Nagarajan Krishnamurthy

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Current Affiliation and Position(s):

June 2019 till date: Associate Professor

December 2011 to June 2019: Assistant Professor

At: Operations Management and Quantitative Techniques Area,
Indian Institute of Management (IIM), Indore, India.

Academic Qualifications:

- Ph.D. (Computer Science), 2011.
  Chennai Mathematical Institute (CMI), Chennai, India.
  - Thesis Title: Equilibria in Bimatrix Games and Stochastic Games: Theoretical and Computational Aspects.
  - Guide: Prof. T. Parthasarathy.
  - Co-guides: Prof. Samir Datta, Prof. G. Ravindran and Prof. K. V. Subrahmanyam.
- Master of Engineering (Computer Science and Engineering), First Class,
  August 1995 to July 1999.
  Indian Institute of Science (IISc.), Bangalore, India.
- Bachelor of Science (Mathematics), First Class,
  June 1992 to May 1995.
  University of Madras, Chennai, India.

Employment History:

- Indian Statistical Institute, July 2011 to November 2011:
  - Visiting Scientist
- i2 Technologies India Pvt. Ltd., Bangalore, India, August 1999 to June 2005:
  - Senior Systems Consultant/ Senior Software Engineer, January 2002 to June 2005.
  - Associate Systems Consultant, August 1999 to December 2001.

Research Interests:

Game Theory, Social Networks, Algorithms, Applications of Game Theory to the above areas and to Business Ethics.

Edited Volumes:

1. Krishnamurthy, N. & Ravichandran, N. (Editors). (2014). *Proceedings of the Advanced Workshop and Tutorial on Operations Research (AWTOR 2012)*, Allied Publishers Pvt. Ltd.
2. Gowda, M. S., Krishnamurthy, N., Parthasarathy, T., Ramanujam, R. & Ravindran, G. (Editors). (2013). *International Game Theory Review*, 15(4) (a special issue containing selected papers from the *International Conference on Game Theory, Operations Research and Applications* 2012 held in Chennai), World Scientific Publishing. doi: 10.1142/S0219198913600013

Peer-reviewed Chapters in Books:

1. Krishnamurthy, N. & Parthasarathy, T. (2011). Multistage (Stochastic) Games. In James J. Cochran, Louis A. Cox, Pinar Keskinocak, Jeffrey P. Kharoufeh, and J. Cole Smith (Eds.). *Wiley Encyclopedia of Operations Research and Management Science (EORMS)*, John Wiley & Sons, Inc. doi: 10.1002/9780470400531.eorms0551

Papers in Peer-Reviewed Journals:

1. Sarkhel, M., & Krishnamurthy, N. (Accepted). Stable Production Networks. *International Game Theory Review*, World Scientific Publishing. 24 pages.
2. Mane, P., Ahuja, K., & Krishnamurthy, N. (2019). Stability, Efficiency, and Contentedness of Social Storage Networks. *Annals of Operations Research*, Springer. 32 pages. doi: 10.1007/s10479-019-03309-9
3. Mane, P., Ahuja, K., & Krishnamurthy, N. (2019). Externalities in Endogenous Sharing Economy Networks. *Applied Economics Letters*, Routledge/ Taylor & Francis. 6 pages. doi: 10.1080/13504851.2019.1683507
4. Mane, P., Ahuja, K., & Krishnamurthy, N. (2019). Formation of Stable and Efficient Social Storage Cloud. *Games*, MDPI, Switzerland. 17 pages.
5. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2017). Stationary, Completely Mixed and Symmetric Optimal and Equilibrium Strategies in Stochastic Games. *International Journal of Game Theory*, Springer, 46(3), 761-782. doi: 10.1007/s00182-016-0555-5
6. Sujatha, B., Krishnamurthy, N., & Parthasarathy, T. (2016). The Creative Genius: John Nash. *Resonance - Journal of Science Education*, Indian Academy of Sciences, September 2016, 769-772.
7. Krishnamurthy, N., Parthasarathy, T., & Sujatha, B. (2012). Existence of Stationary Equilibrium for Mixtures of Discounted Stochastic Games. *Current Science*, 103(9), 1003-1013.
8. Krishnamurthy, N., Parthasarathy, T., & Ravindran, G. (2012). On Solving Subclasses of Multi-Player Stochastic Games via Linear Complementarity Problem Formulations: A Survey and Some New Results. *Optimization and Engineering*, Springer, 13(3), 435-457. doi: 10.1007/s11081-011-9163-1

