MADHAV V. MARATHE

DIVISION DIRECTOR, NETWORK SYSTEMS SCIENCE AND ADVANCED COMPUTING
DISTINGUISHED PROFESSOR IN BIOCOMPLEXITY, BIOCOMPLEXITY INSTITUTE
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Bio

Madhav Marathe is an endowed Distinguished Professor in Biocomplexity, Director of the Network Systems Science and Advanced Computing (NSSAC) Division, Biocomplexity Institute and Initiative, and a tenured Professor of Computer Science at the University of Virginia. Dr. Marathe is a passionate advocate and practitioner of transdisciplinary team science. During his 25-year professional career, he has established and led a number of large transdisciplinary projects and groups. His areas of expertise are network science, artificial intelligence, high performance computing, computational epidemiology, biological and socially coupled systems, and data analytics.

His prior positions include Professor of Computer Science and Director of the Network Dynamics and Simulation Science Laboratory within the Biocomplexity Institute of Virginia Tech and a team leader of research and computing in the Basic and Applied Simulation Science group, Computer and Computational Sciences Division at the Los Alamos National Laboratory. He is a Fellow of the American Association for the Advancement of Science (AAAS), Society for Industrial and Applied Mathematics (SIAM), Association for Computing Machinery (ACM) and Institute of Electrical and Electronics Engineers (IEEE). Dr. Marathe has published more than 350 articles in peer reviewed journals, conferences and workshops. Mentoring and training next generation scientists has been his life-long passion. He has mentored more than a dozen staff scientists, and (co)-advised more than 20 doctoral students, 20+ MS students and 10+ postdoctoral fellows.

Dr. Marathe and his division focus on developing the scientific foundations and the associated engineering principles to study large-scale biological, information, social, and technical (BIST) systems. His current interests span five broad themes: (*i*) methods to construct various BIST networks using partial and noisy data as well as procedural information; (*ii*) understanding the general form and structure of dynamical processes over BIST networks (e.g., key network/pathway properties and typical pathways that impact dynamics); (*iii*) algorithmic theory of optimization and control as it pertains to the dynamical processes, including methods to detect, enhance, arrest, and mitigate dynamics; (*iv*) general conceptual and algorithmic foundations to understand the co-evolution of the networks and dynamics; and (*v*) high-performance services-based computing solutions that can be delivered seamlessly to end users and policy makers.

Research Interests

- Science of massively interacting networked systems
- Machine learning and artificial intelligence
- Computational epidemiology, computational immunology and computational sustainability
- Modeling and simulation
- Data analytics

- Theoretical computer science, including complexity theory and algorithmics

Education

- *Postdoctoral Fellow*
  CIC-3 Group Los Alamos National Laboratory, Los Alamos, NM
  Computer and Computational Sciences Division
  August 1994 – August 1996
  Postdoctoral Supervisors: Dr. Emanuel Knill and Vance Faber
- Ph.D. in Computer Science, 1994
  College of Engineering and Applied Sciences
  University at Albany, SUNY
  Ph.D. Advisors: Professors Harry B. Hunt III and Richard E. Stearns
- Indian Institute of Technology Madras, Chennai, India
  Bachelor of Technology, 1989
  Computer Science and Engineering
  Thesis Advisor: Professor C. Pandurangan

Awards and Honors

- 2018 ***Fellow****, Society for Industrial and Applied Mathematics* (SIAM) for contributions to high performance computing algorithms and software systems for network science and public health epidemiology
- 2018 *Dean's Award for Excellence in Research*, College of Engineering, Virginia Tech
- 2017 Finalist, IEEE SCALE Challenge, CCGRID
- 2017 *National Energy Research Scientific Computing Center NERSC Award* (joint with A Bhatele, J Yeom, N Jain, C Kuhlman, Y Livnat, K Bisset, L Kale) for innovative use of HPC that led to scalable mapping of epidemic simulations on NERSC machines
- 2016 Finalist, Best Paper Award, *ACM Supercomputing* conference
- 2016 *Constellation Group's Supernova Award* presented to NDSSL in the category of "Data to Decisions" for work by the group on developing high performance computing solutions to support national disaster management
- 2015 ***Fellow***, *American Association for the Advancement of Science* (AAAS) for contributions to high performance computing and network science
- 2014 Winner, AAMAS Blue Sky Ideas Best Paper Award
- 2014 ***Fellow***, *Association for Computing Machinery* (ACM) for contribution to high performance computing algorithms and software environments for simulating and analyzing socio-technical systems
- 2013 ***Fellow***, *Institute of Electrical and Electronics Engineers* (IEEE) for contributions to socio-technical network science
- 2013 Invited participant, Computing Community Consortium Leadership in Science Policy Institute organized by the Computing Research Association
- 2011-12 *Inaugural George Michael Distinguished Scholar*, Lawrence Livermore National Laboratory
- 2010 *Award for Research Excellence*, Virginia Bioinformatics Institute, Virginia Tech
- 2006 Best Paper Award, International Conference on Distributed Computing Systems
- 2004 *Distinguished Alumni Award*, University at Albany
- 2004 *Achievement Award*, Los Alamos National Laboratory

