Sujit Prakash Gujar

CONTACT INFORMATION

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RESEARCH INTERESTS

Game Theory, Mechanism Design, Machine Learning

Deep learning and its application in Game Theory

Cryptographic and Game Theory, Blockchain Technology and Bitcoin

Applications of all the above to the modern web and AI applications (Auctions, Internet Advertising, Crowdsourcing, and multiagent systems)

CURRENT AFFILIATION

May 2016-Till Date
Currently I am an *Assistant Professor* at International Institute of Information Technology, Hyderabad. My current work involves designing learning mechanisms when the participating agents are strategic. I also work on designing secure combinatorial auctions, crowdsourcing, and Bitcoins.

POSTDOCTORAL FELLOWSHIP

November 2015 - April 2016.
I was Sr Research Associate with Prof Narahari, IISc.

January 2014 - October 2015.
I worked with Prof Boi Faltings, Artificial Intelligence Laboratory, École polytechnique fédérale de Lausanne (EPFL). I worked on Dynamic mechanism design, Secure Auction design, and Bitcoins during this period.
(Please refer to Appendix 2 for more details).

INDUSTRIAL RESEARCH

October 2018 – March 2019
Dunyalabs: Served as an Academic Advisory

January 2011-Nov 2013.
I worked as a **Research Scientist** at Xerox Research Centre, India (XRCI). I worked on *Enterprise crowdsourcing* where we explored opportunities for enterprises to leverage advantages of crowdsourcing proposed methodologies to enable it. This work lead to a pilot on Amazon Mechanical Turk (AMT). I also worked on *Marketplace for Compute Infrastructure* and *Economic Models for Cloud Computing*. My work at XRCI has resulted in 1 granted patent, 10 published patents, and 4 research publications.

I was Principal Investigator for Open Innovation project with Indian Institute of Science, Bangalore with title: *A Complex Systems Approach for Predictable Job Completion in Business Process Crowdsourcing* (January 2013 - November 2013).
(Please refer to Appendix 3 for more details).

EDUCATION

Ph.D. [2006 - 2011]
Department of Computer Science and Automation (CSA),
Indian Institute of Science (IISc), Bangalore.
Advisor: Prof Y Narahari.
Title: Novel Mechanisms for Allocation of Heterogeneous Items in Strategic Settings
(Received the best thesis award. For summary, please see Appendix)
CGPA: 6.9/8.0.

M.E., [2004 - 2006]
Department of Computer Science and Automation (CSA), IISc, Bangalore.
Thesis Title: Measures for Classification and Detection in Steganalysis
Thesis Supervisor: Prof. C. E. Veni Madhavan.
CGPA: 7.2/8.0 **Rank 1**

B.E. (ECE), [1997 - 2001], Govt. College of Engineering, Pune
GATE Score: 99.66 percentile

ACADEMIC HONORS AND RECOGNITION

- Senior Program Committee IJCAI-2021
- Program Committee Member AAAI-2021,20 IJCAI-2020,19,18,17,16 AAMAS-2020,19,18,17
- Recipient of **Alumni Medal** of IISc for the Best Doctoral Thesis in the Dept Computer Science and Automation, Indian Institute of Science, for the academic year 2012-13, March 2012.
- Recipient of Research Internship at Harvard University (Prof David C Parkes. Harvard EconCS Group, School of Engineering and Applied Sciences), (Summer 2009.)
- Recipient of Highly Competitive **Infosys Doctoral Fellowship** (2007-10).
- **Rank 1**, ME (Internet Science and Engineering), Department of Computer Science and Automation, IISc, 2004-2006 batch.
- GATE Score **99.66** percentile, MHRD Scholarship holder.
- Selected through **IIT JEE** (Joint Entrance Examination) for admission to IIT. (AIR 2255).
- 5^{th} position in **'Ganit Parangat'** state level (Maharashtra) examination.
  Ganit Paragat is Mathematical examination conducted at school level for testing mathematical abilities.

PUBLICATIONS

Journal Publications

1. Satyanath Bhat, Shweta Jain, Sujit Gujar and Y. Narahari, *"An Optimal Bidimensional Multi-Armed Bandit Auction for Multi-Unit Procurement"*. Annals of Mathematics and Artificial Intelligence, 2019, Volume 85(1), pp 1-19.
2. Shweta Jain, Sujit Gujar, Satyanath Bhat, Onno Zoeter and Y. Narahari, *"A Quality Assuring, Cost Optimal Multi-Armed Bandit Mechanism for Expertsourcing"* Artificial Intelligence, Volume

254, January 2018, pp 44-63.

3. Sujit Gujar and Y. Narahari, *"Optimal Multi-Unit Combinatorial Auctions"*. Operational Research, Volume 13, Issue 1, pp 27-46, April 2013.

