

Gautam Shroff

Vice President, Chief Scientist and Head, TCS Research

TCS Research and Innovation

Dr. Gautam Shroff is a Vice President and Chief Scientist in TCS and heads TCS Research across all research areas spanning software, computing, security data science, artificial intelligence as well as life sciences, materials and behavioural sciences.

Education

- PhD in Computer Science, Rensselaer Polytechnic Institute, Troy, NY, USA 1990
- MS in Electrical and Computer Engineering, Rensselaer Polytechnic Institute, Troy, NY, USA - 1989
- BTECH in Electrical Engineering, Indian Institute of Technology, Kanpur, India 1985

Teaching

- 2012+ On Coursera: Web Intelligence and Big Data: Fall & Spring of '12 & '13, Spring '14 1/4 of a project course on Big Data Analytics at IIIT Delhi
- '91-2000 At Indian Institute of Technology Delhi: Numerical Analysis, Scientific Computing, Parallel Computing, Systems Software, Software Engineering

Publications:

Dr. Shroff has published 90 research papers in the areas of computational mathematics, parallel computation, distributed systems, software architecture, software engineering, data science, artificial intelligence and machine learning.

Books:

- "The Intelligent Web: Search, Smart Algorithms, and Big Data", Oxford University Press,
 November 2013 (Paperback edition, June 2015)
- "Enterprise Cloud Computing: Technology, Architectures, Applications", Cambridge University Press, October 2010

References

 Wm Randolph Franklin, Rahul Bansal, Elissa Gilbert, and Gautam Shroff. De-bugging and tracing expert systems. In System Sciences, 1988. Vol. III. Decision Support and Knowledge Based Systems Track, Proceedings of the Twenty-First Annual Hawaii International Conference on, volume 3, pages 159–167. IEEE, 1988.



- 2. Gautam Shroff and Robert Schreiber. Convergence of parallel block jacobi meth- ods. In Advanced Algorithms and Architectures for Signal Processing III, volume 975, pages 59–68. International Society for Optics and Photonics, 1988.
- 3. Gautam Shroff and Robert Schreiber. On the convergence of the cyclic acobi method for parallel block orderings. SIAM Journal on Matrix Analysis and Appli- cations, 10(3):326–346, 1989.
- 4. Gautam M Shroff. A parallel algorithm for the eigenvalues and eigenvectors of a general complex matrix. Numerische Mathematik, 58(1):779–805, 1990.
- 5. Gautam Shroff and Robert Schreiber. On the convergence of cyclic jacobi meth- ods. In Numerical Linear Algebra, Digital Signal Processing and Parallel Algo- rithms, pages 597–604. Springer, Berlin, Heidelberg, 1991.
- 6. GM Shroff and HB Keller. Stabilization of unstable procedures: A hybrid algo- rithm for continuation. SIAM J. Numer. Anal, 1991.
- 7. Christian H Bischof and Gautam M Shroff. On updating signal subspaces. IEEE Transactions on Signal Processing, 40(1):96–105, 1992.
- 8. Gautam M Shroff and Christian H Bischof. Adaptive condition estimation for rank-one updates of qr factorizations. SIAM journal on matrix analysis and appli- cations, 13(4):1264–1278, 1992.
- 9. Rekha Goel and Gautam M Shroff. Transparent parallel replication of logically partitioned databases. In High Performance Computing, 1996. Proceedings. 3rd International Conference on, pages 132–137. IEEE, 1996.
- Rekha Goel and Gautam M Shroff. Transparent parallel transactions on repli- cated autonomous databases. In Algorithms for Parallel Processing, pages 117– 145. Springer, New York, NY, 1999.
- 11. Pankaj Bhatt, Gautam Shroff, and Arun Kumar Misra. Dynamics of software maintenance. ACM SIGSOFT Software Engineering Notes, 29(5):1–5, 2004.
- 12. Abhiram Gandhe, Puneet Agarwal, and Gautam Shroff. Jfelx: A dynamic model driven architecture. In Software Engineering Research and Practice, pages 382–388. CSREA Press, 2005.
- 13. Gautam Shroff, Puneet Agarwal, and Abhiram Gandhe. Jflex: A dynamic model driven architecture, 2005.