9. Krishnamurthy, N., Parthasarathy, T., & Ravindran, G. (2010). Orderfield Property of Mixtures of Stochastic Games. *Sankhya: The Indian Journal of Statistics*, Springer. 72-A(1), 246-275. Retrieved from http://sankhya.isical.ac.in/search/72a1/final16.pdf

Working Papers/ Submitted Papers/ Archived Papers:

1. Krishnamurthy, N., & Neogy, S. K. (Revised and Resubmitted, *Annals of Operations Research*). On Lemke Processibility of Schultz's LCP and New LCP Formulations of Switching Control Stochastic Games.
2. Jain, H., Teja, G. S., Mane, P., Ahuja, K., & Krishnamurthy, N. (2018). Data backup network formation with heterogeneous agents. Extended abstract in the Proceedings of the *10th International Conference on Communication Systems & Networks, COMSNETS 2018*, 418-420. (Also archived: CoRR abs/1711.10283).
3. Mane, P., Ahuja, K., & Krishnamurthy, N. (2016). Unique Stability Point in Social Storage Networks. *IIM Indore Working Paper* WP/02/016/OMQT. (Also archived: CoRR abs/1603.07689).

Papers in Proceedings of Conferences/ Workshops:

1. Mane, P., Krishnamurthy, N. & Ahuja, K. (2014). Externalities and Stability in Social Cloud. *Proceedings of the International Conference on Game Theory for Networks (GameNets 2014)*, Beijing, China. IEEE. (pp. 50-55).
2. Krishnamurthy, N. (2014). Some Applications of Stochastic Games. *Proceedings of the Advanced Workshop and Tutorial on Operations Research (AWTOR 2012)*, Indore, India. Allied Publishers Pvt. Ltd. (pp. 131-141).
3. Krishnamurthy, N. & Datta, S. (2011). Some Tractable Win-Lose Games. *Proceedings of the 8th Annual Conference on Theory and Applications of Models of Computation (TAMC 2011)*, Tokyo, Japan. *LNCS*, Vol. 6648, Springer-Verlag Berlin/ Heidelberg. (pp. 365-376). (Also archived: CoRR abs/1010.5951).
4. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2011). Polynomial time algorithms for sub-classes of simple stochastic games and switching control stochastic games of perfect as well as imperfect information. *Proceedings of the International Conference on Applications of Game Theory in Policies and Decisions (in Honor of Professor C. R. Rao)*, Hyderabad, India.
5. Krishnamurthy, N., Arthanari, T. S. & Sujatha, B. (2011). Stochastic game model for the consignment assignment problem. *Proceedings of the International Conference on Applications of Game Theory in Policies and Decisions (in Honor of Professor C. R. Rao)*, Hyderabad, India.
6. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2009-10). Orderfield Property and Algorithms for Stochastic Games via Dependency Graphs. *Proceedings of the International Conference on Frontiers of Interface between Statistics and Sciences*, (in Honor of Prof. C. R. Rao on Occasion of his 90th Birthday), Hyderabad, India. (pp. 286-297).
7. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2009). Communication Complexity of Stochastic Games. *Proceedings of the International Conference on Game Theory for Networks (GameNets'09)*, Istanbul, Turkey. IEEE Press, NJ, USA. (pp. 411-417).

Invited talks at Conferences, Workshops etc.:

1. Talk on research work "Stability in Core-Periphery Production Networks", delivered at the *International Workshop on Game Theory and Networks*, Dibrugarh University, September 13-15, 2018.
2. Talk on "Finding Nash Equilibria in Bimatrix Games Using Linear Complementarity", delivered at the *Workshop/Mini-symposium on Linear Complementarity Problem and Semi-Definite Programming*, Indian Statistical Institute, Chennai, September 24-25, 2016.
3. Talk on "Linear Programming and Complementarity in Game Theory", delivered at the 6th *National Conference on Management Science and Practice (MSP 2016)*, IIT Madras, September 9-10, 2016.
4. Talk on research work "Dynamic Social Storage as a Stochastic Game" delivered at the *International Conference & Workshop on Game Theory & Optimization*, IIT Madras, June 6-10, 2016.
5. Talks on "Computational Aspects of Game Theory" delivered at the *Winter School on Recent Trends in Mathematical Methods*, Department of Applied Mathematics, University of Calcutta, December 14-21, 2011.
6. Talks delivered at the University of Auckland, New Zealand:
    - "A Gentle Introduction to Game Theory", May 25, 2011
    - "Applications of Game Theory, with Emphasis on Supply Chain Management", June 1, 2011
    - "An Introduction to Stochastic Games", June 3, 2011
    - "A Stochastic Game Model of the Problem of Empty Trucks to/ from the Auckland Port", June 7, 2011.
7. Talk on "Win-lose Games" delivered at the Indian Statistical Institute, Bangalore, March 30, 2011.
8. Talks on "Matrix Games" and "Stochastic Games (Theory and Algorithms)" delivered at the *Winter School on Operations Research and its Applications*. Indian Statistical Institute (ISI), Chennai, India. February 16-27, 2009.
9. Talks on "Introduction to Game Theory (Algorithms and Applications)" delivered at *Workshop on Game Theory and its Applications*. National Institute of Technology (NIT), Suratkal, India. February 14-15, 2009.
10. Talk on "Stochastic Games" delivered at IBM India Research Lab, Delhi, September 25, 2008.

