Curriculum Vitae of Ranjan Pal, Ph.D

Contact Information	Sloan School of Management Massachusetts Institute of Technology 245, First St., Cambridge, MA 02142, USA	*Voice:* +1-617-258-7459 (Office: E94-1562) *E-mail:* ranjanp@mit.edu, ranjanpal9@gmail.com *Homepage:* https://mitmgmtfaculty.mit.edu/rpal/

Research Vision My research vision is to realize using the interplay of management science, applied mathematics, technology, and policy - an enterprise world where *every* inter-networked enterprise and their supply chain ecosystems can seamlessly and cost-effectively manage cyber risks, while being cyber resilient.

Academic Positions
Research Scientist, MIT Sloan School of Management, **MIT** [F[1]'2022 - Present]
Assistant Research Scientist, EECS, **University of Michigan Ann Arbor** [2019 - 2022]
**The grades of 'Research Scientist' form a ladder-track research faculty category in the USA.*

Affiliate Positions
Working Group Member (Cyber-Resilience), **World Economic Forum** [April 2023 - Present]
Affiliate, **Trust and Technology Initiative**, **University of Cambridge**, [F'2018 - F'2022]
Affiliate Faculty, **Michigan Institute for Data Science** (MIDAS) [F'2020 - SP'2022]

Research Appointments (Short Visits)
Indian Institute of Management Ahmedabad (Information Systems), SM'2022
Indian School of Business (Information Systems), CLMP Research Fellow, F'2022
Tsinghua University (Electrical Engineering), SM'2019
King's College London (Mathematical Sciences), SM'2019
Indian Institute of Technology Delhi (Computer Science, Management Studies) SM'2017
Indian Institute of Technology Delhi (Electrical Engineering), SM'2018
Indian Institute of Management Ahmedabad (Economics, Operations Research), SM'2018
University of Helsinki (Computer Science), SP'2018
Indian Institute of Technology Delhi (Computer Science, Management Studies) SM'2017
Indian Institute of Management Calcutta (Operations Research), SM'2017
Hong Kong University of Science and Technology (Computer Science), SM'2017

Research Focus *Solving complex, multi-disciplinary cybersecurity issues via computer, decision, & the data sciences.* I research on (systemic) cyber risk/resilience management in enterprises and their interdependent service networks built upon critical infrastructure driven by IT/IoT information systems. I pioneer mathematical/algorithmic theories guiding cyber-risk/resilience management for such enterprises; their supply chain ecosystems, and validate the theories using system simulation and survey science.

Postdoc Fellow (2015-2018) **University of Southern California** (ECE); Visiting Fellow **University of Cambridge** (CS)
Viterbi Fellow researching new QoS theory for energy (security) applications, and PII markets.

PhD Education **University of Southern California (USC)**, Los Angeles, California, USA, (2008-2014)

Ph.D. (December, 2014), Computer Science, Provost Ph.D. Fellow (Highest Graduate Honor)

- Thesis: *Improving Network Security Through Insurance: A Tale of Cyber-Insurance Markets*
- Thesis Advisors: Leana Golubchik (CS), Konstantinos Psounis (ECE)
- Other Committee Members: Viktor Prasanna (ECE), Minlan Yu (CS@Harvard University)

PhD Internships
Visiting Student Research Scholar (VSRC Program[2], **Princeton University (SEAS)**, 2010-2011
Research Intern, **Deutsch Telekom Labs, Berlin** (with Anja Feldmann/Pan Hui), SM'2011/12
Research Intern, **Ciena Corporation (Cyan SDN Division)** (with Zsolt Haraszti), SM'2013
Research Visitor, **Aalborg University (EE), SDR Team** (hosted by Ramjee Prasad), SM'2009

[1] SP - Spring, SM - Summer, F - Fall
[2] I studied content sharing economics with Mung Chiang & Vince Poor; had the privilege talking to John Nash.

Pre-Doctoral Education

University of California Davis, Davis, California, USA, (2005-2007)

M.S. (April, 2007), Computer Science, Graduate Fellow

- Research: *Load Balancing and Edge Criticality Ranking Schemes for Reliable Networking*
- Mentor: Chen-Nee Chuah (ECE)

National University of Singapore, MIT, Singapore/Cambridge (USA), (2004-2005)

M.S. (July, 2005), Computer Science, Singapore-MIT Alliance Fellow

- Research: *Optimal RAC-BCL2 Protein Docking Structures using Unsupervised Learning*
- Mentor: David Hsu (NUS), Tomas-Lozano Perez (MIT)

Birla Institute of Technology Mesra, Ranchi (India), (1998-2002)

B.E. (June, 2002), Computer Science and Engineering

- Research: *Fuzzy Linear Programming Methods to Optimize System Design and Performance*
- Mentor: Sandip Datta (BIT Mesra), Somprakash Bandyopadhay, Asim Pal (IIM Calcutta)

Pre-Doctoral Experience

Research Intern[3], **Aalborg University**, Denmark (Electrical Engineering, CTiF), SM'2008
Research Intern[4], **Indian Institute of Management Calcutta** (Operations Research), SM'2006
Research Intern[5], **Indian Institute of Management Calcutta** (Operations Research), SM'2001
Software Engineer, *Formal Verification Group*, **Cadence Design Systems**, Delhi NCR, 2002-2004

Teaching Activities

UMichigan (ECE) - Mathematical and Socio-Economic Methods for Cyber-Governance, F'2020/21
USC (CS) - Application of Cryptography to Information Security Problems, F'2016
IIT Delhi (EE, CS) - Game Theory Models for Distributed Network Optimization, SM'2017
IIT Delhi (DMS) - Game Theory Models for Corporate Decision Making, SM'2017
IIM Ahmedabad (IS, OR, Econ) - Network Game Theory, SM'2018
IIM Calcutta (IS, OR, Econ) - Network Game Theory, SM'2017
Teaching Assistant@USC (CS) - Analysis of Algorithms (Graduate), F'2010 - SP'2013

Vedic Astrology Education

Dev Jyotish, Gurgaon, India

Certification in *Introductory Vedic Astrology* (2023)

- Course Instructor: Dr. Richa Shukla (Professional Astrologer)

Certification in *Nakshatra Jyotish* (2023)

- Course Instructor: Dr. Richa Shukla (Professional Astrologer)

Certification (also a Teaching Assistant) in *Advanced Vedic Astrology* (2024)

- Course Instructor: Dr. Richa Shukla (Professional Astrologer)

Graduate Coursework

Analysis of Algorithms
Artificial Intelligence
Applied Cryptography
Computer Security and Data Privacy
Computer and Communication Networks
Cybersecurity
Distributed Systems
Mobile and Wireless Networks
Network Economics and Game Theory
Probability Theory and Its Applications

[3] Reliability analysis in Dynamic Spectrum Access (DSA) networks.
[4] Multi-objective mobile Internet traffic management using lexicographic (integer) optimization methods.
[5] (Fuzzy) linear programming and Analytic Hierarchy Process to optimize performance of networks and systems.