- 14. Gautam Shroff, Anish Mehta, Puneet Agarwal, and Rajesh Sinha. Collabora- tive development of business applications. In CollaborateCom. IEEE Computer Society / ICST, 2005.
- 15. Pankaj Bhatt, Williams K, Gautam Shroff, and Arun Kumar Misra. Influencing factors in outsourced software maintenance. ACM SIGSOFT Software Engineering Notes, 31(3):1–6, 2006.
- 16. Pankaj Bhatt, Gautam Shroff, C. Anantaram, and Arun Kumar Misra. An influ- ence model for factors in outsourced software maintenance. Journal of Software Maintenance, 18(6):385–423, 2006.
- 17. Pankaj Bhatt, Gautam Shroff, K. Williams, and Arun Kumar Misra. An empirical study of factors and their relationships in outsourced software maintenance. In APSEC, pages 301–308. IEEE Computer Society, 2006.
- 18. Gautam Shroff. Dev 2.0: model driven development in the cloud. In SIGSOFT FSE, page 283. ACM, 2008.
- 19. Prasun Dewan, Puneet Agarwal, Gautam Shroff, and Rajesh Hegde. Distributed side-by-side programming. In CHASE, pages 48–55. IEEE Computer Society, 2009.
- Prasun Dewan, Puneet Agarwal, Gautam Shroff, and Rajesh Hegde. Experiments in distributed side-by-side software development. In CollaborateCom, pages 1– 10. ICST / IEEE, 2009.
- 21. Gautam Shroff, Puneet Agarwal, and Premkumar T. Devanbu. Instant multi-tier web applications without tears. In ISEC, pages 3–12. ACM, 2009.
- 22. Gautam Shroff, Puneet Agarwal, and Premkumar T. Devanbu. Instantapps: A WYSIWYG model driven interpreter for web applications. In ICSE Companion, pages 417–418. IEEE, 2009.
- 23. Prasun Dewan, Puneet Agarwal, Gautam Shroff, and Rajesh Hegde. Mixed-focus collaboration without compromising individual or group work. In EICS, pages 225–234. ACM, 2010.
- 24. Gautam Shroff, Puneet Agarwal, and Lipika Dey. Enterprise information fusion for real-time business intelligence. In FUSION, pages 1–8. IEEE, 2011.
- 25. Gautam Shroff, Saurabh Sharma, Puneet Agarwal, and Shefali Bhat. A black-board architecture for data-intensive information fusion using locality-sensitive hashing. In FUSION, pages 1–8. IEEE, 2011.



