Curriculum Vitae

ARUN SHARMA

Date of Birth: 25 July 1962

Education

- PhD in Computer Science, State University of New York at Buffalo, 1990
- MSc (Tech) in Computer Science, Birla Institute of Technology and Science, Pilani, 1985
- All-India Senior School Certificate Examination, Sawan Public School, New Delhi, 1980
  Tenth position in the national order of merit (Science Group)
- All-India Secondary School Examination, Sainik School Goalpara, Assam, India, 1978
  Fifth position in the national order of merit

Professional Training

- Korn Ferry, Executive to Leader Institute (ELI) Program, 2018
- Harvard Business School
  - Authentic Leadership Program, 2014
  - Finance for Senior Executives, 2005
- Australian Institute of Company Directors, Graduate, 2008
- Carnegie Mellon University, Software Engineering Institute
  Certified Instructor for Personal Software Process, 1997

Professional History

- Adani Group
  - Advisor to the Chairman, August 2019 –
  - Member of the Board, Adani Abbot Point Terminal Pty Ltd, June 2011 –
- QIMR Berghofer Medical Research Institute
  - Chair of the Council, July 2019 –
- Queensland University of Technology
  - Distinguished Professor Emeritus, August 2019 –
  - Distinguished Professor, April 2019 – July 2019
  - Deputy Vice-Chancellor and Vice President (Research and Innovation), Jan 2019 – July 2019
  - Deputy Vice-Chancellor (Research and Commercialisation), June 2004 – Dec 2018
- National ICT Australia Limited
  - Vice President and Director, Sydney Research Lab, May 2003 – May 2004
  - Node Director Designate, Sydney Node, July 2002 - May 2003
- University of New South Wales, School of Computer Science and Engineering
  - Professor, May 2001 – May 2004
  - Head of School, January 1999 - June 2002
  - Associate Professor, January 1998 - May 2001
  - Senior Lecturer, July 1994 - December 1997
  - Lecturer (with tenure), October 1992 - June 1994
  - Visiting Fellow, October 1991- October 1992
- Massachusetts Institute of Technology, Department of Brain and Cognitive Sciences
  - Post-Doctoral Research Associate, September 1990 - February 1991

- The University of Delaware, Department of Computer and Information Sciences
  - Research Assistant, September 1989 - August 1990
- State University of New York at Buffalo, Department of Computer Science
  - Research Assistant, September 1988 - August 1989
  - Teaching Assistant, September 1985 - August 1988
- Madras Computer Laboratories, Chennai
  - Computer Engineer, January 1985 - June 1985

Awards and Citations

- Member of the Order of Australia in 2019 Queen's Birthday Honours for services to Computer Science and Information Technology
- Distinguished Alumnus Award from BITS Pilani, 2019
- Lifetime Achievement Award at the 2018 Australia India Business and Community Awards
- Knowledge Nation 100 List, 2015, published by the Australian and Office of the Chief Scientist
- Premier of Queensland Special Award at the 2010 Queensland Export Awards
- Certificate of Commendation for obtaining 7th position at the 1980 Inter-School Mathematics Talent Examination conducted by the Ramanujan Society of Born Mathematicians, New Delhi
- Certificate of Merit for obtaining 10th position in Science group in the All-India Senior School Certificate Examination, 1980, Central Board of Secondary Education
- Certificate of Merit for obtaining 5th position at the All-India Secondary School Examination, 1978, Central Board of Secondary Education

Professional Experience

QUT, Deputy Vice-Chancellor and Vice President (Research and Innovation), June 2004 – July 2019

Developed and executed the strategy to deliver one of the fastest growth in the research trajectory of any Australian university. The plan differentiated QUT from its significantly older competitors by taking advantage of QUT's real-world linkages, by building deep disciplinary depth in selected areas such as robotics, mathematics, big data, material science, additive manufacturing, and by promoting an interdisciplinary approach to solving problems for sectors such as agriculture, resources, health, environment and infrastructure. Some key highlights include:

- A nearly four-fold increase in annual research income from $27 million to $100 million – highest amongst universities without a medical school
- Two and half times increase in the number of Higher Degree Research students graduating annually; QUT placed 8th in the country for research student completions
- The growth in research revenue was accompanied by improvement in quality; in the Australian Research Council (ARC) Excellence for Research Australia (ERA) 2018 exercise, 80% of QUT's research was rated 4 (at **above world standard)** or 5 (at **well above world standard)** – a measure on which QUT was 8th in the country. This performance had steadily increased over the previous decade: 27% in ERA 2010; 44% in ERA 2012; 61% in ERA 2015.
- QUT's research was also assessed to have significant engagement and impact; in the 2018 Engagement and Impact Exercise conducted by the Australian Research Council, 60% of QUT's submission was rated **High** in Engagement, and 59% rated **High** in Impact – QUT was ranked 6th in the country on both these indicators
- Improved QUT's research block grant performance from 18th in the sector to 9th, ahead of several universities with long-established medical schools

- QUT was either a leader or a significant partner in a dozen Cooperative Research Centres and several Australian Research Council (ARC) Centres of Excellence (CoE) and Training Centres; it hosted three ARC CoEs – Digital Child, Robotic Vision and Creative Industries and Innovation, the latter being the country's first ARC CoE in the humanities
- Led QUT's SAGE Athena Swan initiative, and in 2018 led the submission for the successful Bronze Award
- QUT was a leader in indigenous research training and had averaged 6 per cent of the total national indigenous research student completions over three years to 2019. Provided governance oversight of the ARC Special Research Initiative National Indigenous Research and Knowledges Network (NIRAKN) administered by QUT
- Provided leadership of entrepreneurship initiatives in the university, including entrepreneurship education, accelerators, places and seed funding. To raise the quality of entrepreneurship training, working with the Queensland Government to attract the highly successful MIT Global Entrepreneurship Bootcamp to QUT for three consecutive years
- QUT's research performance saw the university rising rapidly in rankings; in 2019, it was in the top 250 universities in the major rankings – QS, Times Higher Education and the US News and World Report, and in the 200-300 range in the Academic Ranking of World Universities (ARWU) having debuted in the top 500 in 2015

UNSW, Head, School of Computer Science and Engineering (CSE), Jan 1992 – May 2002