Stochastic Processes
Machine Learning and Graphical Models
Randomized Algorithms
Optimization Theory (for Real and Vector Spaces)
Economics of Information Security
Performance Modeling of Computer Information Systems
Enterpreneurship

Post-Graduate Honors (Selected)

Awarded CLMP Visiting Faculty Fellowship, Indian School of Business, 2022
Invited as a cyber-risk and cyber-insurance expert to the prestigious Dagstuhl Seminars, Germany, 2021
Awarded Viterbi Postdoctoral Fellowship from USC to conduct **independent research**, 2015
Among the TOP FIVE TAs in the Viterbi School of Engineering[6] at USC, AY: 2011-2012
5-Year Provost PhD Fellowship from USC, 2008 [Awarded to $\approx 5\%$ of all USC PhD entrants of 2008]
1-Year SMA Fellowship for MS study in EECS, jointly from MIT and NUS, 2004 [30/282 applicants awarded]
2-Year Graduate Fellowship from ECE@CMU for PhD study, 2008 (Declined)
2-Year Graduate Fellowship from CS@UC Irvine for PhD study, 2008 (Declined)
Scholarships for PhD Study in UMD College Park (ECE), IIM-Ahmedabad (OR), 2004 (Declined)
2-Year Graduate Scholarship from Columbia University (CS) to pursue MS studies, 2004 (Declined)

'Junior' Speaker

INFORMS Annual Meeting 2001 (**Three talks on Fuzzy-LP applications as a 3rd-year UG Student**)

Contributed Talks

INFORMS Annual Meeting 2001, 2020
SIAM Annual Meeting 2012, 2021
SIAM Conference on Financial Mathematics and Engineering 2012, 2021

Professional Memberships

Member of the IEEE
Member of the ACM
Member of the American Mathematical Society (AMS)
Member of the Game Theory Society
Member of the Society for Industrial and Applied Mathematics (SIAM)
Member of the Institute for Operations Research and Management Sciences (INFORMS)

Editorial Duties

Associate Editor - ACM Transactions on Management Information Systems [2020 - Current]

Professional Activities (Reviewer)

MIS Quarterly Executive
Nature Scientific Data
IEEE Transactions on Communications
IEEE Transactions on Parallel and Distributed Systems
IEEE Transactions on Mobile Computing
IEEE Transactions on Services Computing
IEEE Access
IEEE Transactions on Cloud Computing
IEEE Transactions on Network Science and Engineering
IEEE Journal on Selected Areas in Communications
Theoretical Computer Science (Elsevier)
European Journal of Operations Research (Elsevier)
Cambridge Data and Policy Journal (Cambridge University Press)
Performance Evaluation (Elsevier)
Oxford Journal of Cybersecurity
IEEE Transactions on Industrial Informatics
IEEE Transactions on Information Forensics and Security
IEEE Transactions on Sustainable Computing
IEEE Wireless Communications Letters
ACM Transactions on Management Information Systems

[6] Award received for *Analysis of Algorithms* (Graduate Level) offered by the Computer Science department.

ACM Transactions on Internet Technology
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies
ACM Journal on Digital Threats: Research and Practice
ACM SIGMETRICS
IEEE INFOCOM
IEEE ICDCS
AIS ICIS,
AIS AMCIS

INDUSTRY CONSULTING
Technical Advisor (Cyber-Risk Analysis) - **QxBranch LLC**, (2016 - 2019)
Technical Advisor (Cyber-Risk Analysis) - **Accel**, (2015-2015)

REGULATORY SERVICE
National Association of Insurance Commissioners (NAIC), USA - Invited Expert, 2016

UNIVERSITY SERVICE (2019-2024)

Massachusetts Institute of Technology, USA

1. Organizer, 2024 CAMS Workshop on Data Analytics for Supply-Chain Cyber-Resilience Management
2. Committee Member, CCIS 2023, 2024 (hosted annually by MIT CAMS and MIT Sloan)
3. Committee Member, Quarterly MIT CAMS OT/ICS Subgroup Meetings
4. Committee Member, MIT CAMS Annual Fall Workshop, 2023
5. Host and Coordinator, MIT CAMS Weekly Research Seminar Series

University of Michigan Ann Arbor, USA

1. Served on interview panels for incoming ECE faculty candidates
2. Served on non-evaluative interview panels for incoming university-wide faculty candidates
3. Served as judge for the College of Engineering (CoE) Hugh Rumler Award,
4. Served as judge for the College of Engineering (CoE) Engineering Research Symposium (ERS)
5. Served as a reviewer of applications for incoming Ph.D students
6. Served as a GRIN mentor
7. Served as an MWIN mentor

STUDENTS@MIT (RESEARCH)
Cynthia Zhang, **Electrical Engineering@EECS** (Ongoing)
Konnie Duan, **Computer Science@EECS, Minor in Finance@Sloan** (Ongoing)
Tilek Azkerbekov, **Mathematics, EECS** (Ongoing)
Lillian Bluestein, **Computer Science@EECS** (Ongoing)
Yaphet Lamiesa, **Computer Science@EECS** (Ongoing)
Darrenn Yao, **Computer Science@EECS** (Ongoing)

