SANTOSH S. VENKATESH

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University of Pennsylvania
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Positions Professor of Electrical and Systems Engineering
Chair of the Faculty Grievance Commission
Former Chair of the Faculty Senate

Date/Place of Birth June 8, 1959 / Trichur, India

Citizenship Citizen of U.S.A.

Educational Background

Ph.D. in Electrical Engineering   *August 1986*
California Institute of Technology, Pasadena, California

M.S. in Electrical Engineering   *June 1982*
California Institute of Technology, Pasadena, California

B.Tech in Electrical Engineering with Distinction   *June 1981*
Indian Institute of Technology, Bombay, India

Professional Experience

Assistant/Associate/Full Professor   *September 1986–*
Department of Electrical and Systems Engineering
University of Pennsylvania, Philadelphia, Pennsylvania

Visiting Research and Teaching Fellow   *April 2013*
Aalto University, Espoo, Finland

Visiting Professor   *[July]: 2011–2019*
The Young India Fellowship
Ashoka University, Sonipat, India

Visiting Research and Teaching Fellow   *August 2002*
Department of Electrical Engineering
Helsinki University of Technology, Finland

Visiting Research Fellow   *August 1998*
Microsoft Research, Redmond, Washington

Visiting Associate Professor   *January 1994–December 1994*
Department of Electrical Engineering and Division of Computation and Neural Systems
California Institute of Technology, Pasadena, California

Visiting Research Fellow   *July 1992–August 1992*
AT&T Bell Laboratories, Murray Hill, New Jersey

Visiting Research Fellow   *June 1992–July 1992*
Siemens Corporate Research, Princeton, New Jersey

Visiting Research Fellow   *June 1990–July 1990*
AT&T Bell Laboratories, Holmdel, New Jersey

Graduate Research Assistant   *June 1982–August 1986*
Department of Electrical Engineering
California Institute of Technology, Pasadena, California

Graduate Teaching Assistant   *September 1981–May 1982*
Department of Electrical Engineering
California Institute of Technology, Pasadena, California

Computer Software Technician   *June 1980–September 1980*
Tata Research and Development Corporation, Bombay, India

Research Interests   Communication Networks, Neural Networks, Computational Learning Theory, Information Theory, Random Graphs and Algorithms, Probability Theory, Epidemiology, Mathematical Economics.

Teaching Experience

Courses taught at the California Institute of Technology:

CNS 124	Pattern Recognition

Courses taught at the University of Pennsylvania:

EE 213	Electrical Circuits and Systems
EE 214	Electrical Measurements
EE 224	Signals and Systems
ESE 301	Engineering Probability
ESE 325	Fourier Analysis and Applications
EE 414	Communication Science and Systems
EE 530	Statistical Communication Theory
ESE 530	Elements of Probability Theory
EE 532	Random Processes in Signal Processing
EE 630	Neural Computation, Complexity, and Learning
EE 674	Information Theory
ESE 674	Inequalities, Information, and Concentration of Measure
EE 730	Neural Networks
EE 899	Pattern Recognition
EE 899	Cryptography
ESE 899	Information Theory, Complexity, and Statistics
EMTM 580	Statistics
ENM 503	Introduction to Probability
Tcom 370	Principles of Data Communications
Tcom 501	Telecommunication Networks: Theory and Fundamentals

Asynchronous Learning:
Extensive on-line courses equipped with lecture notes, lecture slides, audio commentaries, lecture menus, and homework menus were developed for Tcom 501 (1997–1999) and EE 530 (1999–2000).

Penn Coursera:
Probability: The Theory of Chance, its Historical Context, and its Applications in the Modern World (2015). Top-rated MOOC.

Honors and Awards

Teaching Awards:

Christian R. and Mary F. Lindback Award for Distinguished Teaching, 2004.

The Lindback Awards are university-wide awards given in recognition of distinguished teaching. "Distinguished" teaching is teaching that is intellectually demanding, unusually coherent, and permanent in its effect.

S. Reed Warren, Jr. Award, 2018.
Presented by the undergraduate student body and the Engineering Alumni Society in recognition of outstanding service in stimulating and guiding the intellectual and professional development of undergraduate students.

Plenary Lecture:
Fourth Nordic Workshop on System and Network Optimisation for Wireless (SNOW), Ylls of Finnish Lapland, Finland, 2013.

Book Unveiling:
Invited lecture on *The Theory of Probability* given at the *Information Theory and Applications Workshop*, San Diego, CA, 2013.

Professional Societies/Institutes

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

International Neural Network Society (INNS)

David Mahoney Institute of Neurological Sciences

The Institute for Medicine and Engineering (IME)

Review Work:

- Foundations of Computational Mathematics
- IEEE Transactions on Information Theory
- IEEE Transactions on Circuits and Systems
- IEEE Transactions on Acoustics, Speech, and Signal Processing
- IEEE Transactions on Neural Networks
- IEEE Circuits and Systems Letters
- IEEE International Symposium on Information Theory
- IEEE Symposium on Neural Information Processing Systems
- International Joint Conference on Neural Networks
- Journal of Complexity
- Journal of Computer and Systems Sciences
- Journal of the Franklin Institute
- Journal of Machine Learning Research
- National Science Foundation
- Neural Computation
- Neural Networks
- Random Structures and Algorithms
- Workshop on Computational Learning Theory

Administration and Professional Service

University of Pennsylvania:

2022–2025	Undergraduate Advising Chair, ESE
2020–2023	Tri-Chair, Faculty Grievance Commission
2022–2023	Past-Chair, Faculty Grievance Commission
2021–2022	Chair, Faculty Grievance Commission
2020–2021	Chair-Elect, Faculty Grievance Commission
2020–2021	M&T Programme Review Committee
2020–2021	Faculty Senate Committee: Planning for Post-Pandemic Penn
2020–2021	Chair, Covid-19 Research & Academic Safety Reporting Committee
2020–2021	Provost's Advisory Committee: Online Learning
2020	Fall Teaching Task Force
2016–2019	Tri-Chair, University of Pennsylvania Faculty Senate
2018–2019	Past-Chair, University of Pennsylvania Faculty Senate
2017–2018	Chair, University of Pennsylvania Faculty Senate
2016–2017	Chair-Elect, University of Pennsylvania Faculty Senate
2018–2019	Trustees Budget and Finance Committee
2018–2019	Capital Council
2018–2019	Provost's Academic Planning and Budget Committee
2018–2019	Campaign for Community Committee (Tri-Chair)
2018–2019	Senate Nominating Committee
2016–2019	Senate Executive Committee
2016–2019	University Council
2016–2019	University Council Steering Committee (Chair 2017)
2016–2019	University Council Committee on Committees (Chair 2016)
2016–2019	Senate Committee on the Economic Status of the Faculty
2016–2018	Senate Committee on Students and Educational Policy
2016–2018	Senate Committee on Faculty and the Academic Mission
2016–2018	Senate Committee on the Faculty and the Administration
2016–2018	Senate Committee on Faculty Development, Diversity, and Equity
2016–2018	Senate Committee on Engagement with the Academic Mission
2016–2018	SEAS Dean's Practice Professor Track Committee
2016–2018	Penn Online Learning Initiative Faculty Advisory Committee
2016–2018	Provost's Penn Global Initiatives: India Working Group
2018	University Disciplinary Hearing Committee
2017	Consultative Committee for the Selection of a Provost
2016–2017	SEAS Dean's Penn Engineering Global Committee
2015–2016	University Senate Committee on Faculty and the Administration
2012–, *Chair* 2013–2015	University Senate Committee on Faculty and the Academic Mission
2013–2015	EE Curriculum Committee
2012–2013	AAU Undergraduate STEM Initiative Work Group
2012–2013	Ad Hoc SEAS Committee to Review Math Category Courses
2011–2013	Year of Proof Faculty Steering Committee
2007–2009	Advancing Women in Engineering (AWE) Advisory Committee
2006–2012, 2015–2016	Undergraduate Curriculum Chair, ESE Department
2006–2007	SEAS Advanced Placement Sub-Committee
2006–2009	SEAS Undergraduate Mathematics Committee
2005–2009	ABET Steering Committee
2005–2006	Lindback Awards Committee

