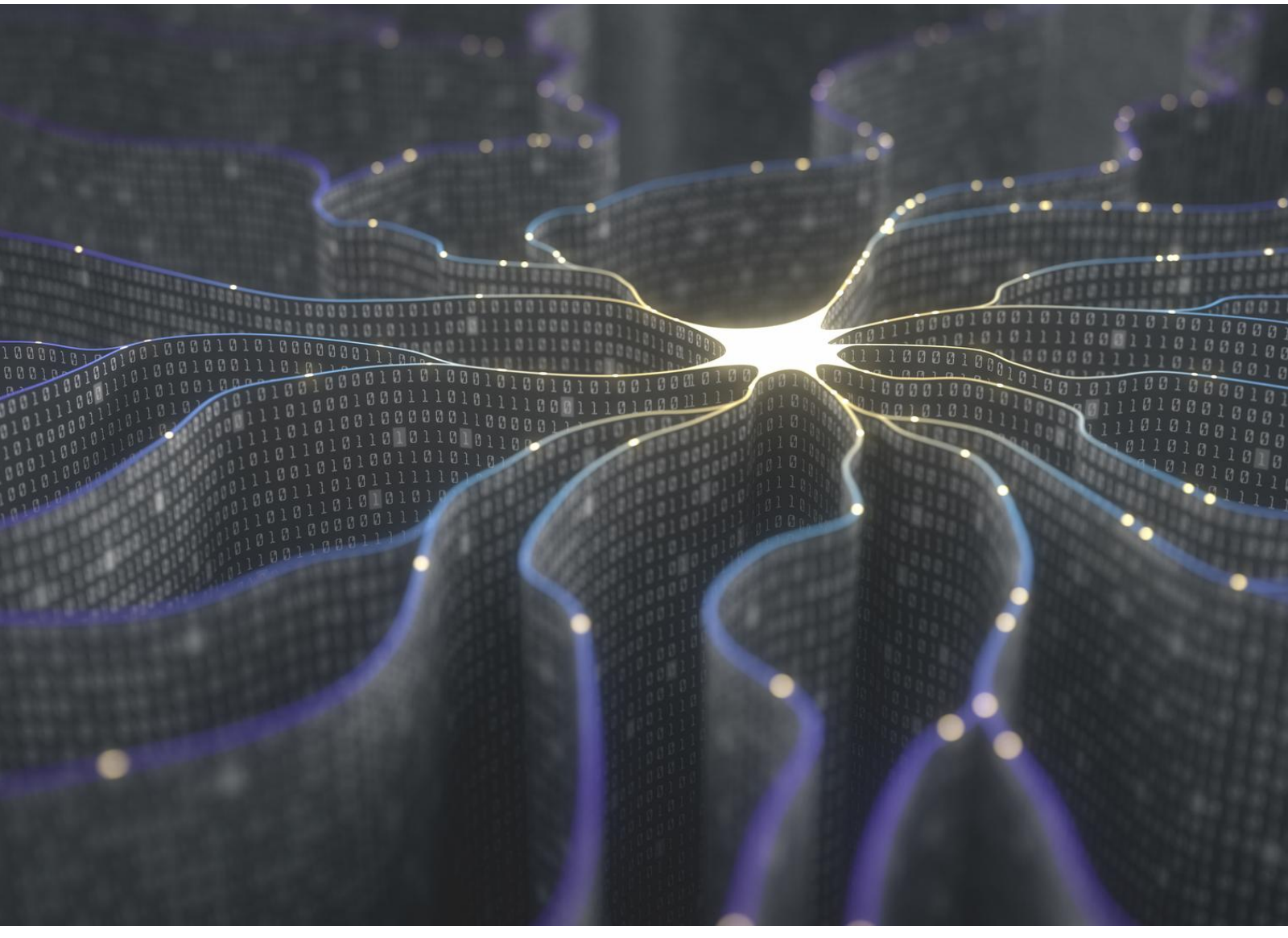
September 2021

CompEpi Quarterly

Newsletter of the Global Pervasive Computational Epidemiology project



NSF Review: Oct 13 + 15

SAVE THE DATE:

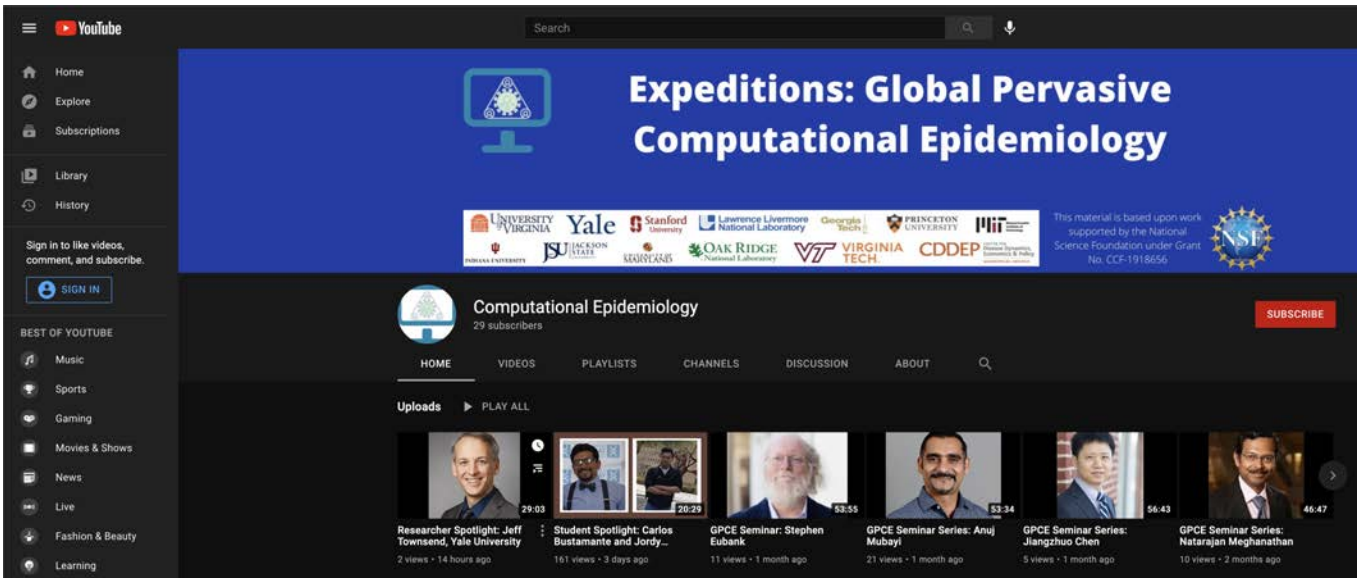
Wednesday 10/13 and Friday 10/15 from ~12pm-4:30pm Eastern we will hold a virtual review with our NSF Program Director. We would love for everyone to attend to answer specific questions about your research, although we won't need everyone to present. We'll reach out soon to the folks we'd like fill that role, and we'll keep you updated with the exact agenda.

10/13 the focus will be on the technical aspects of our work, while 10/15 will review broader impact and outreach.

10/15 we'll start with a **STUDENT POSTER SESSION from 12pm-1pm Eastern**. To reserve your student's spot, contact Golda (ggh5e@virginia.edu) or Erin (er9ff@virginia.edu).

Golda & Erin

And remember you can watch all of our seminars and Spotlight interviews on our YouTube channel!



Seminar Series - 8 July 21

Click here to watch on YouTube

Behavior Matters, Whatever Next: Computational Psychology for Computational Epidemiology

For our presentation, we assume human behavior matters in determining the dynamics of biological epidemics and ask how should we model human behavior in the context of computational epidemiology. Specifically, this talk provides three things: 1. A framework from which to appreciate the varieties and limitations of modeling options, methods and techniques, 2. Some examples from computational psychology that illustrate the modeling of social system, and 3. A pipeline under development for integrating computational psychology at scale in the epidemiological context.