Other Papers Presented at Conferences and Workshops:

1. Krishnamurthy, N., Swain, B., & Ramanathan, J. (2018). Ethical Marketing Strategies: The Unique Nash Equilibrium. The *25th Annual International Vincentian Business Ethics Conference (IVBEC 2018)*, New York, USA (October 25 - 27, 2018).
2. Mane, P., Ahuja, K., & Krishnamurthy, N. (2016). Unique Stability Point in Social Storage. The *5th World Congress of the Game Theory Society (GAMES 2016)*, 24-28 July, 2016, Maastricht University, The Netherlands.
3. Sarkhel, M., & Krishnamurthy, N. (2016). Stable Networks in Peer-to-Peer Based Sharing Economies. The *12th European Meeting of Game Theory (SING12)*, 11-13 July, 2016, University of Southern Denmark, Odense.

4. Mane, P., Ahuja, K., & Krishnamurthy, N. (2016). Stable Social Storage Networks. *International Conclave on Foundations of Decision and Game Theory*, 14-19 March, 2016, Indian Institute of Technology Bombay and Indira Gandhi Institute of Development Research (IGIDR), Mumbai, India.

5. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2015). Stationary Optima, Completely Mixed and Symmetric Equilibria in Stochastic Games. *The 10th ISDG (International Society of Dynamic Games) Workshop,* July 16-17, 2015, University of Strathclyde, Glasgow, UK.

6. Krishnamurthy, N., Mane, P., & Ahuja, K. (2015). Stochastic Social Cloud. *Chennai Mathematical Institute (CMI) Alumni Conference,* January 7-10, 2015, CMI, Chennai, India.

7. Krishnamurthy, N., & Parthasarathy, T. (2014). Algorithmic and Complexity Theoretic Aspects of Stochastic Games and Polystochastic Games. *25th International Conference on Game Theory*, July 7-11, 2014, Stony Brook University, New York, USA.

8. Krishnamurthy, N. & Parthasarathy, T. (2012). Algorithmic and Complexity Theoretic Aspects of Stochastic Games. *International Conference on Game Theory and Management Applications*, Dec 17-18, 2012, Hyderabad, India.

9. Sujatha, B., Krishnamurthy, N. & Ravindran, G. (2012). On Solving Perfect Information Stochastic Games. *The International Conference on Game Theory, Operations Research and their Applications* (GTORA), Jan 5-7, 2012, Chennai, India.

10. Krishnamurthy, N. & Neogy, S. K. (2011). On processibility by Lemke's algorithm of Schultz's LCP formulation of switching control stochastic games. *The International Conference on Applications of Game Theory in Policies and Decisions (in Honor of Professor C. R. Rao)*, Hyderabad, India.

11. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2010). New Classes of Two Player and Multi-Player Stochastic Games with the Orderfield Property. *The Second Brazilian Workshop of the Game Theory Society, in honor of John Nash, on the occasion of the 60th anniversary of Nash equilibrium*, University of São Paulo, Brazil.

12. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2010). On Solving Classes of (Two Person) Stochastic Games via Linear Complementarity Problem Formulations. (Poster). *The Second Brazilian Workshop of the Game Theory Society, in honor of John Nash, on the occasion of the 60th anniversary of Nash equilibrium*, University of São Paulo, Brazil.

13. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2009). Orderfield Property of Stochastic Games via Dependency Graphs. *20th International Conference on Game Theory (ICGT)*, Stony Brook University, New York, USA.

14. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2009). On the Structure of Simple Stochastic Games and Algorithms to Solve them. *20th International Symposium on Mathematical Programming (ISMP)*, Chicago, USA.

15. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2008). Vertical LCP Formulation of Perfect Information Stochastic Games. *International Conference on Operations Research for a Growing Nation*, in conjunction with the annual convention of the *Operations Research Society of India (ORSI)*, Tirupati, India.