4. Akash Das Sarma, Sujit Gujar, Y Narahari, *"Truthful Multi-Armed Bandit Mechanisms for Multi-Slot Sponsored Search Auctions"*, Current Science, Special Issue on Game Theory, Volume 103(9), pp 1064-1077, November 2012.

5. Sujit Gujar and Y. Narahari, *"Redistribution Mechanisms for Assignment of Heterogeneous Objects"*. Journal of Artificial Intelligence Research, Volume 41, pp 131-154, 2011.

6. Dinesh Garg, Y. Narahari, Sujit Gujar, *"Foundations of Mechanism Design: A Tutorial - Part 1: Key Concepts and Classical Results"*. Sadhana - Indian Academy Proceedings in Engineering Sciences, Volume 33, Part 2, pp 83-130, April 2008.

7. Dinesh Garg, Y. Narahari, Sujit Gujar, *"Foundations of Mechanism Design: A Tutorial - Part 2: Advanced Concepts and Results"*. Sadhana - Indian Academy Proceedings in Engineering Sciences, Volume 33, Part 2, pp 131-174, April 2008.

Book Chapters

8. Sujit Gujar and Boi Faltings, *"Auction Based Mechanisms for Dynamic Task Assignments in Expert Crowdsourcing Agent-Mediated Electronic Commerce"*. Designing Trading Strategies and Mechanisms for Electronic Markets: AMEC/TADA 2015 and AMEC/TADA 2016, New York, NY, USA, July 10, 2016, Revised Selected Papers 271 (2017): 50.

9. Y. Narahari and Sujit Gujar, *"Auctions in Electronic Commerce"*. Invited Book Chapter in: The Handbook of Technology Management, Volume III, pg 612-625, 2009. John Wiley and Sons.

Publications in Peer Reviewed Conferences and Workshops

10. Sanidhay Arora, Anurag Jain, Sankarshan Damle and Sujit Gujar *"ASHWAChain: A Fast, Scalable and Strategy-proof Committee-based Blockchain Protocol"* Workshop on Game Theory in Blockchain at WINE 2020. (GTiB@WINE'20).

11. Anurag Jain and Sujit Gujar Block Rewards, *"Not Transaction Fees Keep Miners Faithful In Blockchain Protocols"*. Workshop on Game Theory in Blockchain at WINE 2020. (GTiB@WINE'20).

12. Manisha Padala and Sujit Gujar, *"FNNC: Achieving Fairness through Neural Networks"*. To appear in the Proceedings of 29th International Joint Conference on Artificial Intelligence. (IJCAI'20).

13. Ganesh Ghalme, Swapnil Dhamal, Shweta Jain, Sujit Gujar and Y Narahari, *"Ballooning Multi-Armed Bandits"*. Adaptive and Learning Agents. (ALA@AAMAS'20).

14. Moin Hussain Moti, Dimitris Chatzolpoulos, Pan Hui, Boi Faltings and Sujit Gujar, *"Orthos: A Trustworthy AI Framework For Data Acquisition"*. The 8th International Workshop on Engineering Multi-Agent Systems. (EMAS@AAMAS'20).

15. Sankarshan Damle, Moin Hussain Moti, Praphul Chandra and Sujit Gujar, *"Designing Refund Bonus Schemes for Provision Point Mechanism in Civic Crowdfunding"*. The 2nd Games, Agents, Incentives Workshop. (GAIW@AAMAS'20).

16. Shoeb Siddiqui, Sujit Gujar, Ganesh Vanahalli, *"BitcoinF: Achieving Fairness For Bitcoin In Transaction Fee Only Model"*. To appear in Proceedings of in International Conference on Autonomous Agents and Multiagent Systems, 2020. (AAMAS'20).

17. Kumar Abhishek, Shweta Jain, Sujit Gujar, *"Designing Truthful Contextual Multi-Armed Bandits based Sponsored Search Auctions"*. To appear in Proceedings of in International Conference on Autonomous Agents and Multiagent Systems, 2020. (AAMAS'20).

18. Ganesh Ghalme, Swapnil Dhamal, Shweta Jain, Sujit Gujar, Yadati Narahari, *"Ballooning Multi-Armed Bandits"*. To appear in Proceedings of in International Conference on Autonomous Agents and Multiagent Systems, 2020. (AAMAS'20).

19. Anindya Pradhan, Easwar Subramanian, Sanjay Bhat, Praveen Paruchuri and Sujit Gujar, *"Rise of Algorithmic Trading in Todays Changing Electricity Market"*. India Smart Utility Week, 2020.

20. Dimitrios Chatzopoulos, Sujit Gujar, Boi Faltings and Pan Hui, *"Mneme: A Mobile Distributed Ledger"*. To appear in the proceedings of IEEE International Conference on Computer Communications, (INFOCOM'20).