As Head of School, transformed CSE into one of Australia's leading centres for Computer Science education and research. Some of the highlights were:

- Nearly doubled the size of the school from 945 EFTSL (Equivalent Full-Time Student Load) to 1864 EFTSL
- Increased Higher Degree Research student enrolment from 63 EFTSL to 105 EFTSL
- Increased postgraduate coursework enrolment from 178 EFTSL to 347 EFTSL; this was a direct result of having led the restructuring of coursework programs in 1997
- Developed a high school engagement strategy that resulted in CSE becoming the leader amongst New South Wales universities for attracting students in the top five per cent of the school leaving cohort in computing disciplines
- Led the development of Australia's first undergraduate interdisciplinary degree in Bioinformatics and resourced it with a joint appointment with Life Sciences. Helped establish the Centre for Interactive Cinema in collaboration with the College of Fine Arts (COFA) and funded a joint chair with COFA for Jeffrey Shaw who went on to win an Australian Research Council Federation Fellowship
- To encourage entrepreneurial activity among Computer Science students, worked with the then Australian Graduate School of Management (AGSM) to establish Connector – a business planning competition based on the then MIT 50K Entrepreneurship competition. Sourced sponsorship from Deutsche Bank to fund the initiative; the program was the beginning of an entrepreneurship culture at UNSW bringing together technology and business students
- Recruited 20 faculty (Level B and above) during a global shortage of computing academics
- Helped the school become a national research leader by successfully bidding for Cooperative Research Centre for Smart Internet Technology and National ICT Australia (NICTA)

National ICT Australia Limited, Vice President and Director, Sydney Research Laboratory

NICTA (now Data61 Division of CSIRO) was established as a networked graduate school in response to a perceived weakness in Australia's Information and Communication Technology research and research training.

- Successfully led the bid with Brian Anderson of the ANU for the award of $129.5 million from the Federal Government and $20 million from the NSW Government for an initial five year period
- Recruited 30 researchers over 18 months, several from the leading North American and European research institutions
- Contributed to all operational activities in the start-up phase, developed NICTA's intellectual property policy and its early national and international linkages
- Established its International Scientific Advisory Group consisting of research leaders from MIT, Stanford, Carnegie Mellon and UC Berkeley

Advisory and Policy Contributions

Promotion of Australia India Linkages

- In 2011, was encouraged by the Indian High Commissioner to take on the role of National Chair of the Australia India Business Council (AIBC) to institute governance reform of the organisation as previous attempts had not succeeded. Worked with all the relevant stakeholders to transform the organisation from an association of disparate state chapters into an incorporated national body with a new constitution
- Significantly grew the membership base of the Queensland Chapter of the AIBC as its President during 2005—10, and hosted high profile events that attracted federal and state ministers
- In 2009, was asked to join the Federal Government delegation to India in the aftermath of the student attacks. The Federal Government acknowledged contribution to repairing the relationship between the two countries
- As Chair of Queensland India Council (2011—14) under both the Labor and Liberal National Party governments, provided advice on India-related trade and investment matters
- QUT benefited significantly from these roles. It was the most successful university in attracting funding from the Australia India Strategic Research Fund (approximately $7.5 million). Also worked with both the Indian and Australian Governments to arrange a visit to QUT by the Indian Prime Minister Modi during G20 meeting in 2014

Contribution to National Research and Innovation Policy

- As Chair of Universities Australia Deputy Vice Chancellors - Research (UA DVCR) committee in 2008, led the group's engagement with the Cutler and O'Kane Reviews and coordinated a unified position amongst all universities that led to the change of the Institutional Grant Scheme (IGS) to Joint Research Engagement (JRE) aimed at improving incentives for universities to engage with industry and end-users
- Again, as Chair of UA DVCR committee in 2014, coordinated the committee's engagement with the Watt Review that resulted in parity between competitive grants and end-user linkages in block grant allocation
- Appointed to the inaugural Advisory Council of the ARC in 2008; provided input into the development of the Excellence in Research Australia (ERA) exercise
- As a member of the Advisory Board of the Manufacturing Centre of the Federal Government's Enterprise Connect Program in 2008, provided input into the design of schemes such as Researcher in Business aimed at improving links between universities and SMEs
- Contributed extensively to the national debate on research impact with significant contribution to the original Australian Technology Network (ATN) Impact Trial in the lead up to the proposed Research Quality Framework (RQF). This work was picked up by the Higher Education Funding Council of England (HEFCE) and influenced elements of the impact component of the UK's

Research Excellence Framework (REF). As part of the ATN, engaged extensively with the HEFCE during their development of the impact assessment framework and also helped shape the joint ATN/Go8 impact trial

- For advocacy of research impact and improved incentives for university business linkages, included in the 2015 Knowledge Nation 100 list published by The Australian and the Office of the Chief Scientist – "one of the country's most effective advocates for the research/wealth-creation nexus".

Contribution to Queensland Innovation Policy

- Champion of Team Queensland that participated in the MIT Regional Entrepreneurship Acceleration Program (REAP). This two-year program was a rigorous data-driven initiative of the Queensland Government, Rio Tinto, representatives of the local entrepreneurial and venture capital communities, the University of Queensland and QUT to identify policy settings to make Queensland a global innovation hub for sectors linked to its natural resources – agriculture, mining, environment and tourism. The team continues to grow the entrepreneurial ecosystem and to influence regional economic development policy
- As a member of the Expert Advisory Panel, provided advice on the design of innovation initiatives for the $650 million Advance Queensland program
- Served on the Queensland Premier's Smart State Council (2005—11), and in 2010, was appointed on the Premier's Business Roundtable
- Assisted the Queensland Government in promoting the state's science capabilities in the global marketplace and helped facilitate a significant networking lunch for the Premier or a Senior Minister at the annual BIO Conventions in the US for 15 years
- Assisted the State Government in attracting international companies to base their innovation presence in Queensland.

