Burges C.J.C., and Smola A.J., editors, *Advances in Kernel Methods, Support Vector Learning*, pages 285-291. The MIT Press, Cambridge, Mass and London, England, 1999 (with M.Stitson, V. Vapnik, V. Vovk, C.Watkins and J. Weston).
- Support Vector Density Estimation. In Scholkopf B., Burges C.J.C., and Smola A.J., editors, *Advances in Kernel Methods, Support Vector Learning*, pages 293-305. The MIT Press, Cambridge, Mass and London, England, 1999 (with J.Weston, M.Stitson, V.Vapnik, V.Vovk and C.Watkins).
- Kolmogorov Complexity: Sources, Theory and Applications. The Special Issue of *The Computer Journal*, v.42, No.4, 1999 (with V.Vovk).
- Predictive Complexity Principle. The Special Issue of *The Computer Journal*, v.42, No.4, 1999 (with V.Vovk).
- Learning Algorithms in High Dimensional Space. *Causal Models and Intelligent Data Management*, Springer, 1999 (with V.Vovk).
- A combined Bayesian - ML approach to model selection. *Proceedings of IJCAI99 Workshop on Support Vector Machine*, Stockholm, Sweden, 1999 (with A.Chervonenkis and M.Herbster).
- Learning by Transduction. In Cooper G.F. and Moral S., editors, *Uncertainty in Artificial Intelligence*, Procs of the Fourteenth Conference (1998), Madison, Wisconsin, July 1998, pages 148-155. Morgan Kaufmann, San Francisco, CA, 1998. (with V.Vovk and V.Vapnik) Francisco, CA, 1998. (with V.Vovk and V.Vapnik)
- Multivariate analysis and Bayesian belief networks for Intelligent Decision Support Systems. In: *Proceedings of the EURO XVI: 16th European Conference on Operational Research*, Belgium, 1998.

- Learning by Support Vector Machine, Ridge Regression and Transduction. In: *NTTS98: International Conference on New Techniques and Technologies for Statistics*; pp.175-181, Sorrento, Italy, 1998.
- Ridge Regression Learning Algorithm in Dual Variables, *Proceedings of the Ilia Nouretdinov, Brian Burford Alexey Chervonenkis, Vladimir Vovk and Zhiyuan Luo 15th International Conference on Machine Learning*, 1998 (with C. Saunders and V.Vovk).
- Statistical modelling in specific case analysis. *Science and Justice*, 36(4):245-255, 1996. (with C.G.G.Aitken, T.Connolly, G.Zhang, D.B.Bailey, R.Gordon and R.Oldfield)
- Bayesian belief networks with an application in specific case analysis. In A. Gammerman, editor, *Computational Learning and Probabilistic Reasoning*, pages 169-184. John Wiley & Sons, Chichester, 1996. (with C.G.G.Aitken, G.Zhang, T.Connolly, D.B.Bailey, R.Gordon and R.Oldfield)
- Emily - a minimal length encoding system. In Procs of IFCS-96, Kobe, Japan, 1996. (with A.Bellotti)
- Exact and approximate algorithms and their implementations in mixed graphical models. In A. Gammerman, editor, *Probabilistic Reasoning and Bayesian Belief Networks*, pages 33-53. Alfred Waller, Henley-on-Thames, 1995 (with Z.Luo, C.G.G.Aitken and M.Brewer).
- Induction experiments with a minimal length encoding system. In UNICOM Seminar on Applied Decision Technologies, pages 209-222, London, 1995 (with A.Bellotti).
- Using multiple chains for Gibbs sampling in mixed graphical association models. *Computational Statistics - COMPSTAT*, pages 185-189, Physica-Verlag, Heidelberg, Germany, 1994 (with M.Brewer and Z.Luo).
- Computational models of probabilistic reasoning. In D.J. Hand, editor, *AI and Computer Power, The impact of statistics*, pages 149-168. Chapman and Ilia Nouretdinov, Brian Burford Alexey Chervonenkis, Vladimir Vovk and Zhiyuan Luo Hall, 1994.
- Geometric analogy problem by minimal-length encoding. In: *International Federation of Classification Societies Conference - IFCS*, pages 201-203, Paris, 1993.
- A connectionist expert system and its application to a large set of medical data. In: *Medical Informatics Europe MIE-93*, Jerusalem, February 1993 (with H.Styri).

