MADHAV V. MARATHE
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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 500 articles in refereed journals, conferences and workshops, book chapters, magazine articles, refereed posters and papers based on abstracts, issued patents, and case study technical reports. Mentoring and training next-generation scientists have been his life-long passion. He has mentored more than a dozen staff scientists, and advised or co-advised 30+ doctoral students, 20+ MS students, and 15 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 policymakers.

Research Interests

- Science of massively interacting networked systems
- Machine learning and artificial intelligence
- Multi-agent systems
- 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

- 2021 ***Best paper award, SIGKDD 2021*** Applied Data Science Category, "Supporting COVID-19 policy response with large-scale mobility-based modeling" S Chang, M Wilson, B Lewis, Z Mehrab, K Dudakiya, E Pierson, PW Koh, J Gerardin, B Redbird, D Grusky, M Marathe, J Leskovec
- 2021 ***Finalist, ACM Gordon Bell Special Prize*** for HPC-Based COVID-19 Research, "Data-Driven Scalable Pipeline using National Agent-Based Models for Real-time Pandemic Response and Decision Support" P Bhattacharya, J Chen, S Hoops, D Machi, B Lewis, S Venkatramanan, … M Marathe
- Dec 2020 ***Keynote Speaker***, National Summit on the Science and Technology of Epidemiological Modeling and Prediction, co-organized by the White House Office of Science, Technology and Policy (OSTP), NSF, CDC, and IARPA https://www.jstor.org/stable/resrep29558
- 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 the scalable mapping of epidemic simulations on NERSC machines
- 2016 *Finalist*, Best Paper Award, *ACM Supercomputing* conference
- 2016 *Supernova Award,* Constellation Group*,* "Data toDecisions" work by NDSSL 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 *Best Paper Award*, AAMAS Blue Sky Ideas

- 2014 ***Fellow***, *Association for Computing Machinery* (ACM) for contributions 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
- *Co-Inventor*, TRANSIMS system - a special report by the National Academies TRB entitled "Metropolitan Travel Forecasting" (page 98) cites TRANSIMS as a *pioneering modeling project and groundbreaking work* in travel forecasting
- 2013 *Invited participant*, Computing Community Consortium Leadership in Science Policy Institute, 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

Extramural funding: PI, Co-PI, Senior Investigator on 60+ externally funded programs of over $150M (NSSAC division's portion is approximately $100M) in the last 20 years. Since arriving at UVA in 2018, the division scientists were part of over $40M in funded programs (personal share over $20M).

Scholarly activities

- **Publications**: 500+ total, including refereed journals, refereed conferences and workshops, book chapters, magazine articles, refereed posters and papers based on abstracts, issued patents, and technical reports; h-index: 61, i-10 index: 224, 16400+ Google Scholar citations https://scholar.google.com/citations?user=diIore8AAAAJ&hl=en. Papers published in *Nature*, *PNAS*, *SIAM J. Computing*, *JACM*, *KDD*, *SODA*, *ICALP*, *CIKM*, *SC*, *IPDPS*, *TCS*, *AAAI*, *IJCAI*, *ICML*, *IAAI*, *PLOS Comp. Biology*, *PLOS Neglected Tropical Diseases*, *NeurIPS*.
- **Co-inventor**: 7 patents and 8 additional patent applications
- **Selected Invited Presentations:** Delivered 130+ plenary/invited talks at international conferences, workshops, and universities since 1995
- **Student Advisement**: Served as a (co)-advisor for 30+ Doctoral students and 20+ Master's students. These students have secured prestigious positions after graduation, including positions at national laboratories, IT companies, faculty positions, and leadership positions in government.