1999–2003	EE Ph.D. Qualifying Examination Committee
1999–2000	University Student Disciplinary Committee
1998–2000	EE Faculty Search Committee
1998–2001	Undergraduate Curriculum Chair, CTE
1997–2001	Undergraduate Curriculum Chair, EE
1997–2001, 2006–2012, 2015–2016	SEAS Undergraduate Affairs Committee
1995–1997, 2002–2004	SEAS Faculty Council
1995–1997	EE Faculty Search Committee
1992–93	Chair, Undergraduate Curriculum Committee
1991–92	EE Chair Search Committee
1991–92	(Sub-Committee) Graduate Mathematics Courses
1990–91	Pender Award Search Committee
1990–91	Ramsey Chair Search Committee
1987–89, 92, 93, 97	EE Ph.D. Qualifying Examination Committee
1987–88	EE Graduate Curriculum Committee
1988	EE Qualifying Examination Ad Hoc Committee
1986–87, 93	Secretary, EE Faculty

Professional:

- Member of the Academic Council, Atria University, 2020–.

- Program Committee for IEEE Symposium on Neural Information Processing Systems, Denver, Colorado, November 1987–1991, 1993.

- Program Committee for Workshop on Computational Learning Theory, Pittsburgh, Pennsylvania, July 1992

- Program Committee for IEEE International Symposium on Information Theory, Washington, D.C., 2001.

- Ph.D. Opponent (External Examiner), Helsinki University of Technology, Espoo, Finland, 2004.

Students Supervised

Undergraduates: Senior theses/projects supervised

- Amarbir Jawanda: Fast Multiplication Algorithms (1991)

- Ryan Crowell: Acoustic Signal Processing (1996)

- Alok Kothari: Fingerprint Recognition (1998)

- Michael Shih: Asynchronous Learning Project—Tcom 501 On-Line (1998)

- Shinhwa Kim: Machine Translation from English to Korean via Automated Contextual Analysis (2001)

- Pranav Gupta: A Client-Server Model for Voice Recognition (2002)

- Kathryn E. Mcardle: DDoS Graphical Models and Analysis (independent research 2006).

- Anthony Rodriguez, Network Models for Financial Contagion, independent study, 2016.

- Andrew Connors, Ian Masters, and Anthony Rodriguez, *Pineapple Prodigy*. ESE senior design project, 2016–2017.

- Britney Dorval and Olivia Ly, *NeoNatalytics*. Co-advisors: Jay Zemel and Barbara Medoff–Cooper. ESE senior design project, 2017–2018.

- Amit Gupta, Luv Iyer, Mardia Mayank, *Monitoring Blood Pressure Using Wearables*. Co-advisor: James Weimer. ESE senior design project, 2109–2020.

- Abhi Bhandari, *The Effects of Zealots on a Profile-Based Ising Social Network*, independent research, 2020–2022.
- Yongzhe Zhu, *Contagion and Equilibria in Cross-Shareholding Financial Networks: Stochastic Block Models*. Co-advisor: Rakesh Vohra. Independent research, 2020–2022.
- Max Freeman, *Contagion and Equilibria in Cross-Shareholding Financial Networks: Regular Cliques*. Co-advisor: Rakesh Vohra. Independent research, 2020–2022.
- Mariana Luna, *Comparing and Contrasting Distinct Mathematical Models Used by Large Banks to Predict Stock Outcomes*, independent study, 2021.
- Adit Arora, Parth Daga, Cal Rothkrug, Durga Srivatsan, *Halftime: There's no luck in a winning strategy*. ESE senior design project, 2020–2021.

Graduate students supervised:

- Girish Pancha: Shaping Attraction Basins in Neural Networks (M.S. 1988)
- Sanjay Biswas: Analysis of Computational Capability of Sparse Associative Memory (Ph.D. 1992)
- Vineet P. Nene: Capacity Functions in Computational Learning (M.S. 1992)
- Joel Ratsaby: The Complexity of Learning from a Mixture of Labeled and Unlabeled Examples (Ph.D. 1994)
- Changfeng Wang: A Theory of Generalization in Learning Machines with Neural Network Applications (Ph.D. 1995)
- Shao C. Fang: Capacity and Complexity in Learning Binary Perceptrons (Ph.D. 1996)
- Selaka B. Bulumulla: Orthogonal Frequency Division Multiplexing (Ph.D. 1998)
- Jae Hyung Song: Pattern Classification of Ultrasound Images for Breast Cancer Detection (M.S. 2004)
- Hadi Afrasiabi (co-advisor with Roch Guérin): Decision Making in Networked Systems (Ph.D. 2016).
- Soheil Eshghi (co-advisor with Saswati Sarkar): Optimal Control of Epidemics in the Presence of Heterogeneity (Ph.D. 2016).
- Jungyeol Kim (co-advisor with Saswati Sarkar): An Epidemiological Diffusion Framework for Vehicular Messaging in Transportation Networks (Ph.D. 2022).

Books

1. S. S. Venkatesh, *The Theory of Probability: Explorations and Applications*. Cambridge, UK: Cambridge University Press, 2013, 829 pages.

Book Chapters

1. * D. Psaltis and S. S. Venkatesh, "Information Storage in Fully Interconnected Networks," in *Evolution, Learning, and Cognition*, (ed. Y. C. Lee). Teaneck, New Jersey: World Scientific, pp. 51–90, 1988. [***Invited chapter***.]
2. * S. S. Venkatesh, "Computation and Learning in the Context of Neural Network Capacity," in *Neural Networks for Perception*, (ed. H. Wechsler). New York: Academic Press, 1992. [***Invited chapter***.]
3. * G. Pancha and S. S. Venkatesh, "Feature and Memory Selective Error Correction in Neural Associative Memory," in *Associative Neural Memories: Theory and Implementation* (ed. M. H. Hassoun). New York: Oxford University Press, 1993. [***Invited chapter***.]

4. * S. S. Venkatesh, "Connectivity and Capacity in the Hebb Rule," in *Advances in Neural Networks*, (eds. A. Orlitsky, V. Roychoudhury, and S. Siu). New York: Kluver, 1995. [***Invited chapter***.]

Journal Articles

1. * D. Psaltis, S. S. Venkatesh, and E. G. Peak, "Optical Image Correlation with a Binary Spatial Light Modulator," *Optical Engineering*, vol. 23, no. 6, pp. 698-704, 1984. [***Invited paper***.]

2. R. J. McEliece, E. C. Posner, E. R. Rodemich, and S. S. Venkatesh, "The Capacity of the Hopfield Associative Memory," *IEEE Transactions on Information Theory*, vol. IT–33, pp. 461–482, 1987.

3. P. Baldi and S. S. Venkatesh, "Number of Stable Points for Spin Glasses and Neural Networks of Higher Orders," *Physical Review Letters*, vol. 58, pp. 913–916, 1987.

4. S. S. Venkatesh and D. Psaltis, "Binary Filters for Pattern Classification," *IEEE Transactions on Acoustics, Speech, Signal Processing*, vol. ASSP–37, pp. 604–611, 1989.

5. S. S. Venkatesh and D. Psaltis, "Linear and Logarithmic Capacities in Associative Neural Networks," *IEEE Transactions on Information Theory*, vol. IT–35, pp. 558–568, 1989.

6. S. S. Venkatesh, G. Pancha, D. Psaltis, and G. Sirat, "Shaping Attraction Basins in Neural Networks," *Neural Networks*, vol. 3, no. 6, pp. 613–624, 1990.

7. S. S. Venkatesh and P. Baldi, "Programmed Interactions in Higher-Order Neural Networks: Maximal Capacity," *Journal of Complexity*, vol. 7, no. 3, pp. 316–337, 1991.