- 26. Puneet Agarwal, Rajgopal Vaithiyanathan, Saurabh Sharma, and Gautam Shroff. Catching the long-tail: Extracting local news events from twitter. In ICWSM. The AAAI Press, 2012.
- 27. Puneet Agarwal, Gautam Shroff, and Pankaj Malhotra. Approximate incremental big-data harmonization. In BigData Congress, pages 118–125. IEEE Computer Society, 2013.
- 28. Lipika Dey, Sameera Bharadwaja H., G. Meera, and Gautam Shroff. Email ana-lytics for activity management and insight discovery. In Web Intelligence, pages 557–564. IEEE Computer Society, 2013.
- 29. Ehtesham Hassan, Gautam Shroff, and Puneet Agarwal. Multi-sensor event de-tection using shape histograms. CoRR, abs/1408.3733, 2014.
- 30. Pankaj Malhotra, Puneet Agarwal, and Gautam Shroff. Graph-parallel entity resolution using LSH & IMM. In EDBT/ICDT Workshops, volume 1133 of CEUR Workshop Proceedings, pages 41–49. CEUR-WS.org, 2014.
- 31. Pankaj Malhotra, Puneet Agarwal, and Gautam Shroff. Incremental entity fusion from linked documents. In FUSION, pages 1–8. IEEE, 2014.
- 32. Pankaj Malhotra, Puneet Agarwal, and Gautam Shroff. Incremental entity reso- lution from linked documents. CoRR, abs/1402.4417, 2014.
- 33. Sarmimala Saikia, Gautam Shroff, Puneet Agarwal, Ashwin Srinivasan, Aditeya Pandey, and Gaurangi Anand. Exploratory data analysis using alternating covers of rules and exceptions. In COMAD, pages 105–108. Computer Society of India, 2014.
- 34. Geetika Sharma, Gautam Shroff, Aditeya Pandey, Puneet Agarwal, and Ashwin Srinivasan. Interactively visualizing summaries of rules and exceptions. In Eu- roVA@EuroVis. Eurographics Association, 2014.
- 35. Gautam Shroff, Puneet Agarwal, Karamjit Singh, Auon Haidar Kazmi, Sapan Shah, and Avadhut Sardeshmukh. Prescriptive information fusion. In FUSION, pages 1–8. IEEE, 2014.
- 36. Gautam Shroff, Lipika Dey, and Hiranmay Ghosh. Enterprise contextual intelli- gence. In WI-IAT (1), pages 202–209. IEEE Computer Society, 2014.
- 37. Karamjit Singh, Puneet Agarwal, and Gautam Shroff. Warranty cost estimation using bayesian network. CoRR, abs/1411.3197, 2014.
- 38. Puneet Agarwal, Maya Ramanath, and Gautam Shroff. Distributed algorithm for relationship queries on large graphs. In LSDS-IR@CIKM, pages 9–12. ACM, 2015.



- 39. Puneet Agarwal, Gautam Shroff, Sarmimala Saikia, and Zaigham Khan. Effi-ciently discovering frequent motifs in large-scale sensor data. In CODS, pages 98–103. ACM, 2015.
- 40. Puneet Agarwal, Gautam Shroff, Sarmimala Saikia, and Zaigham Khan. efficiently discovering frequent motifs in large-scale sensor data. CoRR, abs/1501.00405, 2015.
- 41. Rahul Agrawal, Anirban Chakraborti, Karamjit Singh, Gautam Shroff, and Venkatesh Sarangan. Group-based pricing to shape demand in real-time electric- ity markets. In EUMAS/AT, volume 9571 of Lecture Notes in Computer Science, pages 121–128. Springer, 2015.
- 42. Ehtesham Hassan, Gautam Shroff, and Puneet Agarwal. Multi-sensor event de-tection using shape histograms. In CODS, pages 20–29. ACM, 2015.
- 43. Pankaj Malhotra, Lovekesh Vig, Gautam Shroff, and Puneet Agarwal. Long short term memory networks for anomaly detection in time series. In ESANN, 2015.
- 44. Sarmimala Saikia, Gautam Shroff, Puneet Agarwal, and Ashwin Srinivasan. Succinctly summarizing machine usage via multi-subspace clustering of multi- sensor data. In DSAA, pages 1–10. IEEE, 2015.
- 45. Geetika Sharma, Gautam Shroff, Aditeya Pandey, Brijendra Singh, Gunjan Se- hgal, Kaushal Paneri, and Puneet Agarwal. Multi-sensor visual analytics sup- ported by machine-learning models. In ICDM Workshops, pages 668–674. IEEE Computer Society, 2015.
- 46. Karamjit Singh, Gautam Shroff, and Puneet Agarwal. Predictive reliability mining for early warnings in populations of connected machines. In DSAA, pages 1–10. IEEE, 2015.
- 47. Surya Yadav, Gautam Shroff, Ehtesham Hassan, and Puneet Agarwal. Business data fusion. In FUSION, pages 1876–1885. IEEE, 2015.
- 48. Puneet Agarwal, Maya Ramanath, and Gautam Shroff. Relationship queries on large graphs using pregel. CoRR, abs/1605.00060, 2016.
- 49. Anirban Chakraborti, Kiran Sharma, Aditeya Pandey, Kaushal Paneri, Siddharth Verma, Gunjan Sehgal, Bindu Gupta, Geetika Sharma, Lovekesh Vig, Puneet Agarwal, et al. Spatio-temporal analysis of ethnic conflicts and human rights violations in africa and the middle east. In International Conference on Social Computing, Behavioral-Cultural Modeling & Prediction and Behavior Representa- tion in Modeling and Simulation, 2016.
- 50. Auon Haidar Kazmi, Gautam Shroff, and Puneet Agarwal. Generic framework to predict repeat behavior of customers using their transaction history. In WI, pages 449–452. IEEE Computer Society, 2016.