Professional activities

- **Reviewer and program committee member, workshop organization**: Reviewed papers for major CS and interdisciplinary science journals and conferences, including *JCSS*, *TCS*, *SICOMP*, *KDD*, *AAAI*, *Science*, *PNAS*, *Lancet*, *PLOS Comp. Biology*, *Nature Communications*, and *Nature Scientific Reports*. Regularly serve on program committees of conferences, including AAAI, IJCAI, KDD, Infocom, and SIAM Annual meeting
- **Reviewer for funded programs:** Regularly review proposals for NSF, NIH, DHS, and a number of international science foundations, including: Helmholtz Research Foundation, Swiss National Science Foundation, Hong Kong National Science Foundation, and MIT-Skoltech Institute Russia
- **Advisory committees:** Ekagrid University, AI Advisory Council, India, 2021-present; Mehta Family Foundation, Katy, TX, Technical Advisor, 2021-present; Centre for AI and Data Sciences,

Indian Institutes of Science Education and Research, Advisor, 2020-present; European Commission's Global Systems Science Program

- **Service to the broader academic community**
  - Served on the Nuclear Risk Methods and Risk Analysis Committees for the National Academies of Sciences, Engineering, and Medicine (NASEM)
  - Invited participant in NSF National Networks of Research Institutes (NNRI) workshop
  - Led/participated in 40+ significant studies using our HPC-based modeling decision support systems pertaining to homeland security, sustainable interdependent infrastructures, and public health, for example: (*i*) planning and response in the event of a natural or human-initiated crisis (part of DHS NISAC, published in *Nature*); (*ii*) supporting federal pandemic influenza plans (part of NIH MIDAS program, IOM letter report 2006); and (*iii*) DoD pandemic preparedness
  - Invited participant in NSF-sponsored workshops: *Bridging the Gap between Wireless Networking and Advances at Physical Layer*, August 2007; *Mobility in Wireless Networks – Challenges and Opportunities*, July 2007; *Modeling Social Dynamics Workshop*, October 2006
  - *Pandemic Informatics: Preparation, Robustness, and Resilience,* E Bradley, M Marathe, M Moses, W D Gropp, D Lopresti. Computing Research Association's Computing Community Consortium (CCC); a series of white papers*, Quadrennial Papers*, that explore areas and issues around computing research with the potential to address national priorities
  - *Report on Future Research Directions for the National Science Foundation in the Era of COVID-19*, S Weekes, P March, M Berger, M Marathe, J Crowley, L Curfman McInnes, A El-Bakry, R Renaut, A Gelb, F Santosa, T Grandine, P Seshaiyer, J Hestaven, www.siam.org/Portals/0/reports/ReportFutureResearchDirectionsNSFCOVID.pdf?ver=2020-09-28-143348-783.

Key Technical accomplishments:

Research Thrust 1: Computational theory and scalable simulations of graphical dynamical systems for large networked systems.

Since 1998, we have been developing a computational theory of graphical models of dynamical systems, thereby providing formal models of networked multi-agent systems and the dynamics of such systems. They have published over 30 papers on this topic at top-tier venues, including AAAI, IJCAI, ICML, AAMAS, CIKM, JCSS, and TCS. Their results characterize the complexity of solving many design, analysis, inference, and optimization problems, often delineating hard and easy problems via tight dichotomy results. The theoretical underpinnings provide a sound formal footing and pave the way for applying a computational lens to problems in network science and multi-agent systems. Complementing the theoretical advances, we have developed high-performance computing techniques and software systems to solve important societal problems. Examples of such software systems include TRANSIMS (Transportation Analysis and Simulation System), UIS (Urban Infrastructure Suite), and several epidemic simulation systems (e.g., EpiSims, EpiFast, Indemics, EpiSimdemics, Charmsimdemics, Simdemics, and Simfrastructure). The papers on two software systems, EpiSimdemics and EpiFast, describe progressively faster and more expressive simulation environments. The fastest version can be mapped onto machines with 300,000 to 700,000 cores and can simulate an entire flu season in the US in about 10 seconds; it should be noted that the US network is comprised of over 300 million nodes and 1 trillion person-person interactions on a highly irregular and time-varying network. This speedup is obtained by a combination of advances in parallel computing, efficient algorithmics, and network analysis. The work on simulating cascading failures in human-coupled multi-networks provides a novel architecture that was published in a series of papers,

as well as *Science* (www.sciencemag.org/news/2018/04/what-if-nuke-goes-washington-dc-simulations-artificial-societies-help-planners-cope) and *PNAS* (www.pnas.org/content/114/28/7176) articles by Mitch Waldrop. UIS received the distinguished achievement award at the Los Alamos National Laboratory. Our national scale individualized agent-based system to support ongoing COVID-19 response was selected in 2021 as one of the finalists for the prestigious Gordon Bell Prize.