8. S. S. Venkatesh and J. Franklin, "How Much Information Can One Bit of Memory Retain About a Bernoulli Sequence?" *IEEE Transactions on Information Theory*, vol. IT–37, pp. 1595–1604, 1991.

9. S. S. Venkatesh and P. Baldi, "Programmed Interactions in Higher-Order Neural Networks: The Outer-Product Algorithm," *Journal of Complexity*, vol. 7, no. 4, pp. 443–479, 1991.

10. S. S. Venkatesh and D. Psaltis, "On Reliable Computation with Formal Neurons", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 14, no. 1, pp. 87–91, 1992.

11. * S. S. Venkatesh, "The Science of Making *Erors*," *IEEE Transactions on Knowledge and Data Engineering*, vol. 4, no. 2, pp. 135–144, 1992. [***Invited paper***.]

12. S. S. Venkatesh, "Robustness in Neural Computation: Random Graphs and Sparsity," *IEEE Transactions on Information Theory*, vol. 38, no. 3, pp. 1114–1118, 1992.

13. S. S. Venkatesh, "Directed Drift: A New Linear Threshold Algorithm for Learning Binary Weights On-Line," *Journal of Computer and Systems Sciences*, vol. 46, no. 2, pp. 198–217, 1993.

14. S. S. Venkatesh and P. Baldi, "Random Interactions in Higher-Order Neural Networks," *IEEE Transactions on Information Theory*, vol. 39, no. 1, pp. 274–282, 1993.

15. I. Hu and S. S. Venkatesh, "On the Minimum Expected Duration of a Coin Tossing Game," *IEEE Transactions on Information Theory*, vol. 39, no. 2, pp. 581–593, 1993.

16. D. Psaltis, R. Snapp, and S. S. Venkatesh, "On the Finite Sample Performance of the Nearest Neighbour Algorithm," *IEEE Transactions on Information Theory*, vol. IT-40, pp. 820–837, 1994.

17. A. Orlitsky and S. S. Venkatesh, "On edge-colored interior planar graphs on a circle and the expected number of RNA secondary structures," *Discrete Applied Mathematics*, vol. 64, pp. 151–178, 1996.

18. S. C. Fang and S. S. Venkatesh, "Learning Binary Perceptrons Perfectly Efficiently," *Journal of Computer and Systems Sciences*, vol. 52, no. 2, pp. 374–389, 1996.

19. S. C. Fang and S. S. Venkatesh, "A Threshold Function for Harmonic Update," *SIAM Journal of Discrete Mathematics*, vol. 10, no. 3, pp. 482–498, 1997.

20. S. C. Fang and S. S. Venkatesh, "The Capacity of Majority Rule," *Random Structures and Algorithms*, vol. 12, pp. 83–109, 1998.

21. R. R. Snapp and S. S. Venkatesh, "Asymptotic Expansions of the k-Nearest Neighbor Risk," *Annals of Statistics*, vol. 26, no. 3, pp. 850–878, 1998.

22. * S. R. Kulkarni, G. Lugosi, and S. S. Venkatesh, "Learning Pattern Classification—A Survey," *IEEE Transactions on Information Theory, Special Commemorative Issue 1948-1998*, vol. 44, no. 6, pp. 2178–2206, 1998. [***Invited paper***.]

23. S. C. Fang and S. S. Venkatesh, "Learning Finite Binary Sequences from Half-Space Data," *Random Structures and Algorithms*, vol. 14, pp. 345–381, 1999.

24. S. B. Bulumulla, S. A. Kassam, and S. S. Venkatesh, "A Systematic Approach to Detecting OFDM Signals in a Fading Channel," *IEEE Transactions on Communications*, vol. 48, Issue 5, pp. 725–728, 2000.

25. J. H. Song, S. S. Venkatesh, E. A. Conant, P. H. Arger, C. M. Sehgal, "Comparative Analysis of Logistic Regression and Artificial Neural Network for Computer-Aided Diagnosis of Breast Masses," *Academic Radiology*, vol. 12, pp. 487–495, 2005.

26. S. S. Kunniyur and S. S. Venkatesh, "Threshold Functions, Node Isolation, and Emergent Lacunae in Sensor Networks," *IEEE Transactions on Information Theory*, vol. 52, no. 12, pp. 5352–5372, December 2006.

27. Z. Liu, S. S. Venkatesh, and C. C. Maley, "Sequence Space Coverage, Entropy of Genomes and the Potential to Detect Non-Human DNA in Human Samples," *BMC Genomics*, vol. 9, pp. 509–526, October 2008.

28. S. Khanna, S. S. Venkatesh, O. Fatemieh, F. Khan, and C. A. Gunter, "Adaptive Selective Verification: An Efficient Adaptive Countermeasure to Thwart DoS Attacks,"*IEEE Transactions on Networking*, vol. 20, issue 3, pp. 715–728, June 2012.

29. T. W. Cary, A. Cwanger, S. S. Venkatesh, E. F. Conant, and C. M. Sehgal, "Comparison of Naïve Bayes and Logistic Regression for Computer-Aided Diagnosis of Breast Masses Using Ultrasound Imaging," *Medical Imaging 2012: Ultrasonic Imaging, Tomography, and Therapy* (eds. Johan G. Bosch and Marvin M. Doyley), *Proceedings of SPIE*, vol. 8320, pp. 83200M-1 to 83200M-7, 2012.

30. G. Bouzghar, B. J. Levenback, L. R. Sultan, S. S. Venkatesh, A. Cwanger, E. F. Conant, and C. M. Sehgal, "Bayesian Probability of Malignancy With Breast Imaging Reporting and Data System Sonographic Features," *Journal of Ultrasound in Medicine*, vol. 33, pp. 641–648, 2014.

31. E. Hoque, R. Potharaju, C. Nita-Rotaru, S. Sarkar, and S. S. Venkatesh, "Taming Epidemic Outbreaks in Mobile Ad Hoc Networks," *Ad Hoc Networks*, vol. 24, part A, pp. 57–72, Elsevier, January 2015.

32. L. R. Sultan, G. Bouzghar, B. J. Levenback, N. A. Faizi, S. S. Venkatesh, E. F. Conant, and C. M. Sehgal, "Observer Variability in BI-RADS Ultrasound Features and Its Influence on Computer-Aided Diagnosis of Breast Masses," *Advances in Breast Cancer Research*, vol. 4, no. 1, 8 pages, January 2015 (http://dx.doi.org/10.4236/abcr.2015.41001).

33. S. Eshghi, M. H. R. Khouzani, S. Sarkar, N. B. Shroff, and S. S. Venkatesh, "Optimal Energy-Aware Epidemic Routing in DTNs," *IEEE Transactions on Automatic Control*, vol. 60, no. 6, pp. 1554–1569, June 2015.

34. S. S. Venkatesh, B. J. Levenback, L. R. Sultan, G. Bhouzghar, and C. M. Sehgal, "Going Beyond a First Reader: A Machine Learning Methodology for Optimizing Cost and Performance in Breast Ultrasound Diagnosis Using Adaptive Boosting and Selective Pruning," *Journal of Ultrasound in Medicine and Biology*, vol. 41, issue 12, pp. 3148–3162, December 2015.

35. S. Eshghi, M. H. R. Khouzani, S. Sarkar, and S. S. Venkatesh, "Optimal Patching in Clustered Epidemics of Malware," *IEEE/ACM Transactions on Networking*, vol. 24, no. 1, pp. 283–298, February 2016.

36. S. Eshghi, S. Sarkar, and S. S. Venkatesh, "Visibility-Aware Optimal Contagion of Malware Epidemics," *IEEE Transactions on Automatic Control*, vol. 62, issue 10, pp. 5205–5212, October 2017. Print ISSN: 0018–9286. Online ISSN 1558–2523. Digital Object Identifier: 10.1109/TAC.2016.2632426.

37. H. Afrasiabi, R. Guerin, and S. S. Venkatesh, "Opinion Formation in Ising Networks," *Online Social Networks and Media*, vol. 5, pp. 1–22, March 2018.