Contribution to international innovation initiatives and rankings

- Recognising that lists of highly cited researchers disadvantaged those working across disciplinary boundaries and whose publications spanned multiple disciplines, began advocating for a cross-disciplinary highly cited list with Clarivate Analytics – data supplier for the Academic Ranking of World Universities. Advocacy included providing possible methodologies and addressing the Clarivate executive team at their strategic conference in Tokyo. When they released their cross-disciplinary list in 2019, two QUT researchers, who had not previously appeared in any of the discipline-based tables, were included
- As Chair of the ATN DVCR committee, worked with the then ATN Executive Director Vicki Thomson and other DVCRs to influence both QS and the Times Higher Education to publish "Young Universities under 50" lists
- Worked with Phil Baty of the Times Higher Education to advocate for measures of a university's contribution to the broader innovation ecosystem, and was an invited speaker at their 2017 Innovation and Impact Summit in Hong Kong
- As a member of the World Economic Forum Global Future Council on Innovation Ecosystems, contributed as a lead author for the report, "Accelerating the Emergence and Development of Innovation Ecosystems through Procurement: A Toolkit."
- At QUT, championed the Lens – a joint initiative with Richard Jefferson's social enterprise Cambia looking at opening up the global patent database. This initiative attracted significant funding from the Bill and Melinda Gates Foundation and the Wellcome Trust. In 2017, the Lens – in partnership with Nature – published a ranking of universities based on the citations of academic publications in granted patents

The Appendix to this document provides a list of publications, funding, board and advisory roles.

Appendix: Curriculum Vitae of Arun Sharma

Selected Advisory Roles

- Member, World Economic Forum Global Future Council on Innovation Ecosystems, 2018—19
- Member, Advance Queensland Expert Advisory Panel, since 1/10/2015
- Member, Australian Research Council Engagement and Impact – Performance and Impact Working Group, 2016 – 17
- Chair, Universities Australia, Deputy Vice-Chancellors (Research) Committee, 2014-15 and 2008
- Chair, Queensland India Council (an advisory committee of QLD Government), 2011-14
- National Chair, Australia India Business Council, 2011-2012
- Member, Queensland Premier's Business Roundtable, 2010-12
- Member, Queensland Premier's Smart State Council, 2004-2011
- Member, DISSR Research Workforce Strategic Advisory Group, 2011
- Member, Independent Advisory Council, Australian Research Council, 2008 – 2009
- Member, Interim Advisory Board, Manufacturing Centre of the Enterprise Connect Program, 2008
- President, Australia India Business Council (Queensland Chapter), 2006-2011
- Member, Prime Minister's Science Engineering and Innovation Council Working Group on *Science and Technology Led Innovation in Services*, 2007
- Member, Australian Research Council Quality and Scrutiny Committee, 2006
- Member, ICT Sector Advisory Committee, CSIRO, 2004-2007
- Member, Governing Board of CRC for Diagnostics, 2004-2006
- Member, Governing Board of CRC for Construction Innovation, 2004-2007
- Member, Advisory Board, ARC Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS), 2003-2004

Directorships in ASIC registered entities

- Chair, QIMR Berghofer Medical Research Institute (ABN: 31411813344), 05/07/2019 –
- Translational Research Institute Pty Ltd (ACN: 137632565), 12/06/2009 – 31/08/2017
- Queensland Children's Medical Research Institute Ltd (ACN: 137731447), 20/01/2014 – 30/06/2016
- Adani Abbot Point Terminal Pty Ltd (ACN: 149298206), 01/06/2011 --
- Qutbluebox Pty Ltd (ACN: 118773096), 02/05/2006 – 13/08/2015
- Smart Services CRC Pty Limited (ACN: 124836700), 11/04/2007 – 2015
- CIEAM Pty Ltd (ACN: 106026500), 16/11/2004—02/09/2011
- QMI Solutions Ltd (ACN: 076854638), 21/12/2004 – 30/09/2013
- Gallipoli Research Foundation Ltd (ACN: 077750693), 31/03/2006 – 25/03/2009
- Icon.Net Pty Ltd (ACN: 100463821), 08/12/2004 – 20/02/2008; 20/02/2008 – 30/06/2009
- AHURI Queensland Research Centre Limited (ACN: 098552286), 31/01/2005 – 18/04/2005
- Creative Industries Precinct Pty Ltd (ACN: 099110924), 02/08/2004 – 27/02/2008
- Smart Internet Technology CRC Pty Limited (ACN: 096139427), Alternate Director, 17/05/2007 – 10/01/2012
- Diatech Pty Ltd (ACN: 069052197), 30/09/04 – 20/05/2008
- Farmacule Bioindustries Pty Ltd (ACN: 097607102), 02/05/2006 – 05/03/2008
- Sugar Research Limited (ACN: 009666899), Associate Director, 18/07/2005 – 01/04/2008

- Australasian CRC for Interaction Design Pty Ltd (ACN: 105399111), 25/8/2004—03/08/2007 and Alternate Director 22/08/2007—16/10/2008
- University of New South Wales International House Limited (ACN: 000476933), 24/09/2001 – 19/08/2004

Selected University Committees, QUT and UNSW

- Deputy Chair, QUT University Academic Board, 2010 – present
- Chair, QUT University Research and Innovation Committee, 2004 – present
- Sponsor and Chair, QUT SAGE Athena SWAN Self-Assessment Team, 2015 – present
- Chair, UNSW Faculty of Engineering Teaching Committee, 1998
- Member, UNSW Faculty of Engineering Marketing Committee, 1997-2002

Research Funding

- 2002: Co-leader of the successful ICT Centre of Excellence bid that was awarded $129.5 million from the Australian Federal Government for the formation of NICTA (named in the proposal as Sydney Node Director and leader of Symbolic *Machine Learning and Knowledge Acquisition* research program).
- 2000: UNSW leader of the bid committee for the Cooperative Research Centre for Smart Internet Technology that received a funding of $27 million from the Federal Government (developed the *Smart Personal Assistant* research program).
- ARC grants before NICTA and CRC funding affected eligibility:
    - 1998—2000, ARC Large Grant, $177,000
      Investigator: Arun Sharma
      Topic: Learnability of Expressive Logical Languages and Belief Revision
    - 1998—2000, ARC SPIRT Grant, $240,000
      Investigators: Claude Sammut, Arun Sharma, and David Stirling
      Topic: Machine Learning for Dynamically Changing and Noisy Domains
    - 1996—1998, ARC Large Grant, $150,000
      Investigator: Arun Sharma
      Topic: Complexity of Inductive Learning
    - 1995—1997, ARC Large Grant, $175,000
      Investigators: Arun Sharma, Claude Sammut, and John Shepherd
      Topic: Knowledge Discovery Using Inductive Logic Programming
    - 1995—1997, ARC Australian Postgraduate Award (Industry), $57,000
      Investigators: Arun Sharma, Claude Sammut, and Kim Horn
      Topic: Application of Machine Learning to Time-Series Prediction