- 51. [Pankaj Malhotra, Anusha Ramakrishnan, Gaurangi Anand, Lovekesh Vig, Puneet Agarwal, and Gautam Shroff. Lstm-based encoder -decoder for multi- sensor anomaly detection. CoRR, abs/1607.00148, 2016.
- 52. Pankaj Malhotra, Vishnu TV, Anusha Ramakrishnan, Gaurangi Anand, Lovekesh Vig, Puneet Agarwal, and Gautam Shroff. Multi-sensor prognostics us- ing an unsupervised health index based on LSTM encoder -decoder. CoRR, abs/1608.06154, 2016.
- 53. Mayur Patidar, Shaurya Rohatgi, Ashish Chaudhary, Mahesh P. Singh, Puneet Agarwal, and Gautam Shroff. Activity detection from email meta-data clustering. In ICDM Workshops, pages 568–575. IEEE Computer Society, 2016.
- 54. Ramakrishna Perla, Ehtesham Hassan, Ramya Hebbalaguppe, Monika Sharma, Gaurav Gupta, Lovekesh Vig, Geetika Sharma, and Gautam Shroff. An AR in-spection framework: Feasibility study with multiple AR devices. In ISMAR Ad- junct, pages 221–226. IEEE, 2016.
- 55. Sarmimala Saikia, Lovekesh Vig, Ashwin Srinivasan, Gautam Shroff, Puneet Agarwal, and Richa Rawat. Neuro-symbolic eda-based optimisation using ilp- enhanced dbns. CoRR, abs/1612.06528, 2016.
- 56. Sarmimala Saikia, Lovekesh Vig, Ashwin Srinivasan, Gautam Shroff, Puneet Agarwal, and Richa Rawat. Neuro-symbolic eda-based optimization using ilp- enhanced dbns. In CoCo@NIPS, volume 1773 of CEUR Workshop Proceedings. CEUR-WS.org, 2016.
- 57. Karamjit Singh, Kaushal Paneri, Aditeya Pandey, Garima Gupta, Geetika Sharma, Puneet Agarwal, and Gautam Shroff. Visual bayesian fusion to nav- igate a data lake. In FUSION, pages 987–994. IEEE, 2016.
- 58. Ashwin Srinivasan, Gautam Shroff, Lovekesh Vig, and Sarmimala Saikia. Gener ation of near -optimal solutions using ilp-guided sampling. In ILP, volume 10326 of Lecture Notes in Computer Science, pages 120–131. Springer, 2016.
- 59. Ashwin Srinivasan, Gautam Shroff, Lovekesh Vig, Sarmimala Saikia, and Puneet Agarwal. Generation of near -optimal solutions using ilp-guided sampling. CoRR, abs/1608.01093, 2016.
- 60. Mohit Yadav, Pankaj Malhotra, Lovekesh Vig, K. Sriram, and Gautam Shroff. ODE augmented training improves anomaly detection in sensor data from ma-chines. CoRR, abs/1605.01534, 2016.
- 61. Narendhar Gugulothu, Vishnu TV, Pankaj Malhotra, Lovekesh Vig, Puneet Agar wal, and Gautam Shroff. Predicting remaining useful life using time series em-beddings based on recurrent neural networks. CoRR, abs/1709.01073, 2017.
- 62. Prerna Khurana, Puneet Agarwal, Gautam Shroff, Lovekesh Vig, and Ashwin