Research Thrust 2: Computational Epidemiology and Pandemic Response.

In contrast to aggregate computational epidemiology models studied in the literature for over a century, the disaggregated network-based modeling approach pioneered by our team uses a more realistic representation of the underlying social interactions captured by time-varying social contact networks. Our influential 2004 paper in *Nature* (cited over 2150 times) covers work carried out at the request of the Office of Homeland Security. It represents a breakthrough in the use of realistic urban-scale social contact networks to analyze epidemic processes.

1. A study was conducted on behalf of the Office of Homeland Security right after 9/11 to develop plans and response strategies in the event of a smallpox-based bio-terror attack [*Nature*-2004].
2. A study was done at the request of federal authorities to analyze combinations of strategies for responding to an influenza pandemic. Results of this analysis were reviewed in a Letter Report entitled "Modeling Community Containment for Pandemic Influenza" by the Institute of Medicine which is a part of the National Academies. The study played an important role in the development of a targeted layered containment strategy advocated in the *National Strategy for Pandemic Flu* (www.nap.edu/read/11800/chapter/2).
3. A study was undertaken in 2008 following a request to NIH by DHHS on the possible use of anti-virals in the event of an influenza pandemic. The work was covered in the June 2009 report prepared by the Community Guide Branch at the CDC, for the US Task Force on Community Preventive Services. It pertains to economic evidence regarding school closures in response to the threat of epidemics such as H1N1 [*AAAI*-2008, *IAAI*-2009, *Epidemics*-2011].
4. Our group was *one of the only two groups nationally* that was able to provide real-time web-based decision support to analysts in the federal government as they monitored and developed response strategies for H1N1 during Spring 2009.
5. Co-led a group (lead analytical group) that supported DTRA's response efforts to the Ebola crisis, and this work received worldwide attention. The forecasting techniques developed in the Ebola research were among the top methods in a NIH/NSF Ebola Forecasting challenge. For this effort, the NDSSL team won the Constellation Group's *Supernova Award* in 2016. The majority of this forecasting work is embodied in an app called Epicaster. The approach taken is novel, and consists of combining statistical, causal, and human-computation-oriented methods using ensemble techniques to produce timely and accurate forecasts. For example, the my4Sight app allows users to vote on epidemic forecasts. The crowdsourced ranking of simulated forecasts can then be used to improve the overall forecasts provided to users.

The work resulted in a number of publications (e.g., articles in *Nature*, *PNAS*, *PLOS Neglected Tropical Diseases*, *PLOS Outbreaks*, *Epidemics*) and software tools.

*COVID-19 planning and response efforts***:** I am co-leading a large team of researchers at UVA, and its partner institutions, in the development of innovative HPC-oriented decision support systems for COVID-19 planning and response. For over 70 weeks, the team has been providing modeling and analytical support to federal and state agencies as they respond to the pandemic: (*i*) our team is one of the lead analytical groups that support DTRA with modeling products that the DoD incorporates into recommendations provided to a range of federal and state agencies (about 50 different units); (*ii*) since summer 2020, our team has contributed weekly county-level US forecasts to the CDC as part of their COVID-19 Forecast Hub coordinated by Reich's Lab; (*iii*) our team contributes to the COVID-19 Scenario Modeling Hub initiative, the results of which were published in a MMWR and reported to

the national COVID leadership; (*iv*) our team serves as the primary modeling group for the Commonwealth of Virginia in their planning and response efforts (covid19.biocomplexity.virginia.edu/), advising the Virginia Department of Emergency Management, the Virginia Department of Health, and various local and state hospitals, including several departments at the University of Virginia School of Medicine, James Madison University, and Virginia Commonwealth University. The team was recently awarded a highly prestigious NSF Expeditions grant to advance computational epidemiology (computational-epidemiology.org). NSF has also funded Pandemic Research for Preparedness & Resilience (PREPARE): a virtual organization to foster increased discussion and collaboration among CISE pandemic researchers which is part of a Computer and Information Science and Engineering (CISE) initiative to coalesce a community around the topic of pandemic preparedness. The division has received five RAPID awards pertaining to COVID-19, of which I am serving as PI on three. The team has received letters of commendation from multiple agencies, including letters from VDH and DTRA acknowledging our efforts.