38. S. Eshghi, V. Preciado, S. Sarkar, S. S. Venkatesh, Q. Zhao, R. D'Souza, and A. Swami, "Spread, then Target, and Advertise in Waves: Optimal Budget Allocation Across Advertising Channels," *Transactions on Network Science and Engineering*, Print ISSN: 2327–4697, Online ISSN: 2327–4697, vol. 7, issue 2, October 2, 2018: Digital Object Identifier: 10.1109/TNSE.2018.2873281.

39. J. Kim, S. Sarkar, S. S. Venkatesh, M. Ryerson, and D. Starobinski "An Epidemiological Diffusion Framework for Vehicular Messaging in General Transportation Networks," *Transportation Research Part B: Methodological*, Special Issue on *Innovative Shared Transportation*, vol. 131, pp. 160–190, January 2020.

40. A. F. Moustafa, T. W. Cary, L. R. Sultan, S. S. Venkatesh, C. M. Sehgal, "Color Doppler Ultrasound Improves Performance of Machine Learning Diagnosis of Breast Cancer," *Diagnostics*, vol. 10, pp. 631–646, 2020: doi:10.3390/diagnostics10090631.

41. J. Kim, S. Sarkar, S. S. Venkatesh, M. S. Ryerson, D. Starobinski "An epidemiological diffusion framework for vehicular messaging in general transportation networks," *Transportation Research Part B: Methodological*, vol. 131, pp. 160–190, 2020.

42. Laith R. Sultan, Theodore W Cary, Maryam Al-Hasani, Mrigendra Bir Karmacharya, Santosh Venkatesh, Charles-Antoine Assenmacher, Enrico Radaelli, and Chandra M Sehgal, "Can sequential images from the same object be used for training machine learning models? A case study for detecting liver disease by ultrasound radiomics," *Artificial Intelligence*, vol. 3, pp. 739–750, September 2022: https://doi.org/10.3390/ai3030043

43. J. Kim, R. Saraogi, S. Sarkar, D. Starobinski, and S. S. Venkatesh, "Capturing the Spread of Information in Heterogenous V2X through Scalable Computation," *IEEE/ACM Transactions on Networking*, Print ISSN: 1063-6692, Online ISSN: 1558-2566, Digital Object Identifier: 10.1109/TNET.2023.3321836, in press.

44. V. Amelkin, S. S. Venkatesh, and R. Vohra, "Contagion and Equilibria in Diversified Financial Networks," *Journal of Economic Theory*, vol. 217, April 2024, DOI:10.1016/j.jet.2024.105819.

In the review cycle:

45. S. S. Venkatesh, A. DasGupta, and T. M. Sellke, "The Exact and Asymptotic Distributions of X mod k and Connections to Tauberian Theorems, Congruence Algebra, and Fourier Analysis," *Metrika: International Journal for Theoretical and Applied Statistics*, under revision.

Prepublication:

46. K. Dasaratha, S. S. Venkatesh, and R. Vohra, "Optimal Bailouts in Diversified Financial Networks," in preparation for submission to *Journal of Economic Theory*.

47. S. S. Venkatesh, "A Variation on the Littlewood-Offord Theme with Applications to Phase Transitions in CDMA Detection," in preparation for submission to *IEEE Transactions on Information Theory* (preprint available).

48. H. Afrasiabi, R. Guerin, and S. S. Venkatesh, "Spin Glasses with Attitude. Part I: The Emergence of Partisan Behaviour in Social Networks with Party Affiliations," in preparation for submission to *IEEE Transactions on Information Theory* (preprint available).

49. H. Afrasiabi, R. Guerin, and S. S. Venkatesh, "Spin Glasses with Attitude. Part II: Defections from the Party Line in Profile-Based Models of Social Interaction," in preparation for submission to *IEEE Transactions on Information Theory* (preprint available).

Other Articles

1. S. S. Venkatesh, "Remarks at Commencement by the Chair of the Faculty Senate: The Continuing Quest for Knowledge," *The Almanac of the University of Pennsylvania*, volume 63, issue 35, Supplement p. V, May 23, 2017.

2. S. S. Venkatesh, "Welcome Back From the Senate Chair: Knowledge as a Beacon,"*The Almanac of the University of Pennsylvania*, vol. 64, issue 2, August 29, 2017.

3. L. W. Perna, S. S. Venkatesh, and J. A. Pinto-Martin, "Five Tax Changes that will Hurt U.S. Higher Education: A Letter to Members of Congress from the Leaders of Penn's Faculty Senate," *Medium*, December 6, 2017: https://medium.com/@lauraperna1/five-tax-changes-that-will-hurt-u-s-higher-education-239072371409.

4. J. A. Pinto-Martin, S. S. Venkatesh, and L. W. Perna, "2018 Penn Teach-In: The Production, Dissemination, and Use of Knowledge, March 18–22," *The Almanac of the University of Pennsylvania*, volume 64, issue 26, March 13, 2018.

5. S. S. Venkatesh, "Report of the Chair of the Faculty Senate,"*The Almanac of the University of Pennsylvania: Supplements*, vol. 64, issue 34, May 8, 2018.

Patents

1. C. M. Sehgal, S. S. Venkatesh, and L. M. Sultan, *Machine Implemented Methods, Systems, and Apparatuses for Improving Diagnostic Performance*. US 2017/0140124 A1, published May 18. 2017.

Conferences

1. D. Psaltis, E. G. Paek, and S. S. Venkatesh, "Acousto-Optic/CCD Image Processor," *Proceedings of the International Optical Computing Conference*, MIT, Cambridge, Massachusetts, pp. 204–208, 1983.

2. S. S. Venkatesh and D. Psaltis, "Optimal Strategies for Information Storage and Retrieval in Associative Nets," *Workshop on Neural Network Models for Computing*, Santa Barbara, California, 1985.

3. R. J. McEliece, E. C. Posner, E. R. Rodemich, and S. S. Venkatesh, "The Capacity of the Hopfield Associative Memory," *Workshop on Neural Network Models for Computing*, Santa Barbara, California, 1985.

4. S. S. Venkatesh and E. C. Posner, "Capacity of Quantized Connections," *Third Caltech Workshop on Neural Networks*, Caltech, Pasadena, California, 1985.

5. R. J. McEliece, E. C. Posner, E. R. Rodemich, and S. S. Venkatesh, "Log Capacity and Linear Capacity," *Third Caltech Workshop on Neural Networks*, Caltech, Pasadena, California, 1985.

6. [†] S. S. Venkatesh, "Epsilon Capacity of Neural Networks," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1986; reprinted in *Neural Networks for Computing*, (ed. J. Denker). New York: AIP, 1986.

7. D. Psaltis, J. Hong, and S. S. Venkatesh, "Shift Invariance in Optical Associative Memories," in *Proceedings of SPIE: First Annual Symposium on Optoelectronics and Laser Applications*, Los Angeles, California, 1986.

[†]Participation at the Snowbird Conference on Neural Networks for Computing is by invitation.

8. † P. Baldi and S. S. Venkatesh, "Higher Order Spin Glasses and Neural Networks," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1987.

9. † S. S. Venkatesh and D. Psaltis, "Two-Stage Neural Networks with Arbitrary Associative Capacity and Selectively Programmable Error Correction," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1987.

10. * S. S. Venkatesh and P. Baldi, "Programmed and Random Interaction in Large 'Neural' Systems," *Sixth International Conference on Mathematical Modelling*, St. Louis, Missouri, August 1987. [*Invited paper*.]

11. P. Baldi and S. S. Venkatesh, "On Properties of Networks of Neuron-Like Elements," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1987; reprinted in *Neural Information Processing Systems*, (ed. D. Anderson). New York: AIP, 1988.

12. * S. S. Venkatesh, "Computation with Neural Networks," *Proceedings of the Ninth Annual Conference on Engineering in Medicine and Biology*, Boston, Massachusetts, 1987, pp. 1364–1365. [*Invited paper*.]

13. † S. S. Venkatesh and N. Engheta, "Neural Network Architectures Based on Wave Propogation with Individual Weight Controllability," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1988.