Papers Presented by Co-authors at Conferences and Workshops:

1. Mane, P., Krishnamurthy, N., & Ahuja, K. (2019). Formation of Stable and Efficient Social Cloud, (Award for Second Best Poster. Presented by Pramod Mane at) the *International Conference on Game Theory and Networks*, Dibrugarh University, India.
2. Sarkhel, M., & Krishnamurthy, N. (2018). Mutual Monitoring and Cooperation in Networks, (Presented by Manish Sarkhel at) the *International Conference on Network Science in Economics and Finance (NSEF18)*, IIM Ahmedabad, India.
3. Sarkhel, M., & Krishnamurthy, N. (2018). Stability in Core-Periphery Production Networks, (Poster Presented by Manish Sarkhel at) the *International Conference on Complex Networks and their Applications*, Cambridge, UK.
4. Aradhye, A., Krishnamurthy, N., Mane, P., & Ahuja, K. (2017). Stable Social Clouds. (Presented by Aditya Aradhye at) the *2017 Symposium on Mathematical Programming and Game Theory*, Indian Statistical Institute, Delhi.
5. Sarkhel, M., & Krishnamurthy, N. (2016). Network Formation in Peer-to-Peer Additive Manufacturing. (Presented by Manish Sarkhel at) the *International Conference & Workshop on Game Theory & Optimization*, IIT Madras, Chennai, India.
6. Aradhye, A., Krishnamurthy, N., & Mane, P. (2016). Efficient Social Storage Networks. (Presented by Aditya Aradhye at) the *International Conference & Workshop on Game Theory & Optimization*, IIT Madras, Chennai, India.
7. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2016). Stationary, Completely Mixed and Symmetric Optimal and Equilibrium Strategy in Stochastic Games. (Presented by Sujatha Babu at) the *International Conference & Workshop on Game Theory & Optimization*, IIT Madras, Chennai, India.
8. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2016). Completely Mixed Stochastic Games when One Player Controls the Transition. (Presented by T. Parthasarathy at) the *International Conclave on Foundations of Decision and Game Theory*, IGIDR, Mumbai, India.
9. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2015). Completely Mixed Stochastic Games. (Presented by T. Parthasarathy at) the *Research Conference of the Israel Science Foundation on Game Theory*: Honoring Abraham Neyman's Scientific Achievements, The Hebrew University of Jerusalem, Israel.
10. Babu, S., Krishnamurthy, N., & Parthasarathy, T. (2015). Completely Mixed Stochastic Games. (Presented by T. Parthasarathy at) the *Workshop on Applied Optimization Models and Computation*, Indian Statistical Institute (ISI), Delhi, India.
11. Omkar P. D., Krishnamurthy, N., & Jain, N. K. (2012). A Stochastic Game Model to Analyze Entry into Supply Chains. (Presented by Nikunj Kumar Jain at) the *International Conference on Game Theory and Operations Research Applications*, Hyderabad, India.
12. Arthanari, T. S., Sujatha, B., Krishnamurthy, N., & Parthasarathy, T. (2012). An Algorithm to Solve Multi-Player Stochastic Games and Using it to Solve the Consignment Assignment Problem. (Presented by Sujatha, B. at) *The International Conference on Game Theory, Operations Research and their Applications (GTORA)*, Chennai, India.
13. Sujatha, B., Krishnamurthy, N., & Parthasarathy, T. (2012). On Existence of Equilibria in Stochastic Games with Uncountable State Space. (Presented by Parthasarathy, T. at) *The International*

Conference on Game Theory, Operations Research and their Applications (GTORA), Chennai, India.

14. Krishnamurthy, N., Parthasarathy, T., & Ravindran, G. (2012). New Classes of Two-Player and Multi-Player Stochastic Games with the Orderfield Property. (Presented by Ravindran, G. at) *The International Conference on Game Theory, Operations Research and their Applications (GTORA)*, Chennai, India.
15. Krishnamurthy, N., & Arthanari, T. S. (2011). Game theory and supply chain management: A survey. (Presented by Arthanari, T. S. at) *The International conference on Applications of Game Theory in Policies and Decisions (in Honor of Professor C. R. Rao)*, Hyderabad, India.
16. Krishnamurthy, N., Parthasarathy, T., & Ravindran, G. (2009). On techniques to solve perfect information stochastic games. (Presented by Ravindran, G. at) *The 20th International Symposium on Mathematical Programming (ISMP)*, Chicago, USA.