21. Shweta Jain and Sujit Gujar, *"A Multiarmed Bandit Based Incentive Mechanism for a Subset Selection of Customers for Demand Response in Smart Grids"*. To appear in in the Proceedings of the thirty-forth AAAI conference on AI, 2020, (AAAI'20).

22. Susobhan Ghosh, Easwar Subramanian, Sanjay P. Bhat, Sujit Gujar and Praveen Paruchuri, *"Bidding in Smart Grid PDAs: Theory, Analysis and Strategy"*. To appear in in the Proceedings of the thirty-forth AAAI conference on AI, 2020, (AAAI'20).

23. Saurabh Ravindranath, Rahul Baburaj, Vineeth N. Balasubramanian, NageswaraRao Numburu, Sujit Gujar, C. V. Jawahar, *"Human Machine Collaboration for Face Recognition"*. In the proceedings of 7th ACM IKDD CoDS and 25th COMAD, 2020, (CoDS-COMAD'20), pp 10-18. (Best Paper Runner-up Award)

24. Moin Hussain Moti, Dimitris Chatzopoulos, Pan Hui, Sujit Gujar, *"FaRM: Fair Reward Mechanism for Information Aggregation in Spontaneous Localized Settings"*. In the Proceedings of 28^{th} International Joint Conference on Artificial Intelligence, pp 506-512, (IJCAI'19).

25. Sankarshan Damle, Moin Hussain Moti , Praphul Chandra and Sujit Gujar, *"Civic Crowdfunding for Agents with Negative Valuations and Agents with Asymmetric Beliefs"*. In the Proceedings of 28^{th} International Joint Conference on Artificial Intelligence, pp 208-214, (IJCAI'19).

26. Reza Hadi Mogavi, Sujit Gujar, Xiaojuan Ma and Pan Hui, *"HRCR: Hidden Markov-based Reinforcement to Reduce Churn in Question Answering Forums"*. In the Proceedings of 16^{th} Pacific Rim International Conference on Artificial Intelligence, pp 364-376. (PRICAI'19).

27. Sankarshan Damle, Boi Falting and Sujit Gujar, *"A Truthful, Privacy-Preserving, Approximately Efficient Combinatorial Auction For Single-minded Bidders"*. In the Proceedings of International Conference on Autonomous Agents and Multiagent Systems, pp 1916-1918, (AAMAS'19).

28. Sankarshan Damle, Moin Hussain Moti , Praphul Chandra and Sujit Gujar, *"Aggregating Citizen Preferences for Public Projects Through Civic Crowdfunding"*. In the Proceedings of International Conference on Autonomous Agents and Multiagent Systems, pp 1919-1921, (AAMAS'19).

29. Manisha Padala and Sujit Gujar, *"Thompson Sampling Based Multi-Armed-Bandit Mechanism Using Neural Networks*". In the Proceedings of International Conference on Autonomous Agents and Multiagent Systems, pp 2111-2113, (AAMAS'19).

30. Susobhan Ghosh, Easwar Subramanian, Sanjay P. Bhat, Sujit Gujar and Praveen Paruchuri, *"A Reinforcement Learning Based Broker Agent for a Power Trading Competition: Design and Performance"*.In the Proceedings of the 23^{th} AAAI conference on AI, 2019, pp 914-921, (AAAI'19).

31. Susobhan Gosh, Kritika Prakash, Sanjay Chandlekar, Easwar Subramanian, Sanjay Bhat, Sujit Gujar, and Praveen Paruchuri. *"Vidyutvanika: An autonomous broker agent for smart grid envi-*

ronment". In Policy, Awareness, Sustainability and Systems Workshop, vol. 7. 2019, (PASS'19)

32. Praveen Paruchuri and Sujit Gujar, *"Fusion of Game Theory and Big Data for AI Applications"*. In the Proceedings of the 6th International Conference on Big Data Analytics, 2018, pp 55-69, (BDA'18), (Invited Paper).

33. Dimitrios Chatzopoulos, Sujit Gujar, Boi Faltings and Pen Hui, *"Privacy Preserving and Cost Optimal Mobile Crowdsensing using Smart Contracts on Blockchain"*. 15th IEEE International Conference on Mobile Ad-hoc and Sensor Systems, (IEEE MASS'18).

34. Manisha Padala, C V Jawahar, Sujit Gujar, *"Learning Optimal Redistribution Mechanisms Through Neural Networks"*. To appear in the Proceedings of International Conference on Autonomous Agents and Multiagent Systems, pp. 345-353, (AAMAS'18).

35. Ganesh Ghalme, Sujit Gujar, Amleshwar Kumar, Shweta Jain and Y Narahari, *"Design of Coalition Resistant Credit Score Functions for Online Discussion Forums"*. In the Proceedings of International Conference on Autonomous Agents and Multiagent Systems, pp. 95-103, (AAMAS'18).