STUDENTS@UM (RESEARCH)
Peihan Liu **(Graduate School, Harvard (CS))**, *Declined* - Yale, UChicago, Cornell, NYU, USC
Yushi She **(Graduate School, GaTech (CS))**, *Declined* - USC, Cornell, Michigan
Rohan Sequeira **(Graduate School, Viterbi Fellow USC (ECE))** *Declined* - Purdue
Taoan Lu **(Graduate School, CMU (Mathematical Finance))**, *Declined* - NYU, Cornell, UMich, National University of Singapore, Nanyang Technological University, USC, Imperial College London
Zhehong Wu **(Graduate School, UofM (ECE))**, *Declined* - UIUC, Columbia, NYU, Northwestern, USC
Yifan Dong **(Graduate School, UofM (ECE))**, *Declined* - UC Berkeley, Georgia Tech, Cornell, UPenn, UCSD, USC, Columbia
Ziyuan Huang **(Graduate School, UofM (ECE))**, *Declined* - UC Berkeley, UCSD, Cornell
Xinlong Yin **(Graduate School, Georgia Tech (CS))** *Declined* - USC, UofM
Yixuan Wang **(Graduate School, CMU (CS))**, *Declined* - Columbia
Junhui Li **(Graduate School, CMU (CS))** *Declined* - USC
Harshith Nagubandi (MS Candidate, **transferred** to **Graduate School**, **UCSD (ECE))**
Vineeth Kotala **(Graduate School, UIUC (Mathematical Finance))**
Sanjana Prabhu **(Graduate School, CMU (ECE))**, *Declined* - Columbia, UMass Amherst
Charles Light **(Industry, Silicon Labs)**
Yufei Zhu **(Graduate School, UofM (ECE))**, *Declined* - UCSD

STUDENTS@USC/IIT Mentored Sung-Han Lin in his **CS** PhD (now at **Facebook/Meta**) with Leana Golubchik at USC.
Mentored Chien-Lun Chen in his **ECE** PhD (now at **Amazon**) with Leana Golubchik at USC.
Mentored Aditya Ahuja in his **CS** PhD (now at **TCS Research Labs**) with Vinay Ribeiro at IIT Delhi.

BOOK REVIEWING *Performance Modeling and Design of Computer Systems* - **Cambridge University Press**

TALK INVITATIONS (VENUE & TOPIC)

1. **American Insurance Group (AIG)**, Cambridge, USA - *Cyber-Risk Management*, 2024
2. **MIT Sloan School of Management**, Cambridge, USA - *Cyber-Resilience Optimization*, 2024
3. **Cybersecurity at MIT Sloan Members Meet**, Cambridge, USA - *Cyber-Resilience Metrics*, 2023
4. **Cybersecurity at MIT Sloan Medical SIG**, Cambridge, USA - *Cyber-Resilience Metrics*, 2023
5. **Academy of Hospital Administration**, Noida, India - *Hospital Cyber-Risk Management*, 2023
6. **Massachusetts Institute of Technology**, Cambridge, USA - *Cyber-Risk Management*, 2022
7. **Indian Institute of Management**, Ahmedabad, India - *Cyber-Risk Management*, 2022
8. **Indian School of Business**, Hyderabad, India - *Cyber-Risk Management*, 2022
9. **Indian School of Business**, Hyderabad, India - *Personal Data Markets*, 2022
10. **University of Michigan (*Tech for Social Good* Panelist)**-*Privacy Management*, 2020
11. **Schloss Dagstuhl**, Saarland, Germany - *Cyber-Risk Management*, 2021
12. **University of Michigan**, Ann Arbor, USA - *Privacy Management*, 2020
13. **INFORMS Business Analytics 2020**, Denver, USA - *Privacy Management*, 2020 **(Non-Contributed)**
14. **INFORMS Security 2020**, Monterey, USA *Cyber-Risk Management*, 2020 **(Non-Contributed)**
15. **INFORMS Security 2020**, California, USA - *Privacy Management*, 2020 **(Non-Contributed)**
16. **Google Cloud**, California, USA - *Resource Sharing Economics of Boutique Clouds*, 2020
17. **University of Cambridge**, Cambridge, UK - *Privacy Management*, 2018
18. **Alan Turing Institute**, London, UK - *Privacy Management*, 2018
19. **University of Oxford**, Oxford, UK - *Privacy Management*, 2018
20. **University College London**, London, UK - *Privacy Management*, 2018
21. **Imperial College**, London, UK - *Privacy Management*, 2018
22. **Tsinghua University**, Beijing, China - *Privacy Management*, 2019
23. **King's College London**, London, UK - *Privacy Management*, 2018
24. **King's College London**, London, UK - *Cyber-Risk Management*, 2018
25. **LSE**, London, UK - ***Invited Discussion*** *on Cyber-Security and Privacy Economics*, 2018.
26. **Queen Mary University of London**, London, UK - *Privacy Management*, 2018
27. **Nokia Bell Labs**, Helsinki, Finland - *Cyber-Risk Management*, 2018
28. **University of Southern California**, Los Angeles, USA - *Cyber-Risk Management*, 2017
29. **Hong Kong University of Science and Technology**, Hong Kong - *Cyber-Risk Management*, 2017
30. **Indian Institute of Technology**, Delhi, India - *Cyber-Risk Management*, 2019, 2018, 2017, 2016
31. **Indian Institute of Management**, Calcutta, India - *Cyber-Risk Management*, 2019
32. **Indian Institute of Management**, Ahmedabad, India - *Cyber-Risk Management*, 2018
33. **Michigan State University (Criminology)**, Lansing, USA - *Cyber-Risk Management*, 2017
34. **New York University**, New York, USA - *Cyber-Risk Management*, 2015
35. **IBM Research Labs**, India, USA - *Cyber-Risk Management*, 2014
36. **Deutsch Telekom Innovation Labs (T-Labs)**, California, USA - *Cyber-Risk Management*, 2013
37. **Ciena Corporation (Blue Planet Division)**, California, USA - *Cyber-Risk Management*, 2013
38. **Deutsch Telekom Innovation Labs (T-Labs)**, Berlin, Germany - *Cyber-Risk Management*, 2013

39. **Symantec Research Labs**, California, USA - *Cyber-Risk Management*, 2012
40. **Princeton University**, New Jersey, USA - *Cyber-Risk Management*, 2010
41. **EPFL**, Lausanne, Switzerland - *Smart Grid Pricing*, 2011
42. **Nokia-Siemens Networks/IST**, Lisbon, Portugal - *Cyber-Risk Management*, 2009

PUBLICATIONS (BUSINESS LEADERSHIP)

1. **R. Pal***, M. Siegel, and B. Nag: Three Action Items for Sustainable Cyber Insurance-Linked Securities Markets
Venue: *Forbes(I), August, 27*, 2024, Mentioned in **MIT Sloan in the News**.