Dr. Mark Orr

UNIVERSITY of VIRGINIA
BIOCOMPLEXITY INSTITUTE

Mark Orr is a research associate professor in the Network Systems Science and Advanced Computing division. Orr was originally trained as a cognitive psychologist at the University of Illinois at Chicago. Orr received augmentation to this training with postdoctoral fellowships in computational modeling (Carnegie Mellon), neuroscience (Albert Einstein College of Medicine), and epidemiology/complex systems (Columbia University). Over the past decade, he has become heavily involved in understanding dynamic processes and drivers of risky behavior and decision making, primarily in a public health context, at the scale of the individual and populations. Orr is now currently expanding these ideas into other contexts and for other applications (e.g., DoD, DOE, DHS).

Would you like to present at a future Seminar?
Email Golda and Erin with your availability, title, and abstract.

Seminar Series - 12 Aug 21

Click here to watch on YouTube

Controlling Epidemic Spread through Stochastic Networks

The spread of an epidemic is often modeled by an SIR random process on a social network graph. The MinInf problem involves minimizing the expected number of infections when the disease starts at a designated vertex and we are allowed to break at most B edges (or at most B vertices, in the case of vaccination) of the graph. This type of intervention naturally corresponds to implementing social distancing (or vaccination, respectively), and as the COVID-19 pandemic has shown, it is critical in mitigating the infection spread. Although this problem is fundamental in epidemiology, it has remained generally open. In this paper, we study the MinInf problem under the Chung-Lu random graph model, and develop a Sample Average Approximation (SAA) scheme for it. We further show that for certain parameters of the random-graph model affecting the number of paths in a randomly-drawn graph, our framework yields rigorous bicriteria approximation algorithms. Finally, we complement the latter by providing cases demonstrating the limits of our SAA approach. This is joint work with Michael Dinitz (Johns Hopkins University), Leonidas Tsepenekas (University of Maryland), and Anil Vullikanti (University of Virginia).

Dr. Aravind Srinivasan

UNIVERSITY OF MARYLAND

Aravind Srinivasan is a Distinguished University Professor and Professor of Computer Science, UMIACS, and AMSC, at the University of Maryland, College Park. His main research interests are in algorithms, probabilistic methods, data science, network science, and machine learning theory and applications in areas including health, E-commerce, cloud computing, internet advertising, and fairness. They span areas including: algorithms, probabilistic methods, and continuous/combinatorial optimization; the interface of algorithms, AI, and machine learning in data science and health including computational epidemiology, cancer genomics, pharmacology, organ exchange, and medical devices; data science and the internet economy including E-commerce, digital marketing, cloud optimization, crowdsourcing, and social networks; data science and fairness, systematically incorporating (probabilistic, per-user/demographic) fairness in AI and in algorithms; algorithms in networking, social networks, and distributed/parallel computing; and computational approaches to sustainable growth including energy, monitoring and sensing, electric-power and water networks).

Seminar Series - 26 Aug 21

Click here to watch on YouTube

HySec-Flow: Privacy-Preserving Hybrid Computing Model

Vaccines have begun to play an important role for mitigating the ongoing COVID-19 pandemic. While vaccines are being administered, more infectious new variants continue to spread in the population and may soon become dominant; people start reducing social distancing and gradually return to their normal activities. These changes will potentially increase the effective reproduction number R of the disease. On the other hand, it takes time to vaccinate all those who are willing; and for some places in the world it's challenging to obtain a sufficient vaccine supply for all people. Due to the fast changing nature of the disease and human behavior, we need more efficient vaccination strategies to achieve optimal results in terms of reducing infections/hospitalizations/deaths. In this work, we take into account the volatile nature of the COVID-19 pandemic including new variants, relaxation of non-pharmaceutical interventions, and vaccine hesitancy, and use an agent based model to study how speedup of vaccination can help to nullify the impact of these factors; and to compare different strategies of COVID-19 vaccine allocation to individuals, including age based schemes and schemes based on structural properties of the underlying social contact network.