36. Praphul Chandra, Sujit Gujar and Y. Narahari, *"Referral-Embedded Provision Point Mechanisms for Crowdfunding of Public Projects"*. In the Proceedings of the 2017 International Conference on Autonomous Agents and Multiagent Systems, pp. 87-95, (AAMAS'17).

37. Ganesh Ghalme, Shweta Jain, Sujit Gujar, Y Narahari, *"Thompson Sampling Based Mechanisms for Stochastic Multi-Armed Bandit Problems"*. In the Proceedings of the 2017 International Conference on Autonomous Agents and Multiagent Systems, pp 642-650, (AAMAS'17).

38. Sujit Gujar and Boi Faltings, *"Dynamic Task Assignments for Expert Crowdsourcing: Theory and Empirical Evaluation"*. In the Proceedings of 22^{nd} European Conference on Artificial Intelligence (ECAI'16).

39. Praphul Chandra, Sujit Gujar and Y. Narahari, *"Crowdfunding Public Projects with Provision Point: A Prediction Market Approach"*. In the Proceedings of 22^{nd} European Conference on Artificial Intelligence ECAI'16.

40. Praphul Chandra, Sujit Gujar and Y. Narahari, *"Crowdsourced Referral Auctions"*. In the Proceedings of 22^{nd} European Conference on Artificial Intelligence (ECAI'16).

41. Dimitrios Chatzopoulos, Sujit Gujar, Boi Faltings and Pen Hui, *"LocalCoin: An Ad-hoc payment scheme for areas with high connectivity"*. In Proceedings of MobiHoc 2016.

42. Ganesh Ghalme, Shweta Jain, Sujit Gujar, Satyanath Bhat, and Y. Narahari, *"A Deterministic MAB Mechanism for Crowdsourcing with Logarithmic Regret and Immediate Payments"*. In Proceedings of the 2016 International Conference on Autonomous Agents and Multiagent Systems, pp 86-94, (AAMAS'16).

43. Satyanath Bhat, Shweta Jain, Sujit Gujar and Y Narahari, *"An Optimal Bidimensional Multi-Armed Bandit Auction"*. In Proceedings of the 2015 International Conference on Autonomous Agents and Multiagent Systems, pp. 1789-1790, (AAMAS'15).

44. Sujit Gujar and Boi Faltings, *"Auction Based Mechanisms for Dynamic Task Assignments in Expert Crowdsourcing"*. International Workshop on on Agent Mediated E-Commerce and Trading Agent Design and Analysis (AMEC/TADA'15), co-located with AAMAS 2015.

45. Sujit Gujar and Boi Faltings, *"Dynamic Task Assignments: An Online Two Sided Matching Approach"*. In proceedings of 3^{rd} International Workshop on Matching Under Preferences (MATCHUP'15).

46. Tridib Mukherjee, Partha Dutta, Vinay Hegde and Sujit Gujar *"RISC: Robust Infrastructure over Shared Computing Resources Through Dynamic Pricing and Incentivization"*. In Proceedings of

29^{th} IEEE International Parallel & Distributed Processing Symposium 2015. (IPDPS'15).

47. Bhat Satyanath, Swaprava Nath, Sujit Gujar, Onno Zoeter, Y. Narahari and Chris Dance, *"A mechanism to optimally balance cost and quality of labeling tasks outsourced to strategic agents"*. In Proceedings of the 2014 International Conference on Autonomous Agents and Multiagent Systems, pp. 917-924, (AAMAS'14).

48. Shweta Jain, Sujit Gujar, Onno Zoeter, and Y. Narahari, *"A quality assuring multi-armed bandit crowdsourcing mechanism with incentive compatible learning"*. In Proceedings of the 2014 International Conference on Autonomous Agents and Multiagent Systems, pp. 1609-1610, (AAMAS'14).

49. Dutta, Partha, Tridib Mukherjee, Vinay Hegde, and Sujit Gujar. *"C-Cloud: A Cost-Efficient Reliable Cloud of Surplus Computing Resources"*. In Cloud Computing (CLOUD), 2014 IEEE 7^{th} International Conference on Cloud Computing, pp. 986-987. IEEE, 2014 (CLOUD'14).

50. Shourya Roy, Chithralekha B and Sujit Gujar, *"Sustainable Employment in India by Crowdsourcing Enterprise Tasks"*. In Proceedings of the third annual Symposium on Computing for Development, (ACM DEV'13).

51. Mukherjee, Koustuv Dasgupta, Sujit Gujar, Gueyoung Jung and Haengju Lee, *"An Economic Model for Green Cloud"*. In the proceedings of 10th International Workshop on Middleware for Grids, Clouds and e-Science, (MGC'12).