2. **R. Pal***, M. Siegel, and B. Nag: Three Things Industrial Control System Enterprises Should Do to Boost Cyber-Resilience.
Venue: *Forbes(I), April, 11*, 2024, Mentioned in **MIT Sloan in the News**.

3. **R. Pal*** and B. Nag: Considering Insurance to Manage IoT-driven Catastrophic Cyber-Risk.
Venue: *Forbes(I), March, 22*, 2024, Mentioned in **MIT Sloan in the News**.

4. **B. Evans-Pritchard*** (quoted **R. Pal**): India Cyber Feels Reinsurance Capacity Pinch
Venue: *(Re)InAsia, March, 10*, 2024

5. **R. Pal***, B. Nag, and M. Siegel: Cyber-security Management Landscape of the Indian Automation Industry: Overview, Challenges, Action Points.
Venue: *Forbes(I), January, 10*, 2024, Mentioned in **MIT Sloan in the News**.

6. **A. Smith*** (quoted **R. Pal**): Customers Consider Dumping Carriers Over Data Concerns.
Venue: *Life Annuity Specialist, Financial Times, December, 4*, 2023

7. **R. Pal***, C. Zhang*, M. Siegel, and B. Nag: Why AI in Cybersecurity Needs to be Part of Business Strategy to Boost Resilience?
Venue: *Forbes(I), October, 6*, 2023, Mentioned in **MIT Sloan in the News**.

8. **R. Pal***, M. Rodriguez, and B. Nag: The Cyber-Insurance Vision is Failing for Ransomware Attacks in India.
Venue: *Forbes(I), September, 12*, 2023, Mentioned in **MIT Sloan in the News**.

9. **R. Pal*** and B. Nag: How Vedic Philosophies Can Help Boost Security in Indian Corporations
Venue: *Forbes(I), June, 12*, 2023, Mentioned in **MIT Sloan in the News**.

10. **R. Pal***, B. Nag, and S. Madnick: How Insurance-Linked Securities Can Improve Cyber-Security in India
Venue: *Forbes(I), May, 8*, 2023, Mentioned in **MIT Sloan in the News**.

11. **R. Pal***, and B. Nag: Five Ways Indian Medical Administrations Can Boost Hospital Cyber-Security.
Venue: *Forbes(I), April, 17*, 2023, Mentioned in **MIT Sloan in the News**.

12. **R. Pal***, and B. Nag: How Should Regulators Policy Cyber-Insurance for Indian Businesses?
Venue: *Forbes(I), February, 6*, 2023, Mentioned in **MIT Sloan in the News**.

13. **R. Pal***, and B. Nag: Vedas and Puranas Can Inspire Enterprises to Improve Cyber-Security Posture: A Cultural View of IT Security Governance in the Wake of AIIMS-like Cyber-Attacks.
Venue: *The Times of India, January, 5*, 2023

14. **R. Pal***, and B. Nag: Cyber-Politics Meets the Statecraft Game.
Venue: *The Times of India, October, 30*, 2022

15. **R. Pal***, B. Nag, and C. Light: Why Cyber-Security Should Be a Strategy in the Infinite Corporate Game.
Venue: *Forbes(I), October, 17*, 2022

16. **R. Pal***, and B. Nag: Cyber-Threat Information Sharing Cooperative: Need of the Hour.
Venue: *Forbes(I), September, 14*, 2022

17. **R. Pal***, and B. Nag: Seven Challenges Against Securing the Systemic Cyber-Space in the Industrial IoT Age.
Venue: *Forbes(I), July, 14*, 2022

18. **R. Pal***, B. Nag, and C-L. Chen: Seven Commandments of Privacy Governance in Information Capitalist Societies.
Venue: *Forbes(I), April, 5*, 2022

19. **R. Pal***, B. Nag*, C. Light, Y. Wang, D. Romero, J. Crowcroft, and K. Psounis: Behavioral Economics: Why Indian Urbanites May Transparently Sell Their Data.
Venue: *Forbes(I), February, 22*, 2022

20. **R. Pal***, B. Nag*, C. Landwehr*, J. Crowcroft, E. Hua, and T. Bandyopadhyay: Will Insurance Improve Cyber-Security Practice for Businesses?
Venue: *Forbes(I), January, 25*, 2022

21. **R. Pal***, J. Crowcroft*, M. Liu*, S. De*, and B. Nag*: In Defense of a Transparent Data Economy for Data Capitalism.
Venue: *Forbes(I), June, 22*, 2021

22. **R. Pal***, B. Nag*, J. Crowcroft*, M. Liu*, P. Ghosh*, and S. De*: Fixing the Data Economy, and Economic Inequality.
Venue: *The Financial Express, October 26,* 2021

23. **R. Pal***, B. Nag*, J. Crowcroft*, M. Liu*, P. Ghosh*, and S. De*:Few Are Averse to Sharing Personal Data.
Venue: *The Financial Express, October 27,* 2021

24. **R. Pal***, B. Nag*, and R. Sequeira*: It's Time for Cyber-Insurance to Become Personal in the WFH Age.
Venue: *Forbes(I), September, 28*, 2021

25. **R. Pal*** and B. Nag*: The Feasibility of Cyber-Risk Management to Ensure Social Good.
Venue: *Forbes(I), April, 30*, 2020

26. **R. Pal*** and B. Nag*: Only Appropriate Data.
Venue: *The Economic Times, November, 14*, 2019

27. **R. Pal*** and B. Nag*: Women Leadership in the Indian Corporate Sector: A Vedic Insight.
Venue: *The Economic Times, December 14, 2021*

