Jeffrey Keithley

Curriculum Vitae

Los Alamos, NM 87544
✉ *jeffrey-keithley@uiowa.edu*
✉ *jkeithley@lanl.gov*
jeffkeithley.github.io
linkedin.com/in/jeffrey-keithley

▬▬ Summary of Qualifications

I am a PhD Student in Computer Science at the University of Iowa, advised by Dr. Sriram Pemmaraju and Dr. Bijaya Adhikari in the Computational Epidemiology research group. I have performed research in highly multi-disciplinary settings over multiple project scales, from 1 collaborator to nearly 40. My primary research revolves around vaccine allocation approximation algorithms over network disease models, mainly **i)** the role of approximate submodularity in the guarantees associated with greedy allocation, and **ii)** the development of equitable vaccine allocation algorithms. This has provided me with experience using population and mobility data in the development of network disease models and vaccination algorithms. I have prior research experience studying the spread of cholera, data analysis for COVID-19, and mosquito-borne disease incidence under climate change. I am also interested in learning more about how technical results make it into actual policy and using that knowledge to help develop better outbreak response strategies.

▬▬ Education

2026 **Doctor of Philosophy (Expected)**, *Computer Science*, The University of Iowa, Advisors: Dr. Sriram Pemmaraju and Dr. Bijaya Adhikari
3.93/4.33 GPA

2020 **Bachelor of Science**, *Mathematics*, New Mexico Tech, (Presidential Scholarship and Tech Scholar designation)
3.91/4.00 GPA

▬▬ Experience

2021–present **Research Assistant**, *Computational Epidemiology Research Group*, The University of Iowa, Iowa City, Iowa
  ○ **Analyzing the equity and efficiency of vaccine allocation algorithms and policies (ongoing)**
    Key skills: multi-criteria optimization, mentoring
  ○ **Vaccine allocation with respect to varying spatial scales over meta-population disease models (ongoing)**
    Key skills: complex network analysis, disease modeling, resource allocation, non-submodular optimization, approximation algorithm guarantees, network data exploration/processing
  ○ **Online hospital room assignment to minimize infection spread between room clusters (ongoing)**
    Key skills: online algorithms, optimization, mentoring
  ○ **Analyzing the effect of network topology on varying measures of epidemic prevalence over meta-population disease models (ongoing)**
    Key skills: network analysis, nonlinear dynamics

2020–present **Research Assistant**, *Analytics, Intelligence, and Technology Division*, Los Alamos National Laboratory, Los Alamos, New Mexico
  ○ **Analyzing drivers of disparity in vaccine allocation policies using large-scale agent-based disease models (ongoing)**
    Key skills: data analysis, agent-based modeling, multi-criteria optimization
  ○ **Modeling mosquito borne illness under climate change (ongoing)**
    Key skills: object oriented programming, large scale code development, data fusion
  ○ **Modeling genetic patterns of migration for cholera spread (concluded)**
    Key skills: meta-population disease models, data gathering/exploration
  ○ **Analysis and forecasting of COVID-19 hospitalizations (concluded)**
    Key skills: data exploration/processing/visualization, time series analysis/forecasting

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Summer 2023	**REU Computing for Health and Well-Being Co-Mentor**, *Department of Computer Science*, The University of Iowa, Iowa City, Iowa
	Guiding an undergraduate student in a summer research project on vaccine allocation fairness - responsibilities include instruction on the basics of computational epidemiology, basic scientific computing, and conducting research.
Spring 2023	**Teaching Assistant**, *Department of Computer Science*, The University of Iowa, Iowa City, Iowa
	Led discussion sections guiding students in solving problems for a data structures and algorithms class
Summer 2020	**Summer Intern**, *Computational Physics Summer School*, Los Alamos National Laboratory, Los Alamos, New Mexico
	Performed research in applying deep neural networks to photon and neutron transport simulation
	Key skills: computational nuclear physics, recurrent neural networks
Summer 2019	**Summer Intern**, *Parallel Computing Research Internship*, Los Alamos National Laboratory, Los Alamos, New Mexico
	Performed bench-marking study in FORTRAN stencil kernel performance and collaborated with other project teams to generalize results
	Key skills: high performance computing, cache performance, FORTRAN
2017–2020	**Teaching Assistant**, *Departments of Mathematics and Computer Science*, New Mexico Tech, Socorro, New Mexico
	○ Grader, TA, and tutor for a C programming class (2017)
	○ Grader for vector analysis and calculus III (2018, 2020)
	○ Teaching Assistant for calculus I (2019)