- Srinivasan. Hybrid bilstm-siamese network for FAQ assistance. In CIKM, pages 537–545. ACM, 2017.
- 63. Pankaj Malhotra, Vishnu TV, Lovekesh Vig, Puneet Agarwal, and Gautam Shroff. Timenet: Pre-trained deep recurrent neural network for time series classification. In ESANN, 2017.
- 64. Pankaj Malhotra, Vishnu TV, Lovekesh Vig, Puneet Agarwal, and Gautam Shroff. Timenet: Pre-trained deep recurrent neural network for time series classification. CoRR, abs/1706.08838, 2017.
- 65. Gunjan Sehgal, Bindu Gupta, Kaushal Paneri, Karamjit Singh, Geetika Sharma, and Gautam Shroff. Crop planning using stochastic visual optimization. CoRR, abs/1710.09077, 2017.
- 66. Kiran Sharma, Gunjan Sehgal, Bindu Gupta, Geetika Sharma, Arnab Chatterjee, Anirban Chakraborti, and Gautam Shroff. A complex network analysis of ethnic conflicts and human rights violations. CoRR, abs/1705.03405, 2017.
- 67. Karamjit Singh, Garima Gupta, Gautam Shroff, and Puneet Agarwal. Automated product-attribute mapping. In PAKDD (Workshops), volume 10526 of Lecture Notes in Computer Science, pages 163–175. Springer, 2017.
- 68. Karamjit Singh, Garima Gupta, Gautam Shroff, and Puneet Agarwal. Minimally- supervised attribute fusion for data lakes. CoRR, abs/1701.01094, 2017.
- 69. Karamjit Singh, Garima Gupta, Vartika Tewari, and Gautam Shroff. Comparative benchmarking of causal discovery techniques. CoRR, abs/1708.06246, 2017.
- 70. Karamjit Singh, Garima Gupta, Lovekesh Vig, Gautam Shroff, and Puneet Agarwal.

 Deep convolutional neural networks for pairwise causality. CoRR, abs/1701.00597, 2017.
- 71. S. Vishal, Mohit Yadav, Lovekesh Vig, and Gautam Shroff. Information bottle- neck inspired method for chat text segmentation. In IJCNLP(1), pages 194–203. Asian Federation of Natural Language Processing, 2017.
- 72. Mohit Yadav, Lovekesh Vig, and Gautam Shroff. Learning and knowledge transfer with memory networks for machine comprehension. In EACL (1), pages 850–859. Association for Computational Linguistics, 2017.
- 73. Pravin Bhagwat, Andrea Goldsmith, Manish Gupta, Rajeev Rastogi, and Gautam Shroff. Mobicom'18 panel: Hammer & nail vis-a-vis Al / ML applications to networked systems. In MobiCom, pages 653–654. ACM, 2018.