- Stochastic simulation in mixed graphical association models. In K. Dodge and F. Whittaker, editors, *Computational Statistics*, volume 1, pages 257-262, 1992 (with C.G.G.Aitken, M.J.Brewer and Z.Luo).
- Machine learning algorithms. *IMA Journal of Mathematics Applied in Business and Industry*, 3(3), 1992 (with R.H.Davis and D.B.Edelman).
- The representation and manipulation of the algorithmic probability measure for problem solving. *Annals of Mathematics and Artificial Intelligence*, 4:281-300, 1991.
- Bayesian diagnostic probabilities without assuming independence of symptoms. *Methods of Information in Medicine*, 30(1):44-52, 1991 (with A.R.Thatcher).
- PRESS - a probabilistic reasoning expert system shell. Number 548 in *Lecture Notes in Computer Science*, pages 232-237. Springer-Verlag, 1991 (with Z.Luo). Ilia Nouretdinov, Brian Burford Alexey Chervonenkis, Vladimir Vovk and Zhiyuan Luo
- STOSS - a stochastic simulation system for bayesian belief networks. Number 521. In: *Lecture Notes in Computer Science*, pages 97-105. Springer-Verlag, 1991.
- Constructing causal trees for a predictive expert system. In 3rd Conference of the International Federation of Classification Societies, Heriot-Watt University UK, 1991.
- A stochastic simulation system and its application to causal models. In 3rd International Conference on IPMU in Knowledge-Based Systems, pages 186-189, The Institution of Electrical Engineers, Paris, 1990 (with Z.Luo).
- Computer-aided diagnoses using Bayesian inference. In Proceedings of European Conference Simulation in Biology and Medicine, pages 128-132. Erlangen-Nuremberg, June 1990 (with Y.Gu).
- An intelligent tutoring system for medical students. *Theoretical Surgery*, 5(3), 1990 (with D.Wang).
- A computer-aided medical system and its application to the diagnosis of abdominal pain. *Theoretical Surgery*, 5(3), 1990 (with Y.Gu).
- A causal probabilistic reasoning system. In *4th International Symposium on Knowledge Engineering*, pages 23-41, Barcelona, May 1990.
- Bayesian inference in an expert system without assuming independence. In M. Golumbic, editor, *Advances in Artificial Intelligence, Natural Languages and Knowledge Based Systems*, pages 182-218. Springer-Verlag, 1990 (with A.R.Thatcher).

- Probabilistic reasoning in evidential assessment. *Journal of the Forensic Science Society*, 29(5):1-13, 1989 (with C.Aitken).
- TBKS: a tool that captures expertise. In Procs of the 3rd International Conference on Knowledge Engineering, pages 35-46, 1988 (with X.Liu).
- A hybrid approach to deductive uncertain inference. *International Journal Man-Machine Study*, 28:671-681, 1988 (with X.Liu).
- An application of expert systems technology to identification task. *Taxon*, 36(4):705-714, 1987 (with W.Atkinson).
- PROTEST: A prototyping tool for knowledge engineering. In Procs of 7th International Medical Informatics Congress MIE-87, pages 45-49, 1987.
- On the validity and applicability of the INFERNO system. In: *Research and Development in Expert Systems III*, pages 47-56. Cambridge University Press, 1987 (with X.Liu).
- Modelling of uncertainty in expert systems. In Procs of the 2nd International Conference on Expert Systems, London, pages 132-141, 1986.
- Expert key: an expert system for identification. In *Computers in Teaching*, Vol. 5. Oxford University, 1986 (with W.Atkinson).
- An expert system for biological identification. In: *SPIE, Applications of Artificial Intelligence IV*, volume 657, pages 34-38, Washington, 1986 (with B.Skullerand and W.Atkinson).
- Sysex: An expert system for biological identification. In John F. Gilmore, editor, *Procs Applications of Artificial Intelligence IV*, Innsbruck, Austria, April 1986 (with B.Skullerand and W.Atkinson). RHUL navigation button Computer Science Department

Patents

Data classification apparatus and method thereof (with V. Vovk).

- European Patent Application No. 99 954 200.4: the application was allowed in July 2004.
- US Patent Application No. 09/831,262: allowed; (with V.Vovk).
- *Data labelling apparatus and method thereof*. UK Patent Application GB 0017740.2: pending.

Selected Technical Reports

- Theory of SV machines (joint work with M. O. Stitson, J. Weston, V. Vovk and V. Vapnik). Technical Report CSD-TR-96-17, Department of Computer Science, Royal Holloway, University of London, December 1996.
- Support Vector ANOVA decomposition (joint work with M. O. Stitson, A. Gammerman, V. Vapnik, C. Watkins and J. Weston). Technical Report CSD-TR-97-22, Department of Computer Science, Royal Holloway, University of London, November 1997.
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Selected Grants

- Engineering and Physical Sciences Research Council, grant GR/L35812, PI. “Support Vector and Bayesian Learning Algorithms: Analysis and Applications” (with V. Vovk and V. Vapnik), 1997–2000.
- Engineering and Physical Sciences Research Council, grant GR/M16856, PI. “Comparison of the Support Vector Machine and Minimum Message Length methods for induction and prediction” (with V. Vovk and C. Wallace), 1999–2002.
- Engineering and Physical Sciences Research Council, grant GR/R46670/01, PI. “Complexity Approximation Principle and Predictive Complexity: Analysis and Applications” (with Prof. V. Vovk), 2001–2004.
- Biotechnology and Biological Sciences Research Council, grant 111/BIO14428, PI. “Pattern Recognition Techniques for Gene and Promoter Identification and Classification in Plant Genomic Sequences” (with J. Hancock and V. Solovyev), 2002– 2005.
- European Union, grant IST-1999-10226. “EurEdit: The Development and Evaluation of New Methods for Editing and Imputation” (with European partners outside the UK).