28. **R. Pal***, S. Biswas, and B. Nag: Negative Runs Can Better the Commerce and Bat-Ball Fairness of T20s.
Venue: *The Times of India, July 24*, 2021

WEF Publications (World Economic Forum Articles)

1. **N. Perucica*** et.al. (contributed by **R. Pal**): Unlocking Cyber-Resilience in Industrial Environments: Five Principles
   Venue: *World Economic Forum, November, 27*, 2023

2. **K. Ukyab*** et.al. (contributed by **R. Pal**): Facilitating Global Interoperability of Cyber Regulations in the Electricity Sector
   Venue: *World Economic Forum, November, 18*, 2023

3. **K. Ukyab*** et.al. (contributed by **R. Pal**): Response to the White House's Request on Harmonizing Cybersecurity Regulations
   Venue: *World Economic Forum, October, 23*, 2023; Recommendations reached the White House.

Journal Publications

1. **R. Pal***, P. Liu, T. Lu, and E. Hua: How Hard is Cyber-Risk Management in IT and OT Systems? A Tale of Conquering the NP-Hardness of Insuring ICSs
   Venue: *ACM Transactions on Cyber-Physical Systems*, 2022, Vol. 6(4)

2. S. Zeijlemaker*, **R. Pal***, J. Proudfoot, M. Siegel, T. Delvecchio, M. Ishikawa, G. Kim, G. Bernardis, A. Wu: Identifying Strategic Control Gaps in Cyber Risk Management Through Simulation Gaming
   Venue: Under 'Revision', *MIS Quarterly Executive*, 2025.

3. **R. Pal***, X. Yin, R. Sequeira, S. Zeijlemaker, and V. Kotala: How Can Enterprises Quantify and Analyze (Multi-Party) Cyber-Risk in their Industrial IoT Network?
   Venue: *Accepted for publication in the ACM Transactions on Management Information Systems*, 2023.
   [Abstract in SIAM Conference in Financial Engineering 2021]

4. **R. Pal***, B. Nag, S. Madnick, M. Siegel, Y. She: Will Wall Street Solve the Cyber-Security Problem? A Tale of Catastrophe Bond Markets to Improve IT/OT Cyber-Security.
   Venue: Under 'Revision' in *ACM Transactions on MIS*, 2023.

5. **R. Pal***, R. Sequeira, Y. Zhu, A. Marotta, M. Siegel, and E. Hua: How Suboptimal is Work-From-Home Security in IT/OT Enterprises? A Strategic Organizational Theory for Managers.
   Venue: *Accepted for publication in the ACM Transactions on Management Information Systems*, 2022.

6. **R. Pal***, Z. Huang*, S. Lototsky, X. Yin, J. Crowcroft, M. Liu, S. De, N. Sastry, and B. Nag: Will Catastrophic Cyber-Risk Aggregation Thrive in the IoT Age?: A Cautionary Economics Tale for (Re)Insurers and Likes.
   Venue: *ACM Transactions on Management Information Systems*, 2021, Vol. 12(2)

7. **R. Pal***, K. Psounis, J. Crowcroft, P. Hui, J. Kelly, A. Kumar, A. Chatterjee, L. Golubchik, S. Tarkoma, N. Sastry, and B. Nag: When Are Cyber Blackouts in IT-Driven Service Networks Likely?: A Network Oblivious Theory for Cyber (Re)Insurance Feasibility.
   Venue: *ACM Transactions on Management Information Systems*, 2020, Vol. 11(4)
   Invited talk in **INFORMS Security, 2020, INFORMS Business Analytics 2020**

8. **R. Pal***, Z. Huang*, S. Lototsky, X. Yin, J. Crowcroft, M. Liu, S. De, N. Sastry, and S. Tarkoma: Aggregate Cyber-Risk Management in the IoT Age: Cautionary Statistics for (Re)Insurers and Likes.
   Venue: *IEEE Internet of Things Journal*, 2021, Vol. 8(9)

9. **R. Pal***, J. Li*, J. Crowcroft,, M. Liu, Y. Li, and N. Sastry: Privacy Risk is a Function of Information Type: Learnings for the Surveillance Capitalism Age.
   Venue: *IEEE Transactions on Network and Service Management*, 2021, Vol. 18(3)

10. C-L. Chen, **R. Pal**, and L. Golubchik: Achieving Transparency Report Privacy in Linear Time.
Venue: *ACM Journal of Data and Information Quality, 2021, Vol. 14(2)*

11. **R. Pal***, J. Crowcroft, Y. Wang, S. De, M. Liu, P. Hui, S. Tarkoma, A. Kumar, Y. Li, and B. Nag: Preference-Based Privacy Markets. [**Media Attention in The Economic Times**]
Venue: *Proceedings of the IEEE Access, 2020, Vol. 8* [**Invited Talk, INFORMS Security Conference, 2020**]

12. **R. Pal***, L. Golubchik, K. Psounis, and P. Hui: Differentiated Security Pricing as an Enabler of Cyber-Insurance - A First Look at a Markets Approach.
Venue**:** *IEEE Transactions of Dependable and Secure Computing*, 2019, Vol.16(2).

13. **R.Pal***, P. Hui, and V. Prasanna - On Privacy Engineering in the Smart Micro-Grid.
Venue**:** *IEEE Transactions on Knowledge and Data Engineering*, 2018, Vol.31(5)

14. **R. Pal***, L. Golubchik, and K. Psounis: On Robust Estimates of Correlated Cyber-Insured IT Risk. A First Take of Optimal AI-Based Estimates under 'Small' Data.
Venue**:** *ACM Transactions on Management Information Systems*, 2019, Vol 10(3).

15. **R.Pal***, L. Golubchik, K. Psounis, and P. Hui: Improving Cyber-Security via Profitable Insurance Markets.
Venue**:** *ACM SIGMETRICS Performance Evaluation Review*, 2018, Vol.45(4) **[Regular Paper]**

16. **R. Pal***, C. Chelmis*, M. Frincu, and V. Prasanna: Towards Dynamic Demand Response - On Efficient Consumer Grouping Algorithmics.
Venue**:** *IEEE Transactions on Sustainable Computing*, 2017, Vol 1(1).