▬▬ Publications

Peer-Reviewed Articles	**J. Keithley**, A. Choudhuri, B. Adhikari, and S. Pemmaraju, "Greedy Strikes Back: Circumventing the Hardness of Vaccine Allocation," 2023. *In preparation.*
	M. Wilinski, L. Castro, **J. Keithley**, C. Manore, J. Campos, E. Romero-Severson, D. Domman, A. Lokhov, "Congruity of genomic and epidemiological data in modeling of local cholera outbreaks," Proceedings of the Royal Society B: Biological Sciences 291, no. 2019 (March 27, 2024): 20232805. `https://doi.org/10.1098/rspb.2023.2805`.
	I. Trejo, M. Barnard, J. Spencer, **J. Keithley**, K. Martinez, I. Crooker, N. Hengartner, E. Romero-Severson, C. Manore, "Changing temperature profiles and the risk of dengue outbreaks," PLOS Clim 2(2): 0000115. https://doi.org/10.1371/journal.pclm.00001152023, 2023. *Featured on SIAM front page news, 4-3-23.*
Technical Reports	L. Nguyen, **J. Keithley**, D. Armstrong, E. Nelson, and G. Maskaly. "Deep Neural Networks for Photon and Neutron Transport," LANL CompPhys Workshop Final Report, 2020, LA-UR-20-28407.

▬▬ Presentations

Invited Talks	*Constructing Demographically Representative Synthetic Contact Networks*, LANL CNLS Talk Competition, Jul 2024.
	Designing Near-Optimal Spatial Vaccine Allocation Strategies, 9th Iowa Computer Science Graduate Research Symposium, Nov 2023.
	Designing Near-Optimal Spatial Vaccine Allocation Strategies, CDC MInD Meeting, Feb 2023.
	Mosquito-borne Disease Forecasting under Climate Change, "What's Up with LANL Students?" Series, Jul 2021.
	UI CS department colloquium panel on securing internships, UIowa CS Department Colloquium, Oct 2022.
Conference Talks	*Designing Near-Optimal Spatial Vaccine Allocation Strategies*, MIDAS Network Annual Meeting, Oct 2023.

Vaccine Allocation Approximation Guarantees for Curbing Outbreaks, INFORMS Annual Meeting, Oct 2022.

Conference Posters	**J. Keithley**, P. Alexander, N. Parikh, and S. Del Valle. *Constructing Demographically Representative Synthetic Contact Networks*, LANL Student Symposium, Jul 2024.

J. Keithley, A. Choudhuri, B. Adhikari, and S. Pemmaraju. *Designing Near-Optimal Spatial Vaccine Allocation Strategies*, MIDAS Network Annual Meeting, Oct 2023.

M. Bonner, **J. Keithley**, and S. Pemmaraju. *Fairness and Equity in Vaccine Allocation*, Summer Undergraduate Research Conference, Jul 2023.

M. Rozowski, **J. Keithley**, and R. Robey. *Getting the Most out of Your Stencil Kernel on CPUs and GPUs*, LANL Student Symposium, Aug 2019.

Honors and Awards

Civil Air Patrol Mitchell Award (2014)

Scientific Service

Peer Review **Association for the Advancement of Artificial Intelligence (AAAI)** (2021)
Knowledge Discovery and Data Mining (KDD) (2021)
KDD EpiDAMIK Workshop (2022, 2023)
International Joint Conference on Artificial Intelligence (IJCAI) (2022, 2023)
SIAM International Conference on Data Mining (SDM) (2021, 2022, 2023)
Data Mining and Knowledge Discovery (DAMI) (2022)
IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) (2023)