Dr. Judy Fox

Judy Fox is an Associate Professor and the Program Director of the Ph.D. Program at the School of Data Science. Her research focuses on designing computer systems that enable Data Science, Machine Learning, and the Internet of Things applications to harness the computational resources of Cloud and HPC platforms effectively. More information is available at https://datascience.virginia.edu/people/judy-fox.

Publications & Presentations

Our team has been busy supporting the challenges of real-time epidemic science, particularly pertaining to the COVID-19 Pandemic.

Publications & Preprints

Asymptomatic SARS-CoV-2 infection: A systematic review and meta-analysis. Proceedings of the National Academy of Sciences. 2021 Aug 24;118(34). Sah P, Fitzpatrick MC, Zimmer CF, Abdollahi E, Juden-Kelly L, Moghadas SM, Singer BH, Galvani AP.

SARS-CoV-2 infection and mortality during the first epidemic wave in Madurai, south India: a prospective, active surveillance study. The Lancet Infectious Diseases. 2021 Aug 13. Laxminarayan R, Vinay TG, Kumar KA, Wahl B, Lewnard JA.

Opportunities and challenges in developing COVID-19 simulation models: Lessons from six funded projects. Proceedings of the 2021 Annual Modeling and Simulation Conference (ANNSIM). Society for Modeling & Simulation International 2021, 2021 July 19. Giabbanelli P, Badham J, Castellani B, Kavak H, Mago V, Negahba A, Swarup S.

Informing University COVID-19 Decisions Using Simple Compartmental Models. medRxiv. 2021 July 6. Hurt B, Adiga A, Marathe M, Barrett C.

Evolution of an asymptomatic first stage of infection in a heterogeneous population. Journal of the Royal Society Interface. 2021 Jun 16;18(179):20210175. Saad-Roy CM, Grenfell BT, Levin SA, van den Driessche P, Wingreen NS.

Evaluating the utility of high-resolution proximity metrics in predicting the spread of COVID-19. medRxiv. 2021 Jun 10. Mehrab Z, Adiga A, Marathe MV, Venkatramanan S, Swarup S.

When in Doubt: Neural Non-Parametric Uncertainty Quantification for Epidemic Forecasting. arXiv preprint arXiv:2106.03904. 2021 Jun 7. Kamarthi H, Kong L, Rodríguez A, Zhang C, Prakash BA.

Leveraging a multiple-strain model with mutations in analyzing the spread of COVID-19. ICASSP 2021-2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2021 Jun 6 (pp. 8163-8167). IEEE. Sridhar A, Yağan O, Eletreby R, Levin SA, Plotkin JB, Poor HV.

Strategies to Mitigate COVID-19 Resurgence Assuming Immunity Waning: A Study for Karnataka, India. medRxiv. 2021 May 29. Adiga A, Athreya S, Lewis B, Marathe MV, Rathod N, Sundaresan R, Swarup S, Venkatramanan S, Yasodharan S.

Accelerated vaccine rollout is imperative to mitigate highly transmissible COVID-19 variants. EClinicalMedicine. 2021 May 1;35:100865. Sah P, Vilches TN, Moghadas SM, Fitzpatrick MC, Singer BH, Hotez PJ, Galvani AP.

Analysis of the potential impact of durability, timing, and transmission blocking of COVID-19 vaccine on morbidity and mortality. EClinicalMedicine. 2021 May 1;35:100863. Haghpanah F, Lin G, Levin SA, Klein E.

WiFi mobility models for COVID-19 enable less burdensome and more localized interventions for university campuses. medRxiv. 2021 Mar 13. Swain VD, Xie J, Madan M, Sargolzaei S, Cai J, De Choudhury M, Abowd GD, Steimle LN, Prakash BA.

Researcher Spotlight: Stephen Eubank, BII, UVA

*We asked Stephen Eubank to **explain in 5 words or less how his career path brought him to computational epidemiology** - we know you'll love his answer! To see the full interview, click here to visit our YouTube channel.*

What I'm doing right now is trying to figure out how the structure of a contact network dictates the way diseases spread and how you could change that contact network most efficiently to keep the disease from spreading on it, but this of course is a specific case of the really general problem of how anything spreads over a network and how you can control that spread by changing the network structure. I got here because of my interest in epidemiology, in particular, and in agent-based modeling where we take into account what each person does who they come into contact with or each host of an infectious disease. And, in particular, which interventions - like social distancing - are most likely to prevent the spread of disease.