17. **R. Pal***, N. Sastry, E. Obiodu, S. Prabhu, and K. Psounis: EdgeMart - A Networked OTT Economy on the Wireless Edge for Saving Multimedia IP Bandwidth.
Venue**:** *Accepted to Appear in ACM Transactions on Autonomous and Adaptive Systems*, 2023. **[Abstract in INFORMS Annual Meeting 2021]**.

18. A. Ahuja, V. Ribiero, and **R. Pal**: How Should We Regulate Cryptocurrencies by Consensus?: A Strategic Framework for Optimal Legal Transaction Throughput.
Venue: Accepted for Publication in *ACM Journal on Distributd Ledger Technologies*, 2022

19. **R. Pal***, C. Chelmis, M. Frincu, and V. Prasanna: MATCH for the Prosumer Smart Grid: The Algorithmics of Real-Time Power Balance.
Venue**:** *IEEE Transactions on Parallel and Distributed Systems*, 2016, Vol 27(12).

20. **R. Pal***, S-H. Lin*, A. Ahuja, A. Kumar, L. Golubchik, and A. J. Nachiketas: On the Economic Sustainability of Cloud Sharing Systems: Are Dynamic Single Resource Sharing Markets Stable?
Venue**:** *ACM SIGMETRICS Performance Evaluation Review*, 2019, Vol 46(4) **[Regular Paper]**.

21. **R. Pal***, S-H. Lin, A. Ahuja*, A. J. Nachikethas, A. Kumar, and L. Golubchik: Are Federated Cloud Sharing Systems Sustainable?: On Dynamic Sharing Markets and Their Stability.
Venue**:** *IEEE Transactions on Sustainable Computing*, Vol. 5(4), 2020

22. **R. Pal***, X. Yin, and L. Golubchik: Graphical Federated Cloud Sharing Markets
Venue**:** *IEEE Transactions on Sustainable Computing*, Vol. 6(4), 2021

23. **R. Pal***, and J. Crowcroft: Privacy Trading in the Surveillance Capitalism Age: Viewpoints on 'Privacy-Preserving' Societal Value Creation. [**Media Attention in the *Economic Times*, *Forbes***]
***Venue*:** *ACM SIGCOMM Computer Communication Review*, 2019, Vol.49(3)

24. **R. Pal*** and V. Prasanna: The STREAM Mechanism for CPS Security - The Case of the Smart Grid.
***Venue*:** *IEEE Transactions of Computer-Aided Design of Integrated Circuits and Systems*, 2016, Vol.36(4).

25. S-H. Lin*, **R. Pal***, B. Wang, and L. Golubchik: On a Market-Driven Hybrid P2P Video Streaming Approach.
***Venue*:** *IEEE Transactions on Multimedia*, 2016, Vol. 19(5).

26. **R. Pal*** and P. Hui: Economic Models for Cloud Service Markets: Pricing and Capacity Planning.
***Venue*:** *Theoretical Computer Science* (TCS), 2013, Vol 496.
Among Top 5 accessed TCS papers from 2010-2014

27. **R.Pal***, J. Mitra, and M. N. Pal: Evaluation of Relative Performance of Product Designs: A Fuzzy DEA Approach to Quality Function Deployment.
***Venue*:** *Journal of the Operational Research Society* (India), December 2007, Vol 44(4).
(Presentation in INFORMS Annual Meeting 2001, Undergraduate Research Award)

28. **R. Pal***, S. Kosta, and P. Hui: Settling for Less - A QoS Compromise Mechanism for Mobile Social Networks.
***Venue*:** *ACM SIGMETRICS Performance Evaluation Review*, 2011, Vol. 39(3). **[Short Paper]**

29. **R.Pal*** and P. Hui: Cyber-Insurance for Cyber-Security: A Topological Take on Modulating Insurance Premiums.
***Venue*:** *ACM SIGMETRICS Performance Evaluation Review*, 2012, Vol. 40(3). **[Short Paper]**

30. **R. Pal*** and L.Golubchik: On the Economics of Information Security: The Problem of Designing Optimal Cyber-Insurance Contracts.
Venue *- ACM SIGMETRICS Performance Evaluation Review*, 2010, Vol. 38(2). **[Short Paper]**

Conference Publications (Peer Reviewed)

1. C. Zhang*, **R. Pal***, C. Nicholson, and M. Siegel: (Gen)AI vs (Gen)AI in Industrial Control System Cybersecurity.
Venue: To Appear in the Proceedings of *Winter Simulation Conference* (an INFORMS event), 2024 (IEEE Press), Florida, USA.

2. **R. Pal*** and R. Sequeira: How Hard is it to Estimate Systemic Enterprise Cyber-Risk?
Venue: To Appear in the Proceedings of *Winter Simulation Conference* (an INFORMS event), 2024 (IEEE Press), Florida, USA.

3. **R. Pal***, K. Duan, R. Sequeira, and M. Siegel: Is Systemic Cyber Risk Management for Enterprises Sustainable?
Venue: To Appear in the Proceedings of *Winter Simulation Conference* (an INFORMS event), 2024 (IEEE Press), Florida, USA.

4. **R. Pal***, R. Sequeira, S. Zeijlemaker, and M. Siegel: Optimizing Cyber-Resilience in Critical Infrastructure Networks.
Venue: To Appear in the Proceedings of *Winter Simulation Conference* (an INFORMS event), 2024 (IEEE Press), Florida, USA.

5. S. Zeijlemaker*, **R. Pal**, and M. Siegel: Strengthening Managerial Foresight to Defeat Cyber Threats.
   Venue: To Appear in the Proceedings of *Americas Conference on Information Systems*, 2024 (AIS Press), Utah, USA.

6. **R. Pal*** and B. Nag: A Mathematical Theory to Price Cyber-CAT Bonds to Boost IT/OT Security.
   Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2023 (IEEE Press), Texas, USA.

7. **R. Pal***, R. Sequeira, S. Zeijlemaker, and M. Siegel: A Network Theory to Quantify and Bound Cyber-Risk in IT/OT Systems.
   Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2023 (IEEE Press), Texas, USA.