Selected Invited Talks

- Times Higher Education Innovation and Impact Summit May 2017, Hong Kong
- Wharton-QS Stars Reimagine Education 2015, Philadelphia
- Australia-Japan Joint Business Conference, October 2010, Keynote Address
- Asia-Pacific Association for International Education Conference & Exhibition, April 2010, Keynote Address
- Innovation Leadership Summit, November 2007, Melbourne, Panel Member
- CEDA Higher Education Forum, June 2007, Melbourne
- 2005 Conference on Speculation and Innovation: Applying Practice Led Research in Creative Industries, Brisbane, April 2005

- The Sixth Asia Pacific Web Conference, Hangzhou, China, April 2004
- Computing: The Australasian Theory Symposium, Adelaide, February 2003
- International Workshop on Learning and Logic, Boston, June 2001
- Electronics and Information Technology Exposition, Ministry of Information Technology, New Delhi, February 2001
- International Workshop on Quantum Computing and Learning, Eskilstuna, Sweden, May 2000
- Ninth International Conference on Algorithmic Learning Theory, Otzenhausen, Germany, October 1998
- Kyushu Workshop on Learning Theory, Kyushu Institute at Technology, Iizuka, October 1992
- Additionally, invited to speak at several research-related conferences organised by organisations such as Informa and Criterion; a regular presenter at Board Room lunches and dinners, including Clarivate Analytics (formerly IP & Science business of Thomason Reuters), Newcrest Mining, Queensland Resources Council, Eagle Street Directors and various CEO Forums; and given invited talks at the Queensland Grammars School Association and Independent Schools Association conferences

Guest Editorships and Scientific Committee Leadership Roles

- Guest editor, *Theoretical Computer Science*, Volume 241, Numbers 1-2, June 2000. Special issue devoted to papers from the Seventh International Conference on Algorithmic Learning Theory.
- Guest editor, *Theoretical Computer Science*, Volume 288, Number 2, 2002.
  Special issue devoted to papers from the Tenth International Conference on Algorithmic Learning Theory (Co-editor: Osamu Watanabe).
- Chair of the steering committee of the International Federation for Information Professional (IFIP) Working Group 1.4 on Computational Learning Theory, 1999 - 2004
- Co-chair of the steering committee of ALT - International Conference on Algorithmic Learning Theory, 2000-2005
- Coordinator of the steering committee of ICT Outlook Forum, Sydney, September 2003
- Workshop Leader, ICT – Enabling Science, FEAST IV Conference, November 2003, Canberra
- Elected member of the steering committee of COLT - Annual Conference on Computational Learning Theory, 1998-2003
- Elected member of the steering committee of EuroCOLT - European Conference on Computational Learning Theory, 1999-2001.
- Conference Chair for the 2002 Annual Conference on Computational Learning Theory (COLT), June 2002, Sydney.
- Conference Co-Chair for the 6th Annual International Computing and Combinatorics Conference (COCOON'00), July 2000, Sydney
- Conference Chair for the Eleventh International Conference on Algorithmic Learning Theory (ALT'00), December 2000, Sydney
- Program Committee Chair for the Seventh International Conference on Algorithmic Learning Theory (ALT'96), October 2000, Sydney

Scientific Program Committee Memberships

- 2004 Seventh International Colloquium on Grammatical Inference (ICGI’04), Athens, Greece
- 2004 Fifteenth International Conference on Algorithmic Learning Theory (ALT'04), Padova

- 2003 Thirteenth International Conference on Inductive Logic Programming (ILP'03), Szeged, Hungary
- 2002 Sixth International Colloquium on Grammatical Inference (ICGI'02), Amsterdam
- 2001 Australasian Computer Science Conference (ACSC'01), Gold Coast
- 2000 Australasian Computer Science Conference (ACSC'00), Canberra
- 1999 Australasian Computer Science Conference (ACSC'99), Auckland
- 1999 The Third Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD-99), Beijing
- 1998 Fourth International Colloquium on Grammatical Inference (ICGI-98), Ames, Iowa
- 1998 The Second Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD-98), Melbourne
- 1998 Australasian Computer Science Conference (ACSC'98), Perth
- 1997 Australian Joint Conference on Artificial Intelligence (AI'97), Perth
- Eighth International Workshop on Algorithmic Learning Theory (ALT'97), Sendai
- Tenth Conference on Computational Learning Theory (COLT'97), Nashville
- 1997 Australasian Computer Science Conference (ACSC'97), Sydney
- 1997 Computing: The Australasian Theory Symposium (CATS'97), Sydney
- 1995 Sixth International Workshop on Algorithmic Learning Theory (ALT'95), Fukuoka

Contribution to Government Reports

- "*Science and Technology-Led Innovation in Services for Australian Industries*," a report prepared by a working group of the Prime Minister's Science, Engineering and Innovation Council, Garrett, G. (Chair), Cameron, M., Dubs, R., Harvey, J., Kennedy, N., Moon, S., Read, L., Sawyer, N., and Sharma, A. (2008)
- "*Smart State = Design State*," a report prepared by a working group of the Smart State Council, Rayner, M. (Chair), Agnew, C., Caswell, P., Gray, D., Johnson, L., Lotersztain, A., Sharma, A., and Vaughan, S. (2008)
- "*Sparse State – the Death of Distance*," a report prepared by a working group of the Smart State Council, Gray, D. (Chair), Sharma, A., Boydell, M., Rayner, M., Holloway, R., Walker, J., Pears, L., and Reichelt, R. (2007)
- "*Fusion: Activating a Research & Business Development Culture in the Smart State*," a report prepared by a working group of the Smart State Council, Wilson, J. (Chair), Hillyard, C., Sharma, A., Gilmore, R., and Rooke, A. (2007) "Smart Cities: rethinking the city centre," a report prepared by a working group of the Smart State Council, Rayner, M. (Chair), Andrews, P., Johnson, L., Gray, D., Greenfield, P., and Sharma, A. (2007)
- "*Smarter Services: Future Jobs and Growth for the Smart State*," a report prepared by a working group of the Smart State Council, Sharma, A, (Chair), Craig, A., Grant, J., Greenfield, P., Rayner, M., and Walker, J. (2006)

Research Publications

Book

1. Jain, S., Osherson, D., Royer, J., and Sharma, A. (1999), *Systems That Learn: An Introduction to Learning Theory*, second edition, The MIT Press, Cambridge, MA.