This work has resulted in extensive press coverage, over 20 published and in review articles, over 5 dashboards, and over 80 weekly briefings and data products (nssac.github.io/covid-19/index). I have given over 25 invited talks on topics related to COVID-19 response during the last 18 months, including keynote talks at SIAM Data Mining and SIAM ADCA conferences, and an opening keynote talk at the National Summit on the Science and Technology of Epidemiological Modeling and Prediction co-organized by the OSTP, NSF, CDC, and IARPA to discuss the development of a national pandemic forecasting and analytics capability see https://www.cdc.gov/nchs/data/misc/STPI-Epi-Modeling-Summit-Report-01-14-2021.pdf. The team's work (published by CDC as Morbidity and Mortality Weekly Report (MMWR)) has been briefed to the senior leadership at CDC and White House COVID task force and covered in major news outlets. We were the only modeling team that contributed analysis results based on a national individualized agent-based model. Further information about this work can be found at https://nssac.github.io/covid-19/index. Finally, on Nov. 9, 2021, the University of Virginia announced that our team will be one of four teams selected for the Prominence to Preeminence initiative to develop "An Integrative Science Program in Pandemic Science and Response".

Research Thrust 3: At-scale multi-agent models of real-world socio-technical networks.

Urban transport modeling: TRANSIMS (PI: Chris Barrett) is a large DOT-sponsored project to develop agent-based modeling and analysis tools for detailed transportation infrastructure analysis. The project has been covered extensively both in the press and in scientific forums. TRANSIMS was the first HPC (high-performance computing) multi-agent modeling environment to study transportation planning and traffic; more generally, it was the first successful example of high-performance computational social sciences and policy informatics. A special report by the National Academies TRB, "Metropolitan Travel Forecasting" (page 98), cites TRANSIMS as a *pioneering modeling project and groundbreaking work* in travel forecasting. The TRANSIMS team received the Distinguished Copyright award in 1999 at Los Alamos National Laboratory. TRANSIMS has been used in over 20 different case studies, including hurricane evacuation plans in New Orleans, simulation of freight border crossings in Buffalo, and street closure study (WHATS) in and around the White House. I am one of the co-inventors of TRANSIMS and led the development of several technologies, including the well-known methods for multi-modal route planning.

Modeling and analytics for inter-dependent infrastructure systems: Our team developed the Urban Infrastructure Suite (UIS) for the National Infrastructure Simulation and Analysis Center (NISAC), which was established immediately after the 9/11 attack. We built the theoretical foundations and agent-based models of coupled critical infrastructure systems spanning US urban regions. Our work was the first to develop agent-based models to study socio-technical multi-networks consisting of layers of social and infrastructure networks. Our team was a co-recipient of the Los Alamos

Achievement award. During 2006–2019, we conceived of and developed CNIMS (PI: Barrett, Co-PI: Marathe), a decision informatics system for the Defense Threat Reduction Agency. CNIMS incorporated interdependent social, behavioral, economic, and societal infrastructures, mainly to counter-WMD/CBNT threats. Our work on CNIMS demonstrated that planning for pandemics and other catastrophic events can be fundamentally improved by the use of HPC-based decision and policy informatics. Our work on the H1N1 outbreak response received a letter of commendation from DoD. CNIMS was used to understand the social implications of other large-scale disasters, including WMDs, earthquakes, hurricanes, etc. The articles by Mitch Waldrop in *Science* and *PNAS* mentioned above provide a broad overview of this work and point out its significance. I served on the National Academies of Sciences, Engineering, and Medicine (NASEM) Ad hoc Committee of experts to examine whether a risk assessment framework is applicable to determining the potential risks of nuclear terrorism and nuclear war, and to examine assumptions in nuclear policy and doctrine and their implications on national security (www8.nationalacademies.org/pa/projectview.aspx?key=52034). Helbing and Balietti ("How to Do Agent-Based Simulations in the Future: From Modeling Social Mechanisms to Emergent Phenomena and Interactive Systems Design", Santa Fe Institute working paper, 11-06-024, June 2011) call the work on TRANSIMS and UIS "the first successful application of supercomputing to social simulations".