8. **R. Pal***, R. Sequeira, and M. Siegel: A Mathematical Theory to Quantify Cyber-Resilience in IT/OT Networks.
   Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2023 (IEEE Press), Texas, USA.

9. **R. Pal***, S. Madnick and M. Siegel: Trading in Catastrophe Bonds Can Boost Security Improving Cyber (Re-)Insurance Markets.
   Venue: In the Proceedings of *Americas Conference on Information Systems*, 2023 (AIS Press), Panama.

10. **R. Pal***, R. Sequeira*, Y. Zhu*, and Y. She: A Dynamic Theory of Security Free-Riding by Firms in the WFH Age
    Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2022 (IEEE Press), Singapore.

11. B. Nag* and **R. Pal**: Simulation Optimization for Supply Chain Decision Making
    Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2022 (IEEE Press), Singapore.

12. **R. Pal***, T. Lu*, P. Liu*, and X. Yin: Optimal Cyber (Re-)Insurance Policy Writing is NP-Hard in IoT Societies.
    Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2021 (IEEE Press), Phoenix, USA.

13. A. Ahuja, **R. Pal**, V. Ribiero, and L. Golubchik: A Regulatory System for Optimal Legal Transaction Throughput in Cryptocurrency Blockchains.
    Venue: Appeared in the *Conference on Information Systems and Technologies (CIST)*, 2021, Los Angeles, USA.

14. **R. Pal***, Y. Wang*, C. Light*, Y. Dong*, P. Ghosh, M. Liu, H. Nagubandi, L. Golubchik, S. De, and B. Nag: Do People Favor Personal Data Markets in a Surveillance Society? [**Media Attention in *Forbes*, *The Financial Express*,**][**Invited Talk, INFORMS Management Science Conference, 2022**]
    Venue: In Proceedings of *Winter Simulation Conference*, 2021 (IEEE Press), Phoenix, USA.

15. **R. Pal***, Z. Huang*, X. Yin, S. Lototsky, J. Crowcroft, and M. Liu: Sustainable Catastrophic Cyber-Risk Management in IoT Societies.
    Venue: In Proceedings of *Winter Simulation Conference* (an INFORMS event), 2020 (IEEE Press), Orlando, USA.

16. S-H. Lin*, **R. Pal***, M. Paolieri, and L. Golubchik: Performance Driven Resource Sharing Markets for the Small Cloud.
***Venue*:** In Proceedings of *IEEE ICDCS* 2017, Atlanta, USA.

17. **R. Pal***, L. Golubchik, K. Psounis, and P. Hui: Will Cyber-Insurance Improve Network Security? A Market Analysis. [**Media Attention in the *USC News Forbes*, *Wikipedia***]
***Venue*:** In Proceedings of *IEEE INFOCOM*, 2014, Toronto, Canada.

18. **R. Pal*** and L.Golubchik: Analyzing Self-Defense Investments in Internet Security Under Cyber-Insurance Coverage.
***Venue*:** In Proceedings of *IEEE ICDCS* 2010, Genoa, Italy.

19. S-H. Lin, **R. Pal***, B. Wang, and L. Golubchik: Sustaining Ad-Driven P2P Streaming Ecosystems - A Market-Based Approach.
***Venue*:** In Proceedings of *IEEE/ACM IWQoS*, 2015, Portland, USA, with ACM FCRC 2015.

20. **R. Pal***, C. Chelmis*, C. Tadepalli, M. Frincu, S. Aman, and V. Prasanna: On Online Time Series Clustering For Demand Response: A Theory to Break the "Curse of Dimensionality".
***Venue*:** In Proceedings of *ACM E-Energy*, 2015, Bangalore, India.

21. **R. Pal***, L. Golubchik, and K. Psounis: Aegis - A Novel Cyber-Insurance Model.
***Venue*:** In Proceedings of *ACM/GTS GameSec*, 2011, Maryland, USA.

22. **R. Pal*** and P. Hui: Modeling Investments in Internet Security - Tackling Topological Information Uncertainty.
***Venue*:** In Proceedings of ACM/GTS *GameSec*, 2011, Maryland, USA.

23. **R. Pal***, L. Golubchik, K. Psounis, and P. Hui: On A Way to Improve Cyber-Insurer Profits - When A Security Vendor Becomes the Cyber-Insurer.
***Venue*:** In Proceedings of *IFIP Networking*, 2013, New York, USA.

24. C. Leberknight*, **R. Pal***, M. Chiang, and H. V. Poor: The Sharing-Mart System - Online Digital Content Trading, Online Auctions,and Incentives.
***Venue*:** In Proceedings of *GameNets*, 2011, Shanghai, China.

25. **R. Pal*** and C-N.Chuah: Characterizing Link Importance in Multi-Channel, Multi-Radio, Multi-Rate Wireless Mesh Networks.
***Venue*:** In Proceedings of IEEE WCNC, 2008, Las Vegas, USA. **(Research during Masters)**

26. **R. Pal***: On the Reliability of Multi-Hop Dynamic Spectrum Access Networks Supporting QoS-Driven Applications.
***Venue*:** In Proceedings of *IEEE ICC,* 2007, Glasgow, Scotland. **(Solo Masters Research)**

27. **R. Pal***: On Wireless Social Community Network Routers - The Design and Cost-Sharing Problem for Better Deployment.
***Venue*:** In Proceedings of *IEEE GLOBECOM*, 2010, Miami, USA. **(Solo Masters Research)**[A Version appeared in *WWW SIMPLEX* 2012, Lyon, France]

28. **R. Pal***: A Lexicographic Load-Balanced Routing Scheme for Wireless Mesh Networks.
***Venue*:** In Proceedings of *IEEE ICC*, 2008, Beijing, China. **(Solo Masters Research)**

29. **R. Pal*:** Efficient Routing Algorithms for Multi-Channel Dynamic Spectrum Access Networks. ***Venue*:** In Proceedings of *IEEE Dyspan*, 2007, Dublin, Ireland. **(Solo Masters Research)**