If I could give a researcher who's just starting out some advice, I would say whatever you did your thesis on it was wonderful, it was terrific - now find something else to do. But don't spend your life refining every little bell and whistle on your PhD dissertation. There was an experimentalist, where I got my degree who had done that for 40 years and I can't imagine a career like that. On the other hand, I heard a talk by a Nobel Prize winner who said he had just run into a brick wall in the research he was doing. He was a physicist, and he said “So, I went into computer science for 10 years and while I was there I ran into something that let me solve the problem I had to start with.” Branch out - do something different. Remember that what you did in graduate school was you learned how to approach problems and think about them in new ways and find answers where people hadn't been looking before, and that's not confined to the specific problem you were working on, it's a skill you have and take advantage of that.

. . . I closed my eyes - jumped

Student Spotlight: Hayley Hassler, Yale Univ

*We asked Hayley Hassler **how she got into computational biology**, and we think her answer is a great demonstration of what can happen when you say "yes" to the opportunities that come your way! To see the full interview, visit our YouTube channel.*

On Hayley's dream job: I think one of the most amazing aspects of this field is that it is growing and it's changing so rapidly that I think the types of jobs that actually exist in computational biology now may look very different five years from now when I'm hopefully finishing my PhD. So, while I don't quite have an answer for what I think my dream job might be, I do know that, in general, research is always going to be a part of my career. And I'm certain that that research will be for the benefit of not just the scientific community as a whole, but really hopefully for my neighbor or your neighbor or the person standing in the grocery line at the store, which has really been the most fulfilling part of the COVID-19 research that I've been doing with Jeff [Townsend] here at Yale - just knowing that that impact is there.

. . . there's this urgency throughout the pandemic to answer questions we can't yet answer empirically . . .

On who might benefit from her research: Actually, compared to a lot of traditional evolutionary trait research - like looking at the color of butterfly wings - that question is fairly easy for me to answer, in that the research has wholeheartedly been for the benefit of all of us who have felt the impact of the COVID-19 pandemic over the past year and a half, and that's been really, really exciting for me . . . even just having my family take an interest because it's impacting them, it's impacting all of us.

Would you like us to feature one of your students in the Spotlight?
Email Erin (er9ff@virginia.edu) and we'll make it happen!

From the admin team

We are excited to be a part of this team and community. Please let us know about your publications and presentations, if you'd like to present at our Seminar Series, or if you want to share the progress your group has made. Building a community on this scale requires an intentional effort and commitment, and we are here to support you in any way we can.

Golda Barrow {ggh5e@virginia.edu} & Erin Raymond {er9ff@virginia.edu}

Social media

We are always looking for content, so please let us know if there is a link, comment, or video we can share on social media.

@comp-epi

Computational Epidemiology

Join our Seminar Series the 2nd & 4th Thursday of every month!

Here's the schedule for the remainder of 2021 - stay tuned for more details!

9 Sep - Aniruddha Adiga, UVA
23 Sep - Rebecca Powell Doherty, U Oxford
7 Oct - Chadi Saad-Roy, Princeton U
21 Oct - Maimuna Majumder, Harvard U
4 Nov - Samarth Swarup, UVA
18 Nov - Li Xiong, Emory U

Don't forget our Slack channel!

NSF acknowledgement

Remember to acknowledge NSF in your publications. Check with your grant manager for the appropriate number.

- In any publication (including web pages) of any material based on or developed under this project: “This material is based upon work supported by the National Science Foundation under Grant No. [CCF-xxxxxxx].”
- All publications except scientific articles or papers appearing in scientific, technical or professional journals: “Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.”
- NSF support must be orally acknowledged during all news media interviews, including popular media such as radio, television and news magazines.