52. Sujit Gujar and David Parkes, *"Dynamic Matching with a Fall-back Option"*. In the Proceedings 19^{th} European Conference on Artificial Intelligence, pp 263-268, 2010, (ECAI '10).

53. James Zou, Sujit Gujar and David Parkes, *"Tolerable Manipulability in Dynamic Assignment without Money"*. In the Proceedings 24th AAAI Conference on Artificial Intelligence, 2010, (AAAI '10).

54. Sujit Gujar, James Zou and David Parkes, *"Dynamic House Allocation"*. In the Proceedings of 5^{th} Multidisciplinary Workshop on Advances in Preference Handling, pp 43-48, 2010, (M-PREF '10).

55. Sujit Gujar and Y. Narahari, *"Redistribution Mechanisms for Assignment of Heterogeneous Objects"*. Formal Approaches to Multi-Agent Systems, Torino, Italy, (FAMAS'09)..

56. Sujit Gujar and Y. Narahari, *"Optimal Multi-Unit Combinatorial Auctions with Single Minded Bidders"*. The 11th IEEE Conference on Commerce and Enterprise Computing, pp 74-81, 2009, (CEC'09).

57. Sujit Gujar and Y Narahari, *"An Optimal Multi-Unit Combinatorial Procurement Auction with Single Minded Bidders"*. Managing Complexity in a Distributed World, a Centenary Conference of Division of Electrical Sciences, Indian Institute of Science, (MCDES'08).

58. Sujit Gujar and Y Narahari, *"Redistribution of VCG Payments in Assignment of Heterogeneous Objects"*. In Proceedings of the 4^{th} International Workshop on Internet and Network Economics, 2008, pp 438-445, (WINE'08).

59. Sujit Gujar and C E Veni Madhavan, "*Measures for Classification and Detection in Steganalysis"*. In Proceedings of 3^{rd} Workshop on Computer Vision, Graphics and Image Processing, pp. 210-214, January 2006, (WCGVIP'06).

PATENTS

Granted:

1. Methods And Systems for Regulating Service Layer Agreements for Multiple Cloud Services (US10210468B2)

2. Methods And Systems for Creating Tasks of Digitizing Electronic Document (US9652445B2)
3. Feedback Based Technique Towards Total Completion of Tasks in CrowdSourcing (US9727881B2)
4. Methods And Systems for Determining Computational Resource Requirement (US9678796B2)
5. Method And System For A Text Data Entry From An Electronic Document (US8867838B2)
6. Methods And Systems for Sharing Computational Resources (US9471369B2)

Published:

7. Cloud Computing Infrastructure (US20150134396)
8. Methods And Systems for Operating A Marketplace for Software Products (US20150088680)
9. Method and System for Recommending CrowdSourcability of a Business Process (US20140058784)
10. Method And System For Recommending One or More Crowdsourcing Platforms/Workforces for Business Workflow (US20150120350)
11. Methods And Systems for Crowdsourcing a Task (US20140358605)
12. Methods And Systems for Crowdsourcing of Tasks (US20160071048A1)
13. Method And System for Providing Access to CrowdSourcing Tasks (US20140304833)
15. Methods And Systems for Offline Processing of Tasks (US20160379315A1)

REVIEWER

Served as Reviewer
Conferences
WWW'19, ACM EC'15, FSTTCS'15, AAAI'14, WINE'12, Int. Conf. on Operational Research'12
Journals
Journal of AAMAS (JAAMAS), Games and Economic Behaviour (GEB), Artificial Intelligence (AI), Transaction of Mobile Computing (TMC), Machine Learning (MACH), Electronic Commerce Research and Applications (ECRA), European Journal of Operational Research (EJOR), Journal of Industry, Competition and Trade (JICT), IEEE Systems, Man and Cybernetics: Systems (SMC)

SUPERVISION OF STUDENTS

Doctorate Students

- Currently Supervising: Manisha Padala, Sankarshan Damle

Master's Students

- Currently Supervising: Kumar Abhisek, Siddiqui Shoeb Khaled, Kritika Prakash, Anurag Jain, Kanaparthy S V Samhita, Debojit Das, Sambhav Solanki (IIITH)
- Moin Hussain Moti, "
- Susobhan Ghosh, "Learning Strategies for Power Trading in Smart Grids" (July 2019, IIITH) (PhD @Harvard)
- Drissi El Kamili Souleimane."Better Patrolling Strategies to Detect Fare Invasion". (EPFL, Spring 2015)

- Supervised Drissi El Kamili Nassim. "Building Teams: A Co-operative Game Theory Approach And Scalable Solution". (EPFL, Spring 2015)
- Tasorn Sornnarong. "Dynamic Matching in Crowdsourcing Platform". (Optional Thesis at EPFL, Spring 2014)