Books (edited)

1. Arimura, A., Jain, S., and Sharma, A. (Editors), (2000), *Algorithmic Learning Theory*, Lecture Notes in Artificial Intelligence, No. 1968, Springer-Verlag.
2. Du, D.-Z., Eades, P., Estivill-Castro, V., Lin, X., and Sharma, A. (Editors), (2000), *Computing and Combinatorics*, Lecture Notes in Computer Science, No. 1858, Springer-Verlag.
3. Arikawa, A. and Sharma, A. (Editors), (1996), *Algorithmic Learning Theory*, Lecture Notes in Artificial Intelligence, No. 1160, Springer-Verlag.

Book Chapters

1. Martin, E., Sharma, A., and Stephan, F. (2007) "Deduction, Induction and Beyond in Parametric Logic." In Friend, M., Goethe, N., and Harizanov, V., (eds.) *Induction, Algorithmic Learning Theory, and Philosophy*, Series Logic, Epistemology, and the Unity of Science, Vol. 9, pp. 55 – 110. Dordrecht, Springer.
2. Jain, S. and Sharma, A. (1995) "On Identification by Teams and Probabilistic Machines." In Klaus P. Jantke and Steffen Lange (eds.), *Algorithmic Learning for Knowledge-Based Systems*, Lecture Notes in Artificial Intelligence, Volume 961, pp. 109-146, Springer-Verlag, 1995.

Refereed journal articles

1. Martin, E., Sharma, A., and Stephan, F. (2007) "On the Data Consumption Benefits of Accepting Increased Uncertainty." In *Theoretical Computer Science*, Vol 382(3) pp. 170 – 182, Elsevier.
2. Martin E., Sharma A. and Stephan F. (2006) "Unifying Logic, Topology and Learning in Parametric Logic." In *Theoretical Computer Science,* Vol. 350(1), pp. 102 – 124, Elsevier.
3. Case, J., Jain, S., Martin, E., and Sharma, A. (2006) "Identifying Clusters from Positive Data." In *SIAM Journal on Computing*, Vol. 36(1), pp. 28 – 55.
4. Martin, E., Sharma, A., and Stephan, F. (2006) "On the Ordinal VC—Dimension and Some Notions of Complexity." In *Theoretical Computer Science*, Vol. 364(1), pp. 62—76, Elsevier.
5. Sharma, A., Stephan, F., and Ventsov, Y. (2004) "Generalised Notions of Mind Change Complexity." In *Information and Computation,* Vol. 189, pp. 235 – 262, Academic Press.
6. Case, J., Kinber, E., Sharma, A., and Stephan, A. (2004) "On the classification of computable languages." In *Information and Computation*, Vol. 192, pp. 15 – 40, Academic Press.
7. Martin, E., Sharma, A., and Stephan, F. (2003) "Learning power and language expressiveness." In *Theoretical Computer Science*. 298(2) pp. 365 – 383.
8. Ignjatovic, A. and Sharma, A. (2004) "Some applications of logic to feasibility in higher types." In *ACM Transactions on Computational Logic.* Vol. 5(2), pp. 332 – 350.
9. Jain, S. and Sharma, A. (2001) "On a Generalised Notion of Mistake Bounds." In *Information and Computation*, Vol. 166, pp. 156-166, Academic Press.
10. Case, J., Ott, M., Sharma, A., and Stephan, F. (2002) "Learning to Win Process-Control Games Watching Game-Masters." In *Information and Computation*, Vol. 174, pp. 1-19, Academic Press.
11. Jain, S. and Sharma, A. (2002) "Mind Change Complexity of Learning Logic Programs." In *Theoretical Computer Science*, Vol. 284, pp. 143-160, Elsevier (special issue of selected papers invited for review from EuroCOLT'99)
12. Case, J., Jain, S., Kaufmann, S., Sharma, A., and Stephan, F. (2001) "Predictive Learning Models for Concept Drift.'' In *Theoretical Computer Science*, Vol. 268, pp. 323-349, Elsevier. (Special issue of selected papers invited for review from the Ninth International Conference on Algorithmic Learning Theory)
13. Case, J., Jain, S., and Sharma, A. (2001) "Synthesizing Noise-Tolerant Language Learners." In *Theoretical Computer Science*, Vol. 261, No. 1, pp. 31 - 56, Elsevier. (Special issue of

selected papers invited for review from the Eighth International Conference on Algorithmic Learning Theory)