- Royal Society grant, PI. “Efficient randomness testing of random and pseudorandom number generators” (with B. Ryabko), 2003–2005.
- Medical Research Council, grant G0301107 (S505/65). “Proteomic Analysis of the Human Serum Proteome” (with I. Jacobs, M. Waterfield, R. Cramer, V. Vovk, S. Gayther, Z. Luo, U. Menon, J. Timms). 2005–2008.
- QinetiQ grant: “Automated Target Identification”. 2006–2007.
- Research Promotion Foundation of Cyprus. “ASPIDA project: Development of New Conformal Prediction Methods with Applications in Medical Diagnosis”. (with H. Papadopoulos and V. Vovk). 2007–2010.
- Engineering and Physical Sciences Research Council “Practical competitive prediction” (with V. Vovk and Y. Kalnishkan) 2007-2010.
- Department for Environment, Food and Rural Affairs (Defra), Veterinary Laboratories Agency, “Application of Pattern Recognition techniques to Bioinformatics.” 2007–2010.
- European Union EU FP7 programme: “Post-translational modification, O-PTM”, HEALTH-2007-2.4.1-2: Translating clinical ‘omics’-technology (genomics, proteomics, metabolomics) into innovative cancer biomarkers aiding in early diagnosis, prognosis and treatment selection of cancer patients. (with Dr Joy Burchell, Prof Joyce Taylor-Papadimitriou, KCL and 5 other institutions), 2008-2011.
- Application of conformal predictors to functional magnetic resonance imaging research; MRC, 2009–2010.
- Machine learning algorithms for analysis of large veterinary datasets. VLA; 2010–2013.
- Living with uninvited guests: comparing plant and animal responses to endocytic invasions (ERASysBio). EU project (coordinator Judith Klein-Seetharaman), VLA and SGUL; 2010–2013.

Teaching

At the Department of Computer Science of Royal Holloway, University of London, I taught the following courses:

- CS120 (Autumn 1993, Autumn 1994): C++ programming course.
- CS356 (Autumn 1995 and 1996): developed a new course on Intelligent Decision Systems (postgraduate course, Spring 1997 and Spring 1998): developed and taught this course.

- Business Information Systems MSc course (Spring 1999): developed and taught (jointly with V. Vovk) a course on Intelligent Decision Systems.
- CS392 (Spring 1998, Spring 1999, Autumn 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009) a course developed jointly with V. Vovk and V. Vapnik on modern machine learning techniques (SVM, transduction, algorithmic randomness).
- CS393 (Spring 2001, 2002, 2003, 2004, 2005): a course (jointly with V. Vovk) on Computational Finance; includes mathematical and computational models of financial markets and numerical methods for valuation of derivative securities.
- Supervising final year projects in machine learning.

Administration

Over 10 years (1995–2005) of my service as Head of the Computer Science Department the following administrative tasks were accomplished:

- Teaching
 - Master Course in Business Information Systems -**BIS** (with School of Management);
 - Master course **MSc** in Computer Science by Research;
- Research:
 - **RAE 1996** and **RAE 2001** (the department moved from grade 4 to grade 5);
 - **Bioinformatics** research group was established;
 - **CLRC**: in 1998 in recognition of our research in machine learning, the College established the **Computer Learning Research Centre** (CLRC) for fundamental and applied research in machine learning and I was appointed as the Director of the Centre. By virtue of the strong team of researchers in machine learning, employed by the College, and the distinguished visiting fellows associated with the Centre, CLRC has become a world leader in developing machine learning algorithms that are used in many applications. Among **key achievements** of the Centre are:
 - * Game-Theoretic foundations of probability theory by V.Vovk and G.Shafer;
 - * Computable Approximations of Algorithmic Randomness Theory and Conformal Predictors by A.Gammerman and V.Vovk;
 - * String Kernels by C.Watkins;
 - * Theory of Predictive Complexity by V.Vovk;

- * Some Properties of Infinite VC-dimension Systems by A.Chervonenkis;
 - * Statistical Learning Theory by V.Vapnik;
 - * Combined Bayesian-maximum Likelihood Method for Regression by A.Chervonenkis;
 - * Complexity Approximation Principle by V.Vovk, A.Gammerman;
 - * Machine Learning by Induction by R.Solomonoff;
 - * Forbidden Information by L.Levin
 - * Basic of coding with random variables by J.Rissanen.
- In addition to this theoretical development, many applications in environmental science, geostatistics, biomedical science.

For details, see <http://clrc.rhul.ac.uk>

- **Kolmogorov Lecture and Medal** I serve in the nomination and Programme Committee of the annual *Kolmogorov Lecture* run by CLRC. This is the University of London lecture and is given annually since 2003 by distinguished researchers in the field of theoretical computer science, or related mathematical sciences, who made outstanding contributions to developing research directions initiated by Andrei N. Kolmogorov. This is a public lecture on their work delivered at the Royal Holloway, University of London. More details can be found at:
[http : //www.kolmogorov.clrc.rhul.ac.uk/index.html](http://www.kolmogorov.clrc.rhul.ac.uk/index.html)