Technical Reports and Theses:

1. Krishnamurthy, N. (2011). Equilibria in Bimatrix Games and Stochastic Games: Theoretical and Computational Aspects. *Ph.D. Thesis* (Guide: Prof. T. Parthasarathy. Co-guides: Prof. Samir Datta, Prof. G. Ravindran and Prof. K. V. Subrahmanyam), *Computer Science, Chennai Mathematical Institute, Chennai, India.*
2. Krishnamurthy, N., Parthasarathy, T. & Ravindran, G. (2009). Orderfield Property of Mixtures of Stochastic Games. *Technical Report* No. SQCOR-2009-03, *Indian Statistical Institute (ISI)*, Kolkata, India. (Same as [3] in "Papers in Refereed Journals" above).
3. Krishnamurthy, N. (1999). Routing and Wavelength Assignment Algorithms for Large Scale Optical Networks. *Master of Engineering (M.E.) Thesis* (Advisor: Prof. Vijay Chandru), *Department of Computer Science and Automation, Indian Institute of Science (IISc.)*, Bangalore, India.

Academic Visits:

1. The University of Auckland, New Zealand. 19 May to 11 June 2011.

   Collaborated with: Prof. Tiru Arthanari and Prof. Tava Olsen, Department of Information Systems and Operations Management, The University of Auckland Business School, Auckland, New Zealand.

   Work done: Stochastic Game model to assign consignments to truck-operators so as to minimize the number of empty trucks to/ from the Auckland Port.

2. Short-Term Visiting Scholar, The Ohio State University, 01 June to 31 August 2009.

   Collaborated with: Prof. Srinivasan Parthasarathy, Department of Computer Science and Engineering, The Ohio State University, Columbus, Ohio, USA.

   Work done: Generalization of a previous model of the Domination Game and using Clustering to improve the time complexity.

3. Visiting Scholar, Indian Statistical Institute, Delhi, India, 17 August to 30 September 2008.

   Collaborated with: Prof. S. K. Neogy, SQC & OR Unit, ISI Delhi, India.

   Work done: Counter example for a previous LCP formulation and some new formulations of Switching Control Stochastic Games, done jointly with Prof. S. K. Neogy.

Mini-Courses Attended:

(During *The Second Brazilian Workshop of the Game Theory Society, in honor of John Nash, on the occasion of the 60th anniversary of Nash equilibrium*, University of São Paulo, Brazil, Jul-Aug 2010)

1. "Auctions" by Paul Milgrom.
2. "Networks" by Matthew Jackson.
3. "Non-cooperative games" by Shmuel Zamir.
4. "Game Theory and Democracy" by Steven Brams.

Teaching Workshops Attended:

Attended the Case Method Teaching Seminar, offered by Harvard Business Publishing and IIM Ahmedabad Case Centre, held at IIM Ahmedabad, during 17-18 October 2014.

Other Conferences and Workshops Attended:

1. FSTTCS 2005, The 25th Conference on Foundations of Software Technology and Theoretical Computer Science, International Institute of Information Technology, Hyderabad, India, December 15-18, 2005.
2. IRISS 2006, The 5th Annual Inter Research Institute Student Seminar in Computer Science, Indian Institute of Technology (IIT) Madras, Chennai, India, January 19-21, 2006.
3. FSTTCS 2006, The 26th Conference on Foundations of Software Technology and Theoretical Computer Science, Indian Statistical Institute (ISI) Calcutta, Kolkata, India, December 13-15, 2006.
4. Workshop on Algorithms for Data Streams, Indian Institute of Technology (IIT) Kanpur, India, December 18-20, 2006.
5. FSTTCS 2010, The 30th Conference on Foundations of Software Technology and Theoretical Computer Science, Institute of Mathematical Sciences (IMSc.), Chennai, India, December 15-18, 2010.
6. Workshop on Pseudorandomness, Chennai Mathematical Institute (CMI), Chennai, India, August 22-25, 2011.

Summer Internships:

- *National Informatics Centre, Bangalore* (May-July, 1997)
  Project: HTML to text converter.
- *Satyam Computer Services, Bangalore* (May-July, 1998)
  Project: Natural Language Processing.

Professional Activities: Reviewer of papers for the *International Game Theory Review (IGTR), Annals of OR (ANOR), IIMB Management Review, Asia-Pacific Journal of Operational Research (APJOR), Symposium on Theoretical Aspects of Computer Science (STACS), Pacific Asia Conference on Knowledge Discovery and Data Mining* (*PAKDD), International Computer Science Symposium in Russia (CSR)*; Organizer and/ or Program Committee Member for Conferences.