14. Case, J., Jain, S., Ott, M., Sharma, A., and Stephan, F. (2000) “Robust Learning Aided by Context.” In *Journal of Computer and System Sciences*, Vol. 60, No. 2, pp. 234 - 257, Academic Press. (Special issue of selected papers invited for review from the 1998 Annual Conference on Computational Learning Theory)
15. Jain, S. and Sharma, A. (2000) “Team Learning of Computable Languages.” In *Theory of Computing Systems*, Vol. 33, No. 1, pp. 35-58, Springer-Verlag.
16. Ambainis, A., Jain, S., and Sharma, A. (1999) “Ordinal Mind Change Complexity of Language Identification.” In *Theoretical Computer Science*, Vol. 220, No. 2, pp. 323-343, Elsevier.
17. Sharma, A. (1998) “A note on batch and incremental learnability.” In *Journal of Computer and System Sciences*, Vol. 56, pp. 272 - 276, Academic Press.
18. Jain, S. and Sharma, A. (1998) "Generalisation and Specialisation Strategies for Identifying Languages." In *Annals of Mathematics and Artificial Intelligence*, Vol. 23, pp. 1-23 Elsevier. (Special issue of selected papers invited for review from the Fifth International Workshop on Algorithmic Learning Theory, Reinhardsbrunn, Germany)
19. Jain, S. and Sharma A. (1997) “The Structure of Intrinsic Complexity of Learning.” In *Journal of Symbolic Logic*, Vol. 62, No. 4, pp. 1187 - 1201, Association for Symbolic Logic, Inc.
20. Baliga, G., Jain, S., and Sharma, A. (1997) “Learning from Multiple Sources of Inaccurate Data.” In *SIAM Journal of Computing*, Vol. 26, No. 4, 961 - 990.
21. Jain, S. and Sharma, A. (1997) "Characterising language identification in terms of computable numberings." In *Annals of Pure and Applied Logic*, Vol. 84, pp. 51 - 72, Elsevier. (Special issue of selected papers invited for review from the Fifth Asian Logic Conference, Singapore)
22. Jain, S. and Sharma, A. (1997) “Elementary Formal Systems, Intrinsic Complexity, and Procrastination.” In *Information and Computation*, Vol. 132, No. 1, pp. 65 - 84, Academic Press.
23. Jain, S. and Sharma, A. (1996) “Computational Limits on Team Identification of Languages.” In *Information and Computation*, Vol. 130, No. 1, pp. 19 - 60, Academic Press.
24. Case, J., Jain, S., and Sharma, A. (1996) “Machine Induction without Revolutionary Changes in Hypothesis Size.” In *Information and Computation*, Vol. 128, No. 2, pp. 73 - 86, Academic Press.
25. Case, J., Jain, S., and Sharma, A. (1996) “Anomalous Learning Helps Succinctness.” In *Theoretical Computer Science*, Vol. 164, Nos. 1--2, pp. 13--28, Elsevier.
26. Jain, S. and Sharma, A. (1996) “The Intrinsic Complexity of Language Identification.” In *Journal of Computer and System Science*, Vol. 52, No. 3, 393--402, Academic Press. (Special issue of selected papers invited for review from the Seventh Annual Conference on Computational Learning Theory, New Brunswick, USA.)
27. Jain, S., Sharma, A., and Velauthapillai, M. (1996) “Finite Identification of Functions by Teams with Success Ratio ½ and Above.” In *Information and Computation*, Vol. 121, No. 2, pp. 201 - 213, Academic Press.
28. Jain, S. and Sharma, A. (1995) “On Aggregating Teams of Learning Machines.” In *Theoretical Computer Science*, Vol. 137, pp. 85 - 108, Elsevier. (Special issue of selected papers invited for review from the Fourth International Workshop on Algorithmic Learning Theory, Tokyo, Japan.)
29. Jain, S. and Sharma, A. (1995) “Prudence in Vacillatory Identification of Languages.” In *Mathematical Systems Theory*, Vol. 28, No. 3, pp. 267 - 279, Springer-Verlag. (Journal renamed *Theory of Computing Systems*)
30. Case, J., Jain, S., and Sharma, A. (1995) “Complexity Issues for Vacillatory Function Identification.” In *Information and Computation*, Vol. 116, No. 2, pp. 174 - 192, Academic Press.

31. Case, J., Jain, S., and Sharma, A. (1994) “Vacillatory Learning of Nearly Minimal Size Grammars.” In *Journal of Computer and System Sciences*, Vol. 49, No. 2, pp. 189 - 207, Academic Press.
32. Jain, S. and Sharma, A. (1994) "Characterising Language Identification by Standardizing Operations." In *Journal of Computer and System Sciences*, Vol. 49, No. 1, pp. 96 - 107, Academic Press.
33. Jain, S. and Sharma, A. (1994) “Program Size Restrictions in Computational Learning.” In *Theoretical Computer Science*, Vol. 127, No. 2, 351 - 386, Elsevier.
34. Jain, S. and Sharma, A. (1993) “On the Nonexistence of Maximal Inference Degrees for Language Identification.” In *Information Processing Letters*, Vol. 47, No. 2, pp. 81 - 88, Elsevier.
35. Jain, S. and Sharma, A. (1993) “Learning with the Knowledge of an Upper Bound on Program Size.” In *Information and Computation*, Vol. 102, No. 1, pp. 118 - 166, Academic Press.
36. Case, J., Jain, S., Sharma, A. (1992) “On Learning Limiting Programs.” In *International Journal of Foundations of Computer Science*, Vol. 3, No. 1, pp. 93 - 115, World Scientific Publishers**.**
37. Jain, S., and Sharma, A. (1991) “Learning in the Presence of Partial Explanations.” In *Information and Computation*, Vol. 95, No. 2, pp. 162 - 191, Academic Press.

Articles in refereed published proceedings

38. Martin, E. and Sharma, A. (2005) “On a Syntactic Characterisation of Classification with a Mind Change Bound” in Auer, P. and Meir, R. (ed.) *Proceedings of the 18th Annual Conference on Learning Theory*, Lecture Notes in Artificial Intelligence 3559, pp. 413 – 428, Springer.
39. Sharma, A. (2004) “Web Searching and Sigma2 Queries” in Xu, J., Lin, X., Lu, H., and Zhang, Y., *Advanced Web Technologies and Applications, Proceedings of the 6th Asia-Pacific Web Conference*, Hangzhou, China, Lecture Notes in Computer Science 3007, pp. 20 – 23, Springer.
40. Martin E., Sharma, A., and Stephan, F. (2004) “On the Data Consumption Benefits of Accepting Increased Uncertainty” in Ben-David, S., Case, J., and Maruoka, A. (eds.) *Proceedings of the 15th International Conference on Algorithmic Learning Theory*, Padova, Italy, Lecture Notes in Computer Science, Vol. 3244, pp. 83 – 98, Springer.
41. Case, J., Jain, S., Martin, E., and Sharma, A. (2004) “Identifying Clusters from Positive Data” in Paliouras, G. and Sakakibara, Y. (eds.) Grammatical Inference: Algorithms and Applications, 7th International Colloquium, Athens, Greece, Lecture Notes in Computer Science 3264, pp. 103 – 114, Springer.
42. Martin, E., Sharma, A. and Stephan, F. (2003) “On Ordinal VC-Dimension and Some Notions of Complexity” in Gavalda, R. Jantke, K. and Takimoto, E. (ed.) *Proceedings of the 14th International Conference on Algorithmic Learning Theory,* Lecture Notes in Artificial Intelligence 2842, Springer-Verlag.
43. Martin, E., Sharma, A., and Stephan, F. (2002) “Learning, Logic and Topology in a Common Framework” in Cesa-Bianchi, N., Numao, M. and Reischuk, R. (ed.) *Proceedings of the 13th International Conference on Algorithmic Learning Theory,* Lecture Notes in Artificial Intelligence 2533, Springer-Verlag.
44. Martin, E., Nguyen, P. Sharma, A. Stephan, F. (2002) “Learning in Logic with RichProlog” in Stuckey, P. (ed.) *Proceedings of the 18th International Conference on Logic Programming,* Lecture Notes in Computer Science 2401, Springer-Verlag.