14. S. S. Venkatesh, D. Psaltis, and G. Sirat, "A Class of Spectral Algorithms for Neural Associative Memory," *IEEE International Symposium on Information Theory*, Kobe, Japan, June 1988.

15. S. S. Venkatesh and D. Psaltis, "A General Characterisation of Rotation-Invariant Image Classifiers," *IEEE International Symposium on Information Theory*, Kobe, Japan, June 1988.

16. † S. S. Venkatesh, "Computation and Learning with Binary Synapses; or, Why Binary Networks are All Right," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1989.

17. * S. S. Venkatesh, "It's OK to be a *BIT* Neuron," *IEEE/CAM Information Theory Workshop*, Cornell University, Ithaca, New York, July 1989. [*Invited paper*.]

18. * S. S. Venkatesh, "On Computability and Learnability in Neural Models," *Scientific Computing and Automation Conference and Exposition*, Philadelphia, Pennsylvania, October 1989. [*Invited paper*.]

19. S. S. Venkatesh, "What is the Capacity of One Bit of Memory?," *IEEE International Symposium on Information Theory*, San Diego, California, January 1990.

20. S. S. Venkatesh, "Computation and Learning in Neural Networks with Binary Weights," *IEEE International Symposium on Information Theory*, San Diego, California, January 1990.

21. S. S. Venkatesh and D. Psaltis, "Error Tolerance and Neural Capacity," *IEEE International Symposium on Information Theory*, San Diego, California, January 1990.

22. * S. S. Venkatesh, "How Much Dynamic Range in Synapses do we *Really* Need?" *Workshop on Optical Neural Networks*, Jackson, Wyoming, February 1990. [*Invited paper*.]

23. † S. S. Venkatesh, D. Psaltis, and C. Ji, "The Science of Making Errors—and Implications to Learning," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1990.

24. * S. S. Venkatesh, "Folklore and Mathematics in Neural Computation," *IEEE Workshop on Information Theory*, Veldhoven, the Netherlands, June 1990. [*Invited paper*.]

25. * S. S. Venkatesh, "No Defunct Nets," *Workshop on Neural Information Processing Systems*, Keystone, Colorado, November 1990. [*Invited paper*.]

26. R. Snapp, D. Psaltis, and S. S. Venkatesh, "Asymptotic Slowing Down of the Nearest Neighbour Classifier," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1990; reprinted in *Advances in Neural Information Processing Systems 3*, (eds. R. P. Lippman, J. E. Moody, and D. S. Touretzky). San Mateo, California: Morgan Kaufmann, 1990.

27. S. Biswas and S. S. Venkatesh, "The Devil and the Network: What Sparsity Implies to Robustness and Memory," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1990; reprinted in *Advances in Neural Information Processing Systems 3*, (eds. R. P. Lippman, J. E. Moody, and D. S. Touretzky). San Mateo, California: Morgan Kaufmann, pp. 883–885, 1990.

28. [†] S. S. Venkatesh, "Probabilistic Algorithms for On-Line Learning in a Binary Weight Setting," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1991.

29. [†] S. Biswas and S. S. Venkatesh, "Robustness and the Design of Codes for Sparsely Interconnected Networks," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1991.

30. [*] S. S. Venkatesh, "Probabilistic Capacity and Links to Distribution Dependent Learning," *Workshop on Theoretical Issues in Neural Nets*, Center for Discrete Mathematics and Theoretical Computer Science, Rutgers University, May 1991. [**Invited paper**.]

31. S. S. Venkatesh, "On Learning Binary Weights for Majority Functions," *Workshop on Computational Learning Theory*, University of California, Santa Cruz, California, August 1991; reprinted in *Proceedings of the Fourth Workshop on Computational Learning Theory*, (eds. L. G. Valiant and M. K. Warmuth). San Mateo, California: Morgan Kaufmann, 1991.

32. [†] J. Ratsaby and S. S. Venkatesh, "Learning Classification with a Small Number of Labelled Examples," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1992.

33. [†] S. Fang, S. S. Venkatesh, and C. Wang, "On-Line, Batch, and Off-Line Learning in a Binary Weight Setting," *Conference on Neural Networks for Computing*, Snowbird, Utah, April 1992.

34. S. S. Venkatesh, R. Snapp, and D. Psaltis, "Bellman Strikes Again!—the Growth Rate of Sample Complexity with Dimension for the Nearest Neighbour Classifier," *Workshop on Computational Learning Theory*, University of Pittsburgh, Pittsburgh, Pennsylvania, July 1992; reprinted in *Proceedings of the Fifth Workshop on Computational Learning Theory*. Baltimore, Maryland: ACM Press, pp. 93–102, 1992.

35. J. Ratsaby and S. S. Venkatesh, "Learning with Few Labelled Examples," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1992.

36. I. Hu and S. S. Venkatesh, "On the Minimum Expected Duration of a Coin Tossing Game," *IEEE International Symposium on Information Theory*, San Antonio, Texas, January 1993; reprinted in *Proceedings 1993 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1993.

37. D. Psaltis, R. Snapp, and S. S. Venkatesh, "On the Finite Sample Performance of the Nearest Neighbour Classifier," *IEEE International Symposium on Information Theory*, San Antonio, Texas, January 1993; reprinted in *Proceedings 1993 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1993.

38. S. C. Fang and S. S. Venkatesh, "On the Average Tractability of Binary Integer Programming and the Curious Transition to Perfect Generalisation in Learning Majority Functions," *Workshop on Computational Learning Theory*, University of California, Santa Cruz, California, July 1993; reprinted in *Proceedings of the Sixth Workshop on Computational Learning Theory*. Baltimore, Maryland: ACM Press, 1993.

39. [*] B. Sarath and S. S. Venkatesh, "Auditor Liability for Management Fraud," *Fifth Annual Conference on Intelligent Systems in Accounting, Finance, and Management*, Palo Alto, California, November 1993. [**Invited paper**.]

40. C. Wang, S. J. Judd, and S. S. Venkatesh, "When to Stop: On Optimal Stopping and Effective Machine Size in Learning," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1993.

41. S. S. Venkatesh, "On Approximations of Functions by Depth-Two Neural Networks," *IEEE International Symposium on Information Theory*, Trondheim, Norway, June 1994; reprinted in *Proceedings 1994 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1994.

42. R. R. Snapp and S. S. Venkatesh, "Asymptotic Predictions of the Finite-Sample Risk of the k-Nearest Neighbor Classifier," *Proceedings of the 12th International Conference on Pattern Recognition*, vol. 2, pp. 1–7. Los Alamitos, California: IEEE Computer Society Press, 1994.

43. C. Wang and S. S. Venkatesh, "Machine Size Selection for Optimal Generalisation," *Workshop on Applications of Descriptional Complexity to Inductive, Statistical, and Visual Inference*, New Brunswick, New Jersey, July 1994.

44. C. Wang and S. S. Venkatesh, "Temporal Dynamics of Generalization in Neural Networks," *Conference on Neural Information Processing Systems*, Denver, Colorado, November 1994; reprinted in *Advances in Neural Information Processing Systems 7*, (eds. D. S. Touretzky, G. Tesauro, and T. K. Leen). Cambridge, MA: MIT Press, p. 263, 1995.

45. J. Ratsaby and S. S. Venkatesh, "Learning from a Mixture of Labelled and Unlabelled Examples with Parametric Side-Information," *Workshop on Computational Learning Theory*, University of California, Santa Cruz, California, July 1995; reprinted in *Proceedings of the Eighth Annual Workshop on Computational Learning Theory*. Baltimore, Maryland: ACM Press, 1995.

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47. R. R. Snapp and S. S. Venkatesh, "k-Nearest Neighbors in Search of a Metric," *IEEE International Symposium on Information Theory*, Whistler, Canada, September 1995; reprinted in *Proceedings 1995 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1995.