Research Thrust 4: AI for Food Security.

There are two threads that I have been working on in this context. Invasive alien species are an emerging threat to global biodiversity, human health, and the socio-economic stability of nations, a threat which is aggravated by international trade and travel. One such invasion that recently received global attention is *Tuta absoluta*, a devastating pest of tomato crops worldwide. First, as part of a USAID funded project (PI: Abhijin Adiga, Co-PI: Marathe) our group has been developing multi-agent models to study the global spread of *Tuta absoluta* and its potential risk to the US; *Tuta absoluta* affects several plants including tomato. We are currently working on applying deep learning to remote-sensing data to map invasive plants in a biodiversity hotspot. Our group is part of the team (led by Washington State University, PI: Ananth Kalyanaraman, UVA PI: Marathe) that was selected by NSF and NIFA to establish an AI for Agriculture Center (AgAID Institute). Our team will develop robust scalable agent-based models to study complex problems at the interface of climate change, human behavior, and AI.

Selected Publications:

500+ total publications, including refereed journals, refereed conferences and workshops, book chapters, magazine articles, refereed posters and papers based on abstracts; h-index: 61, 16400+ citations 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 Foundationsof 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 onMeasurements 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 DistributedProcessing 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 interactivehigh-performance computing framework for data-intensive epidemic modeling. *ACM Transactions on Modeling and Computer Simulation* (TOMACS), 24(1): 4:1-4:32.

15. Venkatramanan S, Sadilek A, Fadikar A, Barrett C, Biggerstaff M, Chen J, Dotiwalla X, Eastham P, Gipson B, Higdon D, Kucuktunc O, Lieber A, Lewis B, Reynolds Z, Vullikanti A, Wang L,

Marathe M. (2020) Forecasting influenza activity using machine-learned mobility map. *Nature Communications* 12, 726. doi.org/10.1038/s41467-021-21018-5T.

16. 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. Chang S, Wilson M, Lewis B, Mehrab Z, Dudakiya K, Pierson E, Koh P, Gerardin J, Redbird B, Grusky D, Marathe M, Leskovec J (2021) Supporting COVID-19 policy response with large-scale mobility-based modeling. *Proceedings of the ACM Annual Conference on Knowledge Discovery and Data Mining (KDD2021)*. **Best paper award.**

17. Sadilek A, Liu L, Nguyen D, Kamruzzaman M, Rader B, Ingerman A, Mellem S, Kairouz P, Nsoesie E, MacFarlane J, Vullikanti A, Marathe M, Eastham P, Brownstein J, Howell M, Hernandez J. (2021). Privacy-first health research with federated learning. *Nature, Digital Medicine*. 2021 Sep 7;4(1):pp. 1-8. doi: 10.1038/s41746-021-00489-2. PubMed PMID: 34493770; PubMed Central PMCID: PMC8423792.

18. Alam M, Khan M, Perumalla K, Marathe M (2020) Generating massive scale-free networks: Novel parallel algorithms using the preferential attachment model. *ACM Transactions on Parallel Computing (TOPC),* 7(2):13. doi.org/10.1145/3391446.

19. McNitt J, Chungbaek Y, Mortveit H, Marathe M, Campos M, Desneux N, Brevault T, Muniappan R, Adiga A (2019) Assessing the Multi-pathway Threat from an Invasive Agricultural Pest: *Tuta absoluta* in Asia. *Proceedings of the Royal Society B,* 286 (1913).

20. Fadikar A, Higdon D, Chen J, Lewis B, Venkatramanan S, Marathe M (2018) Calibrating a Stochastic, Agent-Based Model Using Quantile-Based Emulation. *SIAM/ASA Journal on Uncertainty Quantification*, 6(4):1685-706.