45. Martin, E., Sharma, A. and Stephan, F. (2001) "A General Theory of Deduction, Induction, and Learning" in Jantke, K. and Shinohara, A. (ed.) *Proceedings of the 4th International Conference on Discovery Science,* Lecture Notes in Artificial Intelligence 2226, Springer-Verlag.
46. Mitchell, A., Scheffer, T., Sharma, A., and Stephan, F. (1999) "The VC-Dimension of Subclasses of Pattern Languages" in O. Watanabe and T. Yokomori (editors), *Proceedings of the Tenth International Conference on Algorithmic Learning Theory* (ALT'99), Tokyo, Lecture Notes in Artificial Intelligence, Vol. 1720, pp. 93 - 105, Springer-Verlag, December 1999.
47. Martin, E. and Sharma, A. (1999) "On Sufficient Conditions for Learnability of Logic Programs from Positive Data" in Saso Dzeroski and Peter Flach (editors), *Proceedings of the Ninth International Conference on Inductive Logic Programming* (ILP'99), Bled, Slovenia, Lecture Notes in Artificial Intelligence, Vol.1634, pp. 198 - 209, Springer-Verlag, June 1999.
48. Jain, S. and Sharma, A. (1999) "On a Generalised Notion of Mistake Bounds" in *Proceedings of the Twelfth Annual Conference on Computational Learning Theory* (COLT'99), Santa Cruz, 249--256, ACM Press, July 1999.
49. Jain, S. and Sharma, A. (1999) "Mind Change Complexity of Learning Logic Programs" in P. Fischer and H.U. Simon (editors) *Proceedings of the 4th European Conference on Computational Learning Theory* (EuroCOLT'99), Nordkirchen Castle, Germany, Lecture Notes in Artificial Intelligence, Vol. 1572, pp. 198--213, Springer-Verlag, March 1999.
50. McCreath, E. and Sharma, A. (1998) " LIME: A System for Learning Relations" in M. Richter et al. (editors), *Proceedings of the 9th International Conference on Algorithmic Learning Theory* (ALT'98), Otzenhausen, Germany, Lecture Notes in Artificial Intelligence, Vol. 1501, pp. 336 - 374, Springer-Verlag, October 1998.
51. Case, J., Ott, M., Sharma, A., and Stephan, F. (1998) "Learning to Win Process-Control Games Watching Game-Masters" in M. Richter et al. (editors) *Proceedings of the 9th International Conference on Algorithmic Learning Theory* (ALT'98), Otzenhausen, Germany, Lecture Notes in Artificial Intelligence, Vol. 1501, pp. 31 - 45, Springer-Verlag, October 1998.
52. Case, J., Jain, S., Kaufmann, S., Sharma, A., and Stephan, F. (1998) "Predictive Learning Models for Concept Drift" in M. Richter et al. (editors*), Proceedings of the 9th International Conference on Algorithmic Learning Theory* (ALT'98) Otzenhausen, Germany, Lecture Notes in Artificial Intelligence, Vol. 1501, pp. 276 - 290, Springer-Verlag, October 1998.
53. Case, J., Jain, S., Ott, M., Sharma, A., and Stephan, F. (1998) "Robustly Learning Aided by Context" in the *Proceedings of the Eleventh Annual Conference on Computational Learning Theory*, (COLT'98), Wisconsin-Madison, pp. 44 - 55, ACM Press, July 1998.
54. Case, J., Jain, S., and Sharma, A. (1997) "Synthesizing Noise-Tolerant Language Learners" in M. Li and A. Maruoka (editors), *Proceedings of the 8th International Workshop on Algorithmic Learning Theory* (ALT'97), Sendai, Japan, Lecture Notes in Artificial Intelligence, Vol. 1316, pp. 228 - 243, Springer-Verlag, October 1997.
55. McCreath, E. and Sharma, A. (1997) "ILP with Noise and Fixed Example Size -A Bayesian Approach" in the *Proceedings of the Fifteenth International Joint Conference on Artificial Intelligence*, (IJCAI'97), Nagoya, pp. 1310 - 1315, distributed by Morgan Kaufmann Publishers, August 1997.
56. Sharma, A., Stephan, F., and Ventsov, Y. (1997) "Generalised Notions of Mind Change Complexity" in the *Proceedings of the Tenth Annual Conference on Computational Learning Theory*, (COLT'97), Nashville, pp. 96 - 108, ACM Press, July 1997.
57. Ambainis, A., Jain, S., and Sharma, A. (1997) "Ordinal Mind Change Complexity of Language Identification" in Shai Ben-David (editor), *Proceedings of the Third European*

Conference on Computational Learning Theory, (EuroCOLT'97), Jerusalem, Israel, Lecture Notes in Artificial Intelligence, Vol. 1208, pp. 301 - 315, March 1997.