48. C. Wang, S. S. Venkatesh, and J. S. Judd, "Optimal Stopping and Effective Machine Complexity in Learning," *IEEE International Symposium on Information Theory*, Whistler, Canada, September 1995; reprinted in *Proceedings 1995 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1995.

49. S. C. Fang and S. S. Venkatesh, "On Batch Learning in a Binary Weight Setting," *IEEE International Symposium on Information Theory*, Whistler, Canada, September 1995; reprinted in *Proceedings 1995 IEEE International Symposium on Information Theory*. Piscataway, New Jersey: IEEE Press, 1995.

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51. S. B. Bulumulla and S. S. Venkatesh, "On the Quantized Decorrelating Detector," *Conference on Information Sciences and Systems*, Princeton University, Princeton, New Jersey, March 1996.

52. * S. C. Fang and S. S. Venkatesh, "Learning Finite Binary Sequences from Half-Space Data," in *Proceedings of the International Conference on Neural Networks*, Perth, Australia, November 1996. [***Invited paper***.]

53. * S. S. Venkatesh, "Finite Sample Effects in Pattern Recognition," *Workshop on Computational Learning*, Australian National University, Canberra, Australia, December 1996. [***Invited paper***.]

54. S. B. Bulumulla, S. A. Kassam, and S. S. Venkatesh, "Optimum and Sub-Optimum Receivers for OFDM Signals in Rayleigh Fading Channels," *Conference on Information Sciences and Systems*, Johns Hopkins University, Baltimore, Maryland, March 1997.

55. S. B. Bulumulla, S. A. Kassam and S. S. Venkatesh, "An Adaptive Diversity Receiver for OFDM in Fading Channels," *International Conference on Communications*, pp. 1325–1329, 1998.

56. S. B. Bulumulla, S. A. Kassam and S. S. Venkatesh, "Pilot Symbol Assisted Diversity Reception for a Fading Channel," *International Conference on Acoustics, Speech, and Signal Processing*, 1998.

57. * S. S. Venkatesh, "Information Storage in Finite Memory," *Workshop on Randomised Algorithms*, Centre for Discrete Mathematics and Theoretical Computer Science, Rutgers University, November 1999. [**Invited paper**.]

58. * S. S. Venkatesh, J. S. Judd, and L. Gurvits, "Lookahead Complexity," *Workshop on Probabilistic Graph Theory*, Special Year on Graph Theory and Combinatorial Optimization, Fields Institute of Mathematical Sciences, University of Toronto, February 14–19, 2000. [**Invited paper**.]

59. * S. S. Venkatesh, "CDMA Capacity," *2000 Conference on Information Sciences and Systems*, Princeton University, March 15–17, 2000.

60. * S. S. Venkatesh and J. Ratsaby, "On Partially Blind Learning Complexity," *Special Session on Statistical Learning, ISCAS 2000*, Geneva, pp. 765–768, May 28–31, 2000. [**Invited paper**.]

61. * S. S. Venkatesh and C. Wang, "On the Generalisation Process in Learning: Approximation Error, Effective Complexity, and Optimal Stopping," *Joint International Meeting of the American Mathematical Society and the Hong Kong Mathematical Society*, Special Invited Session on The Mathematics of Learning Theory, December 13–16, 2000. [**Invited paper**.]

62. S. S. Venkatesh, "Mathematical Models and Methods in Neurally Inspired Computation and Learning," *IME Minisymposium on the Interface of Systems Engineering and Biomedical Research*, University of Pennsylvania, Philadelphia, February 11, 2003.

63. C. Gunter, S. Khanna, K. Tan, and S. S. Venkatesh, "DoS Protection for Reliably Authenticated Broadcast," *11th Annual Network and Distributed System Security Symposium* , San Diego, California, February 2004.

64. S. S. Kunniyur and S. S. Venkatesh, "Network Devolution and the Growth of Sensory Lacunae in Sensor Networks," *WiOpt'04: Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks*, University of Cambridge, UK, March 2004.

65. S. S. Kunniyur and S. S. Venkatesh, "Sensor Network Devolution and Breakdown in Survivor Connectivity," *2004 International Symposium on Information Theory*, Chicago, Illinois, June 27–July 2, 2004.

66. J. H. Song, S. S. Venkatesh, E. A. Conant, T. W. Cary, P. H. Arger, and C. M. Sehgal, "ArtificialNeural Network to Aid Differentiation Between Malignant and Benign Breast Masses by Ultrasound Imaging," *Ultrasonic Imaging and Signal Processing, SPIE Conference on Medical Imaging*, San Diego, California, February 12–17, 2005.

67. M. Sherr, M. Greenwald, C. A. Gunter, S. Khanna, and S. S. Venkatesh, "Mitigating DoS Attack Through Selective Bin Verification," *Proceedings of the Workshop on Secure Network Protocols (NPSec)*, Boston, Massachusetts, November 2005.

68. * S. S. Venkatesh, "Connectivity, Devolution, and Lacunae in Geometric Random Digraphs," `http://www.seas.upenn.edu/∼venkates/Papers/mosaic.pdf`, in *Proc. Inaugural Workshop on Information Theory and Applications*, San Diego, CA, February 2006. [**Invited paper**.]

69. * M. B. Greenwald, S. Khanna, and S. S. Venkatesh, "How Much Bandwidth Can Attack Bots Commandeer?" `http://www.seas.upenn.edu/∼venkates/Papers/DoS_ITA.pdf` in *Proc. Workshop on Information Theory and Applications*, San Diego, CA, January 2007. [**Invited paper**.]

70. S. Khanna, S. S. Venkatesh, O. Fatemieh, F. Khan, and C. A. Gunter, "Adaptive Selective Verification," *Proceedings of IEEE INFOCOM 2008*, Phoneix, AZ, April 2008.

71. * S. S. Venkatesh, S. Khanna, O. Fatemieh, F. Khan, and C. A. Gunter, "Nimble Clients Thwart Versatile DDoS Adversaries," *Information Theory and Applications Workshop*, San Diego, CA, 2009. [***Invited paper***.]

72. * S. S. Venkatesh, "A Variation on the Littlewood-Offord Theme with Applications to Phase Transitions in CDMA Detection," *Information Theory and Applications Workshop*, San Diego, CA, 2011. [***Invited paper***.]

73. M. H. R. Khouzani, S. S. Venkatesh, and S. Sarkar, "Market-Based Control of Epidemics," *49th Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Centre, Monticello, IL, September 2011.

74. * S. Eshghi, M. H. R. Khouzani, S. Sarkar, and S. S. Venkatesh*, "Optimal Patching in Clustered Epidemics of Malware," *Information Theory and Applications Workshop*, San Diego, CA, February 2012. [***Invited paper***.]

75. M. H. R. Khouzani, S. Eshghi, S. Sarkar, S. S. Venkatesh, and N. B. Shroff, "Optimal Energy-Aware Epidemic Routing in DTNs," *13th Annual ACM Symposium on Mobile Ad Hoc Networking and Computing (ACM MobiHoc 2012)*, Hilton Head, SC, June 2012.

76. R. Potharaju, E. Hoque, C. Nita-Rotaru, S. Sarkar, and S. S. Venkatesh, "Closing the Pandora's Box: Defenses for Thwarting Epidemic Outbreaks in Mobile Adhoc Networks,"*9th IEEE International Conference on Mobile Ad hoc and Sensor Systems (IEEE MASS 2012)*, Las Vegas, NV, October 2012.

77. T. W. Cary, A. Cwanger, B. Levenback, S. S. Venkatesh, and C. M. Sehgal, "Combined Naïve Bayes and Logistic Regression for Quantitative Breast Sonography," *2012 IEEE International Ultrasonics Symposium*, Dresden, Germany, October 2012.

78. L. Yan, R. Guerin, K. Hosanagar, Y. Tan, and S. S. Venkatesh, "Online Social Interactions and Opinion Formation," *22nd Annual Workshop on Information Technologies and Systems*, Orlando, FL, December 2012.

79. * H. Afrasiabi, R. Guerin, and S. S. Venkatesh*, "Opinion Formation in Ising Networks," *Information Theory and Applications Workshop*, San Diego, CA, February 2013. [***Invited paper***.]