Undergraduate Students

- Sanidhay Arora, "ASHWAChain – A Fast,Scalable and Strategy-proof Committee-based Blockchain Protocol". (IIITH, June19-May21)
- Ayush Deva, "MAB-based Subset Selection" (IIITH, May17-May20)
- Ganesh Vanahalli, "Bitcoin Protocol under Transaction Fee Only Model". (IIITH, July19-Nov19)
- Vedant Sareen, Deepanshu Garg, "Role of Game Theory in NLP" (IIITH, May-17-Apr19)
- Plancherel Nicolas Bernard Lucien. "Exploring Pay What You Want Strategy for Pricing A New Product in Monopolistic Market" (EPFL, Spring 2015)
- Mizraji Thomas. "Securing Auctions". (EPFL, Fall 2014)

Visiting Students

- Dimitrios Chatzopoulos (HKUST)
- Sahil Singh (IIT Kharagpur)
- Sneha Maheswari (IIT Roorkee)
- Teja Gowtham (University of Hyderabad)

TEACHING EXPERIENCE

Technical

- Data Structures and Algorithms (IIITH Spring'21)
- CSE512: Distributed Trust and Blockchains (IIITH Monsoon'20, '19,'18, Spring'18)
- CSE435: Advanced Computer Networks (IIITH Monsoon'20,'19,'18)
- CSE481: Optimization Methods (IIITH Spring'18,'17)
- CSE498: Introduction to Game Theory (IIITH Spring'21,'20,'19, Monsoon'17,16)
- CS715: Advanced Topics in Algorithmic Game Theory and Mechanism Design (EPFL Spring'15)
- Teaching Assistant for CS430: Intelligent Agents at EPFL (Fall 2014). and CS436: Computational Game Theory and Applications at EPFL (Fall 2014).

Non-Technical

- Human-Values-I (IIITH Monsoon'20,'16)
- Human-Values-II (IIITH Spring'20,17)

INDUSTRY EXPERIENCE

January 2011 - November 2013.
I worked as a research scientist in Xerox Research Center, India. (More details in appendix 3)

July 2001 - July 2004.
I worked as Software Engineer in PACE Soft Silicon Pvt. Ltd. During this period I acquired various skills such as programming for multiprocessor environment, cryptography, network security and multimedia related technologies. I got exposure to work with various embedded OS/ RTOS, (Real Time Operating Systems) on different platforms.

PROFESSIONAL TRAININGS RECEIVED

- "Introduction to University Teaching", École Polytechnique Fédérale de Lausanne, June 2015.
- "Effective Lecturing", École Polytechnique Fédérale de Lausanne, May 2015.
- "Teaching Toolkit", École Polytechnique Fédérale de Lausanne, March 2015.
- "Design for Lean Six Sigma (DfLSS) Software Systems", Green Belt. Xerox Research Centre India. April 2013.

COURSE WORK AT IISc

ME Courses (Grade)		**PhD Courses** (Grade)
Cryptography (**S**)	Game Theory(**S**)	Analysis-I (**S**)
Network Storage and Security.(**S**)	Design and Analysis of Algorithms(A)	Topology(A)
Data Structures(B)	E-commerce(**S**)	Linear Algebra(A)
Computational Methods of Optimization(A)	Computer Communication Network (A)	Topics in Approximation Algorithms(B)
Discrete Structures(A)	Pattern Recognition(B)	

(S Grade: 8/8; A Grade: 7/8; B Grade: 6/8)

Other Courses (Audit)

Stochastic Modeling and Applications, Topology-II, Discrete Structures, Analysis-II (Measure Theory), Topics in Graph Theory, Algebra and Computation, Modeling and Algorithms for Large Data Sets, Stochastic Approximation Algorithms, Convex Optimization (@EPFL)

APPENDIX 1

Summary of Doctoral Work

Novel Mechanisms for Allocation of Heterogeneous Items in Strategic Settings

Allocation of heterogeneous objects or resources to competing agents is a ubiquitous problem in the real world. For example, a federal government may wish to allocate different types of spectrum licenses to telecom service providers; a search engine has to assign different sponsored slots to the ads of advertisers; etc. The agents involved in such situations have private preferences over the allocations. The agents, being strategic, may manipulate the allocation procedure to get a favorable allocation. If the objects to be allocated are heterogeneous (rather than homogeneous), the problem becomes quite complex. The allocation problem becomes even more formidable in the presence of a dynamic supply and/or demand. Our thesis work is motivated by such problems involving strategic agents, heterogeneous objects, and dynamic supply and/or demand. In this thesis, we model such problems in a standard game theoretic setting and use mechanism design to propose novel solutions to the problems. We extend the current state-of-the-art in a non-trivial way by solving the following problems:

Mechanism Design with Money

- Optimal combinatorial auctions with single minded bidders, generalizing the existing methods to take into account multiple units of heterogeneous objects.