58. Case, J., Kinber, E., Sharma, A., and Stephan, F. (1997) "On the Classification of Computable Languages" in *Proceedings of the 14th Annual Symposium on Theoretical Aspects of Computer Science*, (STACS'97), Lubeck, Germany, Lecture Notes in Computer Science, Vol. 1200, pp. 225 - 236, Springer-Verlag, February/March 1997.
59. Jain, S. and Sharma, A. (1996) "Team Learning of Recursive Languages" in N. Foo and R.G. Goebel (editors*), Proceedings of the Pacific Rim International Conference on Artificial Intelligence* 1996, (PRICAI'96), Cairns, Lecture Notes in Artificial Intelligence, Vol.1114, pp. 324 - 335, Springer Verlag, August 1996.
60. Jain, S. and Sharma, A. (1996) "Elementary Formal Systems, Intrinsic Complexity, and Procrastination" in *Proceedings of the Ninth Annual ACM Conference on Computational Learning Theory*, (COLT'96), Italy, pp. 181 - 192, ACM Press, June 1996.
61. McCreath, E. and Sharma, A. (1995) "Extraction of Meta-Knowledge to Restrict the Hypothesis Space for ILP Systems" in X. Yao (editor), *Proceedings of the Eighth Australian Joint Conference on Artificial Intelligence*, (AI'95), Canberra, pp. 75 - 82, World Scientific, November 1995.
62. Case, J., Jain, S., and Sharma, A. (1995) "Machine Induction Without Revolutionary Paradigm Shifts" in K. P. Jantke, T. Shinohara, and T. Zeugmann (editors), *Proceedings of the Sixth International Workshop on Algorithmic Learning Theory*, (ALT'95), Fukuoka, Japan, Lecture Notes in Artificial Intelligence, Vol. 997, pp. 153 - 168, Springer-Verlag, October 1995.
63. Jain, S. and Sharma, A. (1995) 'The Structure of Intrinsic Complexity of Learning" in Paul Vitanyi (editor), *Computational Learning Theory, Second European Conference*, (EuroCOLT'95), Barcelona, Spain, Lecture Notes in Artificial Intelligence, Vol. 904, pp. 168 - 181, Springer-Verlag, March 1995.
64. Jain, S. and Sharma, A. (1994) "Monotonic Strategies for Identifying recursively enumerable Languages" in *Proceedings of the Fifth International Workshop on Algorithmic Learning Theory*, (ALT'94), Reinhardsbrunn Castle, Germany, Lecture Notes in Artificial Intelligence, Vol. 872, pp 349 - 364, Springer-Verlag, October 1994.
65. Jain, S. and Sharma, A. (1994) "On the Intrinsic Complexity of Language Identification" in *Proceedings of the Seventh ACM Conference on Computational Learning Theory*, (COLT'94), Rutgers University, pp. 278 - 286, ACM Press, July 1994.
66. Jain, S. and Sharma, A. (1993) 'On Aggregating Teams of Learning Machines" in *Proceedings of the Fourth Workshop on Algorithmic Learning Theory*, (ALT'93), Tokyo, Lecture Notes in Artificial Intelligence, Vol. 744, pp. 150 - 163, Springer-Verlag, November 1993.
67. Jain, S. and Sharma, A. (1993) "Probability is More Powerful Than Team for Identification of Languages from Positive Data" in *Proceedings of the 1993 Conference on Computational Learning Theory*, (COLT'93), Santa Cruz, pp. 192 - 198, ACM Press, July 1993.
68. Baliga, G., Jain, S., and Sharma, A. (1992) "Learning from Multiple Sources of Inaccurate Data" in *Proceedings of the Third International Workshop on Analogical and Inductive Inference*, (AII'92), Dagstuhl Castle, Germany, pp. 108 - 128, Lectures Notes in Artificial Intelligence, Vol. 642, Springer-Verlag, October 1992.
69. Jain, S. and Sharma, A. (1992) "Prudence in Vacillatory Language Identification" in *Proceedings of the 1992 Algorithmic Learning Theory Workshop*, (ALT'92), Tokyo, pp. 159 - 168, JSAI Press, October 1992. (Proceedings republished as Lecture Notes in Artificial Intelligence, Springer-Verlag.
70. Case, J., Jain, S., and Sharma, A. (1992) "On Learning Limiting Programs" in

Proceedings of the 1992 ACM Workshop on Computational Learning Theory, (COLT'92), July pp. 27 - 29, Pittsburgh, Pennsylvania, pp. 193 - 202, ACM Press, July 1992.

71. Case, J., Jain, S., and Sharma, A. (1991) “Complexity Issues for Vacillatory Function Identification” in S. Biswas and K. V. Nori (editors), *Proceedings of the Foundations of Software Technology and Theoretical Computer Science*, Eleventh Conference, New Delhi, India, Lecture Notes in Computer Science, Vol. 560, pp. 121 - 40, Springer-Verlag, December 1991.
72. Case, J., Jain, S., and Sharma, A. (1990) “Anomalous Learning Helps Succinctness” in S. Arikawa, et al. (editors), *Proceedings of the First International Workshop on Algorithmic Learning Theory*, (ALT'90), Tokyo, Japan, pp. 282 - 288, Ohmsa Publishers, October 1990. (Proceedings republished by Ohmsa-Springer.)
73. Jain, S. and Sharma, A. (1990) “Language Learning by a Team” in M. Paterson (editor), *Proceedings of the International Colloquium on Automata, Languages, and Programming* 1990, (ICALP'90), pp. 153 - 166, Springer-Verlag, July 1990.
74. Jain, S. and Sharma, A. (1990) “Finite Learning by a Team” in M. Fulk and J. Case (editors), *Proceedings of the 1990 ACM Workshop on Computational Learning Theory*, (COLT'90), pp. 163 - 177, Morgan Kaufmann Publishers, July 1990.
75. Jain, S. and Sharma, A. (1990) “Hypothesis Formation and Language Acquisition with Infinitely Often Correct Teacher” in R. Parikh (editor), *Proceedings of the Third Conference on Theoretical Aspects of Reasoning about Knowledge*, (TARK III), pp. 225 - 239, Morgan Kaufmann Publishers, March 1990.
76. Jain, S.and Sharma, A. (1990) "Characterising Language Learning by Standardizing Operations" in S.G. Akl, F. Fiala, and W.W. Koczkodaj (editors), *Advances in Computing and Information, Proceedings of the International Conference on Computing and Information*, (ICCI'90), pp. 144 - 148, Canadian Scholars' Press, Toronto, 1990.
77. Case, J., Jain, S., and Sharma, A. (1989) “Convergence to Nearly Minimal Size Grammars by Vacillating Learning Machines” in R. Rivest, et al. (editors), *Proceedings of the 1989 Workshop on Computational Learning Theory* (COLT'89), pp. 189 - 199, Morgan Kaufmann Publishers, Inc., 1989.