80. * S. S. Venkatesh, "The Theory of Probability: Explorations and Applications," Lecture on *The Theory of Probability* given at the *Information Theory and Applications Workshop*, San Diego, CA, February 2013. [***Invited presentation***.]

81. * S. S. Venkatesh, "Opinion Formation in Ising Networks and Some Connections to the Littlewood-Offord Problem," *Fourth Nordic Workshop on System and Networks Optimization for Wireless (SNOW 2013)*, Äkäslompolo, Finland, April 2013. [***Plenary talk***.]

82. C. Sehgal, L. Sultan, B. Levenback, S. S. Venkatesh, "Statistical Methods for Breast Mass Classification by Ultrasound Imaging," *55th Annual Meeting and Exhibition of the American Association of Physicists in Medicine*, Indianapolis, Indiana, August 2013.

83. * H. Afrasiabi, R. Guerin, and S. S. Venkatesh, "Spin Glasses with Attitude—and What They Say About Opinion Formation in a Partisan World," *Information Theory and Applications Workshop*, San Diego, CA, February 2014. [***Invited paper***.]

84. S. Eshghi, S. Sarkar, and S. S. Venkatesh, "Visibility-Aware Optimal Contagion of Malware Epidemics," *Information Theory and Applications Workshop*, San Diego, CA, February 2015. [***Invited paper***.]

85. S. Eshghi, S. Sarkar, V. M. Preciado, S. S. Venkatesh, Q. Zhao, R. D'Souza, and A. Swami, "Spread, then Target, and Advertise in Waves: Optimal Capital Allocation Across Advertising Channels," *Information Theory and Applications Workshop*, San Diego, CA, February 2017. [***Invited paper***.]

86. L. R. Sultan, S. S. Venkatesh, E. Conant, and C. M. Sehgal, "Quantitative Doppler Vascularity Improves Computer-Based Sonographic Diagnosis of Breast Cancer," *Annual Convention of the American Institute of Ultrasound in Medicine (AIUM)*, Orlando, Florida, March 2017.

87. J. Kim, S. Sarkar, S. S. Venkatesh, M. Ryerson, and D. Starobinski, "Modelling Information Propagation in General V2V-Enabled Transportation Networks," *Information Theory and Applications Workshop*, San Diego, CA, February 2019. [***Invited paper***.]

88. J. Kim, R. Saraogi, S. Sarkar, S. S. Venkatesh, "Modeling the Impact of Traffic Signals on V2V Information Flow," *2020 IEEE 91st Vehicular Technology Conference*, online only, (VTC2020-Spring).

89. V. Amelkin, R. Vohra, and S. S. Venkatesh, "Structure and Dynamics of Contagion in Financial Networks with Implications for Systemic Risk," *Sixth Annual Conference on Network Science in Economics*, Chicago, IL, March 2021.

90. V. Amelkin, R. Vohra, and S. S. Venkatesh, "Contagion and Equilibria in Diversified Financial Networks," *Economic Theory Conference VI*, Becker–Friedman Institute, University of Chicago, Chicago, IL, August 2021.

91. K. Dasaratha, S. S. Venkatesh, and R. Vohra, "Financial Contagion in Stochastic Block Graphons", *Seventh Annual Conference on Network Sciences and Economics*, Booth School of Business, University of Chicago, Chicago, IL, March 18–20, 2022.

92. S. S. Venkatesh, "Clarity Amid Catastrophe—Understanding Chance", *TEDx Penn 2022: Æffect*, https://www.youtube.com/watch?v=OxKQU2Vn9JA, University of Pennsylvania, Philadelphia, PA, April 16, 2022.

93. S. S. Venkatesh, "From the Sad Story of a Birthday Cake to Social Distancing, Political Turmoil, and Pandemic," *ASIME Keynote*, Adelphi University, New York, July 2022.

94. K. Dasaratha, S. S. Venkatesh, and R. Vohra, "Optimal Bailouts in Diversified Networks," *Workshop on Networks in Finance*, The Warren Center for Networks and Data Science, University of Pennsylvania, May 2023.

95. V. Amelkin, S. S. Venkatesh, and R. Vohra, "Contagion and Equilibria in Diversified Financial Networks," *Fifth Economics and Networks Conference*, London School of Economics, November 2023. [***Invited paper***.]

Talks and Presentations

1. "Neural Networks," Colloquium at the Indian Institute of Technology, Bombay, India, January 1986.

2. "Computing with Neural Networks," Colloquium at Siemens Corporation, Bombay, India, January 1986.

3. "An Overview of Neural Networks," Colloquium at the University of California, Berkeley, California, August 1986.

4. "The Capacity of Neural Networks," Colloquium at the University of California, Berkeley, California, August 1986.

5. "Implementing Neural Networks," Colloquium at the University of California, Berkeley, California, August 1986.

6. "Neural Networks and Computation," Computer and Information Sciences Colloquium, School of Engineering and Applied Science, University of Pennsylvania, Philadelphia, Pennsylvania, October 1986.

7. "Complexity in Neural Computation," Decision Sciences Colloquium, Wharton School of Business Administration, University of Pennsylvania, Philadelphia, Pennsylvania, February 1987.

8. "The Capacity of Neural Networks," Electrical Engineering Colloquium, Columbia University, New York, New York, December 1987.

9. "Arguments Adducing Fault-Tolerance in Neural Networks," Workshop on Neural Information Processing Systems, Keystone, Colorado, November 1988.

10. "Computability and Capacity in Neural Networks," Colloquium at the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, November 1988.

11. "Computation with Neural Networks: An Overview," Colloquium at Dupont, Nemours, & Co., Inc., Wilmington, Delaware, April 1989.

12. "It's OK to be a *BIT* Neuron," Colloquium at Bell Communications Research, Morristown, New Jersey, May 1989.

13. "Extensions of the Basic Neural Model: Binary Synapses and Higher-Order Neurons," Colloquium at the Jet Propulsion Laboratories, California Institute of Technology, Pasadena, California, July 1989.

14. "Gamb*o*ling with Neural Networks; Or, What Probability Theory tells us about Neural Computation and Learning," IEEE ASSP Colloquium (Philadelphia Chapter), Philadelphia, Pennsylvania, February 1990.

15. "Folklore and Mathematics in Neural Computation," Colloquium at Bell Communications Research, Morristown, New Jersey, May 1990.

16. "Folklore and Mathematics in Neural Computation," Colloquium at IBM Almaden Research Center, San Jose, California, August 1990.

17. "Folklore and Mathematics in Neural Computation," Colloquium at NEC Research Institute, Princeton, New Jersey, October 1990.

18. "Gamb*o*ling with Neural Networks: A Computational Perspective," Colloquium at Princeton University, Princeton, New Jersey, February 1991.

19. "On Neural Network Capacity and the Sample Complexity of Learning," Statistics Colloquium, the Wharton School, University of Pennsylvania, Philadelphia, November 1991.

20. "Artificial Intelligence and Neural Networks," University Colloquium, Vikram University, Ujjain, India, January 1992.

21. "On the Curious Case of Learning in Neurons with Binary Weights," Colloquium at Siemens Corporate Research, Princeton, New Jersey, May 1992.

22. "Everything You've Always Wanted to Learn About Coin Tossing—But Were Afraid to Ask," Colloquium at AT&T Bell Laboratories, Murray Hill, New Jersey, July 1992.

23. "Twenty Questions, Coin Tossing, and Cryptography," Systems Seminar Series, Drexel Unversity, Philadelphia, February 1993.

24. "Learning Dynamics," Colloquium at Dupont, Nemours, & Co., Inc., Wilmington, Delaware, April 1995.

25. "Optimal Stopping, Effective Machine Complexity, and Learning," Colloquium at Australian National University, Canberra, Australia, December 1996.

26. "Model Selection and Optimal Stopping in Learning," Electrical Engineering Colloquium, University of Queensland, Brisbane, Australia, December 1996.