  In this work, we address designing of optimal combinatorial auctions. We extend the current art by proposing an optimal auction for procuring multiple units of multiple items when the bidders are single minded and capaciated. We develop a procurement auction that minimizes the cost of procurement while satisfying Bayesian incentive compatibility and interim individual rationality. Under appropriate regularity conditions, this optimal auction also satisfies dominant strategy incentive compatibility. The results presented here hold true for equivalent forward auction settings as well. We design an combinatorial procurement auction for the case of two item multi-unit case when single minded bidders are willing to offer volume discounts. We also, study design of optimal auction in the presence of XOR minded bidders who submit an XOR bid on two disjoint subsets of items.

- Multi-armed bandit mechanisms for sponsored search auctions with multiple slots, generalizing the current methods that only consider a single slot.

  Search engines display various ads on their sites whenever there is a search. Display of these ads occur through auctions, namely sponsored search auctions. In such auctions, the advertisers pay only if their ad receives a click. Thus, the probabilities of clicks, click through rates, (CTRs) play an important role in designing sponsored search auctions. However, typically, neither search engine nor the advertisers know the CTRs before hand. The search engine can learn the CTRs by displaying the ads from various advertisers over repeated auctions. The question we address in this work is how to design a truthful multi-slot sponsored search auction which learns CTRs.

- Strategy-proof redistribution mechanisms for heterogeneous objects, expanding the scope of the current state of practice beyond homogeneous objects.

  We study problem of designing redistribution mechanisms for assignment of p heterogeneous objects among n competing agents ($n > p$), each with unit demand. To measure a performance of a redistribution mechanism, we propose a redistribution index. Our main result states that, in general settings, no linear redistribution mechanism can have non-zero redistribution index. We propose two escape routes around this impossibility theorem. In first approach, we restrict the agents' valuations to the case of having scaling based relation, and designed an optimal redistribution mechanism with non-zero redistribution index. In second approach, we show an existence of non-linear redistribution mechanism with non-zero redistribution index if $n > 2p$. Moulin as well as Guo and Conitzer have designed an optimal redistribution mechanism for homogeneous object settings. We extend their linear redistribution mechanism into a non-linear redistribution mechanism, namely HETERO, that is applicable to homogeneous as well as heterogeneous settings. We conjecture that HETERO is optimal redistribution mechanism as well as redistribution index in heterogeneous settings is also same as homogeneous settings. Recently, it has been shown by Guo, that HETERO is indeed an optimal redistribution mechanism.

On-line Mechanisms without Money

- Dynamic stable matching in two sided markets.

  In their seminal work, Gale and Shapley addressed the college admission problem where colleges have preferences over students and the students have preferences over various colleges. They proposed an ingenious algorithm, deferred acceptance, for such two sided matching markets where monetary transfers are not feasible. This algorithm yields a stable matching and is strategy-proof for one side of the market. However, an inherent assumption here is that the all the agents are available. Consider the situation of campus recruitment or faculty recruitment where not all agents are simultaneously present, that is agents arrive dynamically. Any decision pertaining to a dynamic agent needs to be taken before he/she leaves the system. In the thesis, we generalize the deferred acceptance algorithm namely, GSODAS. The GSODAS is strategy-proof for static side of the market and always produces the stable matching. In general, stable matching is not possible in online settings. However, GSODAS uses the fallback option for the departing agents to achieve stability.

- Dynamic house allocation

  In the house allocation problem, each of a set of self-interested agents owns a distinct object (a house) and has strict preferences over houses. The problem is to find a reallocation of objects amongst agents that is robust against misreports of preferences by agents while identifying beneficial trades and without using money. The top-trading cycle algorithm (TTCA) by Shapley and Scarf is strategy-proof and finds an allocation in the core. An allocation in the core is stable. In the dynamic model of the house allocation problem discussed, each agent has an arrival period and a departure period and is only able to trade with other agents present simultaneously in the market at the same time. For a motivating example, consider college housing, with students on different leases and willing to trade during the month before their lease expires. Given TTCA, has very nice properties, it is natural to use TTCA as basic trading algorithm in online settings as well. We show that a naive usage of TTCA in online settings fails. We establish general conditions under which no mechanism in which an agent can influence the set of agents with which it participates in a TTCA (e.g., the period in which it trades and thus the other agents that it trades with) can be strategy-proof. Based on these conditions, we study partition mechanisms, in which each agent is assigned online to a group of agents with which it will engage in a single TTCA. We propose various partition mechanisms and experimentally shows that stochastic optimization based partition mechanism (SO-TTCA) performs quite well on rank-efficiency analysis.