Selected Publications

See: https://scholar.google.com/citations?user=cLjMQqsAAAAJ&hl=en

1. Eubank S, Guclu H, Kumar A, Marathe M, Srinivasan A, Toroczkai Z, Wang N (2004). Modelling disease outbreaks in realistic urban social networks. *Nature*, 429(6988): 180-184.
2. Barrett C, Jacob R, Marathe M (2000). Formal language constrained path problems. *SIAM Journal on Computing* (SICOMP), 30(3): 809-837.
3. Hunt III H, Marathe M, Radhakrishnan V, Stearns R (1998). The complexity of planar counting problems. *SIAM Journal on Computing* (SICOMP), 27(4): 1142-1167.
4. Eubank S, Kumar A, Marathe M, Srinivasan A, Wang N (2004). Structural and algorithmic aspects of massive social networks. *Proceedings of the 15th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA'04), 718-727.
5. Adiga A, Kuhlman C, Marathe M, Ravi SS, Vullikanti A (2019) PAC learnability of node functions in networked dynamical systems. *Proceedings of the 36th International Conference on Machine Learning,* 82-91.
6. Wang L, Chen J, Marathe M (2019) DEFSI: Deep learning based epidemic forecasting with synthetic information. *Proceedings of the 30th Innovative Applications of Artificial Intelligence* (IAAI).
7. Kumar A, Marathe M, Parthasarathy S, Srinivasan A (2005). Approximation algorithms for scheduling on multiple machines. *Proceedings of 46th Annual IEEE Symposium on Foundations of Computer Science* (FOCS'05), 254-263. Complete version: *Journal of the ACM,* 2009*,* 56(5): 28:1-28:31.
8. Kumar A, Marathe M, Parthasarathy S, Srinivasan A (2005). Algorithmic aspects of capacity in wireless networks. *Proceedings of the 2005 ACM International Conference on Measurements and Modeling of Computer Systems* (SIGMETRICS'05), 33: 133-144.
9. Marathe M, Vullikanti A (2013). Computational epidemiology. *Communications of the ACM* (CACM), 56(7): 88-96.
10. Hunt III HB, Marathe M, Radhakrishnan V, Ravi S, Rosenkrantz D, Stearns R (1998). NC approximation schemes for NP- and PSPACE-hard problems for geometric graphs. *Journal of Algorithms*, 26(2): 238-274.
11. Yeom J, Bhatele A, Bisset K, Bohm E, Gupta A, Kale L, Marathe M, Nikolopoulos D, Schulz M, Wesolowski L (2014). Overcoming the scalability challenges of epidemic simulations on blue waters. *Proceedings of the 28th IEEE International Symposium on Parallel and Distributed Processing Symposium* (IPDPS), 755-764.
12. Alam M, Khan M, Vullikanti A, Marathe M (2016). An efficient and scalable algorithmic method for generating large–scale random graphs. *Proceedings of the IEEE International Conference for High Performance Computing, Networking, Storage and Analysis* (SC'16), 372-383.
13. Parikh N, Hayatnagarkar H, Beckman R, Marathe M, Swarup S (2016). A comparison of multiple behavior models in a simulation of the aftermath of an improvised nuclear detonation. *Journal of Autonomous Agents and Multi-Agent Systems* (JAAMAS), 30(6): 1148-1174.
14. Bisset K, Chen J, Deodhar S, Feng X, Ma Y, Marathe M (2014). Indemics: An interactive high-performance computing framework for data intensive epidemic modeling. *ACM Transactions on Modeling and Computer Simulation* (TOMACS), 24(1): 4:1-4:32.
15. Han B, Hui P, Kumar A, Marathe M, Shao J, Srinivasan A (2012). Mobile data offloading through opportunistic communications and social participation. *IEEE Transactions on Mobile Computing*, 11(5): 821-834.