27. "Capacity and Complexity in Learning Systems of Linear Inequalities with Binary Coefficients," Microsoft Research Colloquium, Redmond, Washington, August 1998.

28. "Optimal Stopping and Effective Machine Complexity in Learning," Microsoft Research Colloquium, Redmond, Washington, August 1998.

29. "How Much is a Teacher Worth in Pattern Classification?" Statistics Colloquium, University of Pennsylvania, October 1999.

30. "A Poisson Paradigm and Combinatorial Limits on the Number of Users that can be Supported in a Direct Sequence Spread Spectrum System," AT&T Shannon Laboratory Colloquium, April 2002.

31. "Borel and After: From Numbers to Independence," Lecture series on *Independence and Symmetry in Probability Theory*, Helsinki Univeristy of Technology, Finland, August 2002.

32. "Chebyshev and After: From Exponential Bounds to Uniform Laws," Lecture series on *Independence and Symmetry in Probability Theory*, Helsinki Univeristy of Technology, Finland, August 2002.

33. "Erdös and After: From Probabilistic Designs to Random Graphs," Lecture series on *Independence and Symmetry in Probability Theory*, Helsinki Univeristy of Technology, Finland, August 2002.

34. "Combinatorial Limits on CDMA Capacity," Electrical Engineering Colloquium, Helsinki Univeristy of Technology, Finland, August 2002.

35. "Coverage and Connectivity in Metric Random Graphs," Learning Theory Colloquium, University College of London, London, April 2004.

36. "Establishing and Losing Sensor Networks: Graph Devolution from Initial Connectivity to Emergent Lacunae," Electrical Engineering Colloquium, Helsinki University of Technology, Finland, March 2004.

37. "Connectivity, Devolution, and Lacunae in Geometric Random Graphs; Or, How a Sensor Network Loses Its Groove," *Communications and Networking Seminar*, Yale University, November 1 2006.

38. "How a Sensor Network Loses Its Groove," *ISS Seminar*, Princeton University, March 1, 2007.

39. "Evolution and Devolution in Geometric Random Graphs," *Hybrid Networks Centre Colloquium*, University of Maryland, April 20, 2007.

40. "Connectivity Phase Transitions in Geometric Random Graphs," *Communications Seminar*, AT&T Shannon Labs, May 4, 2007.

41. "Poisson Laws in Geometric Random Graphs," *WINLAB Seminar Series*, Rutgers University, May 31, 2007.

42. "Evolution and Devolution in Geometric Random Graphs; Or, How a Sensor Network Loses Its Groove," *Electrical Engineering Colloquium*, University of Delaware, October 15, 2007.

43. "Problem Solving the Pólya Way," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

44. "Randomised Experiments and Sampling," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

45. "Parameter Estimation," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

46. "Tests of a Mean," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

47. "A Chi-Squared Test," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

48. "Testing Two Means," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

49. "The Analysis of Variance," Lectures on Statistics, The Young India Fellowship, New Delhi, India, July 2011.

50. "A Variation on the Littlewood-Offord Theme with Applications to Phase Transitions in CDMA Detection and Neural Computation," Electrical Engineering Seminar, Indian Institute of Technology, Bombay, January 3, 2013.

51. "Problem Solving in Domains of Chance: I. The Art of Problem Solving," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 7, 2013, July 30, 2013, July 18, 2016.

52. "Problem Solving in Domains of Chance: II. Sampling," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 9, 2013, July 31, 2013, July 21, 2016.

53. "Problem Solving in Domains of Chance: III. Estimation," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 14, 2013, August 1, 2013, July 25, 2016.

54. "Problem Solving in Domains of Chance: IV. Hypothesis Testing," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 17, 2013, August 6, 2013, July 28, 2016.

55. "Problem Solving in Domains of Chance: V. Incentives and Fraud," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 21, 2013, August 8, 2013, August 1, 2016.

56. "Problem Solving in Domains of Chance: VI. Principled Tests of a Mean," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 22, 2013, August 12, 2013, August 2, 2016.

57. "Problem Solving in Domains of Chance: VII. Regression, a Word from Our Founder," Lectures on Statistics, The Young India Fellowship, New Delhi, India, January 24, 2013, August 14, 2013, August 4, 2016.

58. "Numbers Play a Game of Chance: I. Rademacher Functions and Independence," Lectures on *The Theory of Probability*, Aalto University, Espoo, Finland, April 9, 2013.

59. "Numbers Play a Game of Chance: II. The Law of Large Numbers," Lectures on *The Theory of Probability*, Aalto University, Espoo, Finland, April 10, 2013.

60. "Numbers Play a Game of Chance: III. Central Tendency and the Ubiquitous Appearance of the Normal Law," Lectures on *The Theory of Probability*, Aalto University, Espoo, Finland, April 11, 2013.

61. "Problem Solving the Pólya Way," Workshop on the Art of Problem Solving, Ashoka University, New Delhi, August 13, 2013.

62. "What Statistical Physics has to Say on the Diffusion of Opinions in Socio-Political Settings," Dinner with Gregory, Gregory College House, University of Pennsylvania, February 24, 2014.

63. "From Viète to Borel, and Beyond," Student Statistics Seminar, Department of Statistics, University of Pennsylvania, September 30, 2014.

64. "Problem Solving the Pólya Way," Workshop on the Art of Problem Solving, Ashoka University, New Delhi, August 12, 2015.

65. "Engineering in 100 Seconds," School of Engineering and Applied Science, University of Pennsylvania, October 1, 2015 (https://www.youtube.com/results?search_query=santosh+venkatesh).

66. "Spin glasses with attitude: opinion formation in a partisan world, connections to the Littlewood–Offord problem, and the limits of wireless communication," Seminar, Washington University in St. Louis, November 6, 2015.

67. "Information Theory and Statistical Physics," Dinner with Gregory, Gregory College House, University of Pennsylvania, October 26, 2016.

68. "Machine Learning: The Past is Prologue," Lunch and Learn Seminar, Academic Mentorship Committee of the SEAS Council, University of Pennsylvania, February 23, 2017.

69. "On the Diffusion of Opinions in Socio-Political Settings," Dinner with Our Friends Series, Kings Court English College House, University of Pennsylvania, March 16, 2017.

70. "Opinion Formation in a Partisan World," Philomathean Society, University of Pennsylvania, April 7, 2017.

71. "From Viète to Borel: The Development of the Fundamental Limit Laws in Probability," Student Lunch Seminar, Department of Statistics, the Wharton School, University of Pennsylvania, April 10, 2017.

72. "The Continuing Quest for Knowledge," Remarks at Commencement by the Chair of the Faculty Senate, University of Pennsylvania, May 15, 2017.

73. "Penn's Teach-In 2018: the Quest for Knowledge," Free Library of Philadelphia, February 1, 2018.

74. "On Leadership," South Asian Leadership Conference, University of Pennsylvania, November 3, 2017.

75. "Fraud, Statistics, and the Central Limit Theorem: The Curious Case of Sir Cyril Burt, Psychologist," Data@Nite Lecture, a Wharton Undergraduate Data Analytics Club Speaker Event, the Wharton School, University of Pennsylvania, April 18, 2018.

76. "Mathematics by Allegory," Dinner with HKN, the Eta Kappa Nu Honor Society, University of Pennsylvania, November 15, 2018.

77. "The Myriad Paths of Education," Provost's Theme Year on "Why": Beyond the Classroom, University of Pennsylvania, January 22, 2019.

78. "The Art of Problem Solving; or, Problem Solving the Pólya Way," Global Lecture Series, Ruia College, Mumbai, India, August 12, 2019.

79. "The Sad Persistence of Lethal Genes; or, Natural Selection Can Only Do So Much," Global Lecture Series, Ruia College, Mumbai, India, August 13, 2019.

80. "On the Proper Size of a Jury; or, From Polls to Bombs—the Binomial and Poisson Distributions Entwined," Global Lecture Series, Ruia College, Mumbai, India, August 14, 2019.