30. S. Bandyopadhyay, M. N. Pal, D. Saha, T. Ueda, K. Hasuike, **R. Pal***: Improving System Performance of Ad Hoc Wireless Network with Directional Antenna.
***Venue*:** In Proceedings of *IEEE ICC*, 2003, Anchorage, USA. **(Undergraduate Research)**

Book Chapters

1. **R. Pal***: Cyber-Insurance Market
Venue: *Encyclopedia of Cryptography, Security, and Privacy*, **Springer Nature**, Eds. S. Jajodia, M. Yung, and P. Samarati. To Appear in 2025

2. B. Nag*, M. Devnani, and **R. Pal***: Navigating the Ethereal: Ethical Frameworks in AI for Healthcare.
Venue: *Advances in Artificial Intelligence for Healthcare Applications*, **CRC Press (Taylor and Francis)**, Eds. V. Anoop, S. Verma, and H. Pillai. To Appear in 2025

3. **R. Pal*** J. Mitra, and M. N. Pal: A Fuzzy-DEA Approach on Quality Function Deployment for Evaluation of Relative Efficiency of Product Designs.
Venue: *Theory and Applications of Productivity and Efficiency: Econometric and DEA Approach*, **Macmillan Publishers**, Eds. R. Ghosh and C. Neogi. 2005

Research Pitches (To Companies)

1. C. Zhang*, **R. Pal***, and M. Siegel: (Gen)AI vs (Gen)AI in Industrial Control System Cybersecurity
Venue: *MIT CAMS Annual CCIS Event, May, 15*, 2024

2. **R. Pal*** and M. Siegel: Quantifying and Optimizing ICS Cyber Resilience
Venue: *MIT CAMS Annual CCIS Event, May, 15*, 2024

3. S. Zeijlemaker*, G. Kim*, **R. Pal**, J. Proudfoot, M. Ishikawa, and M. Siegel: Identifying Strategic Control Gaps in Managing Cyber Risk Through Simulation Gaming
Venue: *MIT CAMS Annual CCIS Event, May, 15*, 2024

4. **R. Pal***, S. Madnick, and M. Siegel: Will Wall Street Solve the Cyber-Security Problem?
Venue: *MIT CAMS Annual CCIS Event, May, 11*, 2023

5. **R. Pal***, S. Zeijlemaker, and M. Siegel: APT Induced IT/OT Cyber-Risk Quantification
Venue: *MIT CAMS Annual CCIS Event, May, 11*, 2023

6. **R. Pal***, S. Zeijlemaker, and M. Siegel: A New FAIR Method to Boost Resilience in IT/OT Enterprise Infrastructures
Venue: *MIT CAMS Annual CCIS Event, May, 11*, 2023

7. **R. Pal***, C. Zhang, C. Nicholson, and M. Siegel: AI in Cyber-Security as a Business Strategy
Venue: *MIT CAMS Annual CCIS Event, May, 11*, 2023

8. **S. Zeijelmaker***, R. Pal, and M. Siegel: Perusing Watermelon Risks to Strengthen Cyber-Resilience
Venue: *MIT CAMS Annual CCIS Event, May, 11*, 2023

Funded Projects

1. **Liberty Mutual Insurance**: Strategic Agent-Based Cyber-Defense Mechanisms for Critical Infrastructure Graphs to Boost Resilience. *Funding Amount:* USD 350K (Ongoing), **Co-PI@MIT**

2. **German Cybersecurity Agency**: Graph-based Information Aggregation to Improve the Cyber-security Management in Critical Infrastructures. *Funding Amount:* USD 150K (Completed), **Co-PI@MIT** - received funding via *Asvin*, Germany

3. **US DOE (DE-EE0008003)**: Data Driven Modeling and Analytics for Enhanced System Layer Implementation. *Funding Amount:* USD 100,000,000 (Completed)

4. **NSF (CNS - 1637372)**: Safer Connected Communities Through Integrated Data Driven Modeling. Learning, and Optimization. *Funding Amount:* USD 199,984 (Completed)

5. **US DOE (DE-OE0000192)**: LADWP Smart Grid Regional Demonstration Project. *Funding Amount:* USD 120,560,000 (Completed)

6. **NSF (ACI 1339756)**: The XScala Project: A Community Repository for Model Driven Design and Tuning of Data-Intensive Applications for Extreme-Scale Accelerator-Based Systems. *Funding Amount:* USD 748,914 (Completed)

7. **NSF (CNS - 1616575)**: Network-Level Security Posture Assessment and Predictive Analytics: From Theory to Practice. *Funding Amount:* USD 499,982 (Completed)

8. **NSF (CNS - 1939006)**: Theory and Practice of Risk-Informed Cyber-Insurance Policies: Risk Dependency, Risk Aggregation, and Active Threat Landscape. *Funding Amount:* USD 199,997 (Completed)

9. **ARO (W911NF1810208)**: Multiscale Network Games of Competition and Collusion. *Funding Amount:* USD 100,000,000 (Completed)

Writings (Astrology)

1. **R. Pal*** and R. Shukla: A Simple Approach to demystify Timing of Events in Vedic Astrology. ***Venue:*** Medium, July 21, 2024. (**Original Research Article**)

2. **R. Pal*** and R. Shukla: A Simple Approach to Judge a Horoscope in Vedic Astrology. ***Venue:*** Medium, July 5, 2024.

3. **R. Pal*** and R. Shukla: Do You Have the Behavioral Aptitude for Vedic Astrology? A Guru Questions a Disciple from MIT. ***Venue:*** Medium, May 14, 2024.

4. **R. Pal*** and R. Shukla: Do You Have the Predictive Aptitude for Vedic Astrology? A Guru Questions a Disciple from MIT. ***Venue:*** Medium, May 14, 2024.

5. **R. Pal*** and R. Shukla: A Simplified Approach to Demystify the Navamsa (D9) Chart. ***Venue:*** Medium, November 09, 2023.

6. **R. Pal*** and R. Shukla: A Systematic Methodology to Analyse Career Strength in Vedic Astrology. ***Venue:*** Medium, September 22, 2023.

7. **R. Pal*** and R. Shukla: The 'Marriage' of Artificial Intelligence with the Vedic Astrology Business. ***Venue:*** Medium, September 10, 2023.