- Dynamic allocation mechanisms for allocations of heterogeneous objects

  It has been shown that for allocation of goods to the agents, serial dictatorship is the only mechanism that is strategyproof. We study allocation of goods to dynamically arriving agents. We first show that, arrival-priority serial dictatorship (APSD) is the only strategyproof mechanisms for this problem and it performs poor on rank analysis. We propose a mechanism, namely Scoring Rule, (SR) which improves rank efficiency, but is manipulable. If every agent manipulates optimally, it reduces to APSD and hence we say it has tolerable manipulability.

APPENDIX 2

Summary of Post-Doctoral Work at EPFL 2014-15

- **Dynamic Mechanisms for Expert Crowdsourcing**
  Crowdsourcing marketplaces link large populations of workers to an even larger number of tasks. Thus, it is necessary to have mechanisms for matching workers with interesting and suitable tasks. Earlier work has addressed the problem of finding optimal workers for a given set of tasks. However, workers also have preferences and will stay with a platform only if it gives them interesting tasks. We therefore analyze several matching mechanisms that take into account workers' preferences as well. Towards this, we propose dynamic mechanisms with money and without money as well. We propose that the workers may pay premiums to get preferred matches and auction-based models where preferences are expressed through variations of the payment for a task. Following are our contributions:
  - Proposed notion of **premium** and auction based mechanisms (AMEC'15)
  - Proposed different dynamic mechanisms achieving different properties (AMEC'15, MATCHUP'15)
  - Introduced notion of **progressive stability** (MATCHUP'15)

- **Privacy Preserving Auctions**
  Privacy of bids in auctions is of utmost importance. In many settings bidders' interest in an item or bundle of items (bid topology) is also very sensitive information. We address the challenges in designing privacy preserving truthful combinatorial auction. Towards this, we propose VCG-SBB, an assignment mechanism based on Vickrey-Clarke-Groves (VCG) that satisfies strict budget balance (SBB). We demonstrate that a multi-agent system can protect the privacy of both, the bids and the bid topology in combinatorial Vickrey auctions. The proposed protocol PPVCG, privacy preserving Vickrey-Clarke-Groves (VCG) mechanism, obtains item assignments and payments through distributed computation. The key innovation is using a trusted third party (TTP) to validate the integrity of the computations while ensuring that this party learns nothing about the topology or amounts of the bids, except possibly the winning bid amounts. We prove that PPVCG implements VCG-SBB mechanism faithfully.

- **Localcoin**
  The popularity of digital currencies, especially cryptocurrencies, has been continuously growing since the appearance of Bitcoin. Bitcoin is a peer-to-peer (P2P) cryptocurrency protocol enabling transactions between individuals without the need of a trusted authority. Despite advances in mobile technology no cryptocurrencies have been proposed for mobile devices. This is largely due to the lower processing capabilities of mobile devices when compared with conventional computers and the poorer Internet connectivity to that of the wired networking. We propose *LocalCoin*, an alternative cryptocurrency that requires minimal computational resources, produces low data traffic and works with off-the-shelf mobile devices. LocalCoin replaces the *computational* hardness that is at the root of Bitcoin's security with the *social* hardness of ensuring that all witnesses to a transaction are colluders.

APPENDIX 3

Summary of Research Work at Xerox

We explored opportunities for enterprises to leverage advantages of crowdsourcing proposed methodologies to enable it. This work lead to a pilot on amazon mechanical turk. I also worked on *economic models for cloud computing*. Based on the work at XRCI, I have 1 granted patent, 10 published patents and 5 patents are under preparations. I co-authored 4 papers based on my work at XRCI. I was Principal Investigator for Open Innovation project (**Academic Collaboration**) with Indian Institute of Science, Bangalore with title: "A Complex Systems Approach for Predictable Job Completion in Business Process Crowdsourcing" (Jan13 - Nov13). At XRCI, I was involved in the following research projects.

- **Enterprise Crowdsouring** Enterprises are intrigued by advantages of crowdsoucing such as access to 24x7 on-demand, geographically distributed workforce with varying skills. However, at the same time, there are challenges regarding the quality, turn-around-time, privacy of data etc. At Xerox, we developed a technology that can leverage crowdsourcing for certain recurrent human intensive processes and at the same time ensures the quality of service. We had successfully completed a small pilot to demonstrate this technology. This work is published as "Sustainable Employment in India by Crowdsourcing Enterprise Tasks" at ACM DEV 2013. This work has resulted into 7 patents.
- **Marketplace for Compute Infrastructure (MCI)** It is well known that within big enterprises, lot of computing resources remain idle across different branches. We proposed and developed a preliminary proof-of-work, innovative marketplace for creating dynamic cloud infrastructure. At MCI, employees within an enterprise can share their idle resources with other employees to cater to their computational needs. Apart from security, there are many interesting research challenges like dynamic scheduling algorithm, incentives to the employees who share their resources, dynamic pricing for the requesters which is competitive over hiring a temporary cloud. This work has resulted into 3 papers and 4 patents.