- 74. Vishwanath D, Lovekesh Vig, Gautam Shroff, and Puneet Agarwal. MEETING BOT: reinforcement learning for dialogue based meeting scheduling. In AAAI Workshops, pages 699–705. AAAI Press, 2018.
- 75. Narendhar Gugulothu, Pankaj Malhotra, Lovekesh Vig, and Gautam Shroff. Sparse neural networks for anomaly detection in high-dimensional time series. 2018.
- 76. Priyanka Gupta, Pankaj Malhotra, Lovekesh Vig, and Gautam Shroff. Transfer learning for clinical time series analysis using recurrent neural networks. CoRR, abs/1807.01705, 2018.
- 77. Priyanka Gupta, Pankaj Malhotra, Lovekesh Vig, and Gautam Shroff. Using features from pre-trained timenet for clinical predictions. In KHD@IJCAI, volume 2148 of CEUR Workshop Proceedings, pages 38–44. CEUR-WS.org, 2018.
- 78. Prerna Khurana, Puneet Agarwal, Gautam Shroff, and Lovekesh Vig. Resolving abstract anaphora implicitly in conversational assistants using a hierarchically stacked RNN. In KDD, pages 433–442. ACM, 2018.
- 79. Mayur Patidar, Puneet Agarwal, Lovekesh Vig, and Gautam Shroff. Automatic conversational helpdesk solution using seq2seq and slot-filling models. In CIKM, pages 1967–1975. ACM, 2018.
- 80. Sarmimala Saikia, Richa Verma, Puneet Agarwal, Gautam Shroff, Lovekesh Vig, and Ashwin Srinivasan. Evolutionary RL for container loading. In ESANN, 2018.
- 81. Sarmimala Saikia, Richa Verma, Puneet Agarwal, Gautam Shroff, Lovekesh Vig, and Ashwin Srinivasan. Evolutionary RL for container loading. CoRR, abs/1805.06664, 2018.
- 82. Sakti Saurav, Pankaj Malhotra, Vishnu TV, Narendhar Gugulothu, Lovekesh Vig, Puneet Agarwal, and Gautam Shroff. Online anomaly detection with concept drift adaptation using recurrent neural networks. In COMAD/CODS, pages 78–87. ACM, 2018.
- 83. Gunjan Sehgal, Mrinal Rawat, Bindu Gupta, Garima Gupta, Geetika Sharma, and Gautam Shroff. Visual predictive analytics using ifuseml. In Eu- roVA@EuroVis, pages 13–17. Eurographics Association, 2018.
- 84. Karamjit Singh, Garima Gupta, Vartika Tewari, and Gautam Shroff. Comparative benchmarking of causal discovery algorithms. In COMAD/CODS, pages 46–56. ACM, 2018.
- 85. Mahesh P. Singh, Puneet Agarwal, Ashish Chaudhary, Gautam Shroff, Prerna Khurana, Mayur Patidar, Vivek Bisht, Rachit Bansal, Prateek Sachan, and Rohit Kumar. KNADIA: enterprise knowledge assisted dialogue systems using deep learning. In ICDE, pages 1423–1434. IEEE, 2018.

Experience certainty



- 86. Vishal Sunder, Lovekesh Vig, Arnab Chatterjee, and Gautam Shroff. Prosocial or selfish? agents with different behaviors for contract negotiation using reinforce- ment learning. CoRR, abs/1809.07066, 2018.
- 87. TV Vishnu, Pankaj Malhotra, Lovekesh Vig, and Gautam Shroff. Deep ordi- nal regression for remaining useful life estimation from censored data. In Joint Workshop on Deep Learning for Safety-Critical Applications in Engineering at ICML- IJCAI-AAMAS, 2018.
- 88. Arun Bahulkar, K. Kesavasamy, T. V. Prabhakar, and Gautam Shroff, editors. Proceeding of the 4th Annual India Software Engineering Conference, ISEC 2011, Thiruvananthapuram, Kerala, India, February 24-27, 2011. ACM, 2011.
- 89. Sugata Ghosal, Gautam Shroff, Satish Chandra, and Nachiappan Nagappan, editors. 6th India Software Engineering Conference, ISEC '13, New Delhi, India February 21 23, 2013. ACM, 2013.
- 90. Gautam Shroff. Enterprise cloud computing: technology, architecture, applications. Cambridge University Press, 2010.
- 91. Gautam Shroff. The Intelligent Web: Search, smart algorithms, and big data. Oxford University Press, 2013.

Awards/Honors

'Young Scientist Award from the Indian Department of Atomic Energy In 1994

Membership

 Dr. Shroff is an active member of ACM and ACM-India, and has served on the ACM India Council and was the founding chair of the ACM-India SIG on Knowledge Discovery from Data (IKDD), which is also the India chapter of ACM SIGKDD. He has also served on the senate and as adjunct professor at the IIIT Delhi. He was also a member of the AI Task Force constituted in 2017 by the Ministry of Commerce & Industry in the Government of India.

.