
BIOGRAPHICAL SKETCH

NAME: Horn, Abigail

eRA COMMONS USER NAME (credential, e.g., agency login): abigaillhorn

POSITION TITLE: Clinical Assistant Professor of Population and Public Health Sciences

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
College of Creative Studies, University of California, Santa Barbara	B.A.	09/2007	Physics
Massachusetts Institute of Technology	Ph.D.	09/2016	Engineering Systems; Data, Systems, & Society
German Federal Institute for Risk Assessment and Kühne Logistics University, Germany	Postdoctoral Researcher	09/2018	Transport and Logistics Modeling
Keck School of Medicine, University of Southern California	T32 Postdoctoral Fellow	01/2022	Preventive Medicine; Biostatistics

A. Personal Statement

I am a Research Assistant Professor in the Department of Industrial and Systems Engineering and a Lead Scientist at the Information Sciences Institute (ISI) in the Viterbi School of Engineering. I also hold positions as Associate Director for the AI Research for Health Center (AI4Health) and co-direct the DataFest, a cross-campus program for facilitating interdisciplinary data science student projects. The general area of my research is the combination of tools from computational social science, systems and mathematical modeling, and AI with emerging large-scale data sources to understand drivers of pressing public health challenges that can inform future interventions, with a focus on food supply chain resilience and health behaviors. My primary areas of research expertise include (i) novel data sources and computational social science, including analysis of large-scale mobility data, for understanding health behaviors in context and using insights to inform new research directions; (ii) network science, supply chain optimization, and computational epidemiology for modeling food supply chains for applications in supply resilience and food safety; and (iii) computational epidemiological modeling for understanding drivers of disparities of the COVID-19 epidemic, with a focus on Los Angeles County (LAC). I have multidisciplinary training with a PhD from the Institute for Data, Systems, and Society at the Massachusetts Institute of Technology (MIT), where I developed mathematical modeling and systems engineering approaches for tracing foodborne disease outbreaks; a postdoctoral fellowship in food supply system logistic modeling from the Kühne Logistics University (KLU); a research stay in the Division of Informatics at the German Federal Institute for Risk Assessment, Germany's federal-level food safety research authority; and training in Biostatistics and Health Behavior from the Department of Population and Public Health Sciences (DPPHS) at the University of Southern California (USC). I have helped to develop collaborative teams within and across all of these institutions, and play a leading role in bringing innovative analytics to team-based health science. This collaborative approach is essential to address systemic public health challenges, which have complex drivers and require multidisciplinary solutions.

Ongoing and recently completed projects that I would like to highlight include:

June 2023 – May 2024 *ChefRecs: A.I.-Driven Meal Prescriptions To Meet Sociocultural and Nutritional Dietary Needs*

PI: Abigail Horn, PhD

Information Sciences Institute Keston Exploratory Research Award,
\$100,000

Role: PI. I developed this project, including acquiring data and partnership with dieticians in organ transplant, to apply techniques from machine learning to recipe data to develop a mobile app that will support clinicians in implementing meal prescription interventions that are tailored to the needs of patients with diverse sociocultural backgrounds and food preferences.

June 2022 – Dec 2023 *MenuAnalysis: Analyzing Digital Menu Data to Characterize Nutritional Quality of Food Environments in Los Angeles*

PI: Abigail Horn, PhD

USC Keck School of Medicine Dean's Pilot Grant, **\$50,000**

Role: PI. I developed this project, including acquiring data and community partnerships, to apply techniques from machine learning to digital menu data to quantify the nutrition of food sold in restaurants and evaluate nutritional disparities in the restaurant food environment.

Oct 2021 – Sep 2024 *Using Community Partnerships, Novel Data Streams, and a Data Portal to Strengthen Food Systems, Security, & Justice*

PI: Kayla de la Haye, PhD

*National Science Foundation, S&CC-IRG Track 1: Smart & Connected Community Food Systems, **\$2,054,156***

Role: Co-investigator (budgeted at 2.4 months/year). I helped to develop the data analytics aim of the proposal.

Mar 2020 – Dec 2022 *Using Big Mobility Data to Map the Food Environments of Diverse Los Angeles Residents*

Pis: Kayla de la Haye, PhD; Esteban Moro, PhD; Sandy Pentland, PhD

USC Keck School of Medicine Dean's Pilot Grant, **\$40,000**

Role: Co-author and co-investigator (no effort funded). I worked with Dr. de la Haye to devise the aims and write the proposal. I have led the design and implementation of the data analysis approach.

Jan – Dec 2021 *Incorporation of risk factors in a multi-population stochastic epidemiological COVID-19 model for Los Angeles County*

PI: David Conti, PhD

W.M. Keck Foundation, COVID-19 Rapid Research Fund, **\$70,000**

Role: Co-investigator (full time). My work to develop mathematical models of COVID-19 transmission in Los Angeles County was the basis for this grant. I designed and carried out the data science analysis and modeling approach with Dr. Conti.

Jan 2021– June 2022 *Incorporation of risk factors in a multi-population stochastic epidemiological COVID-19 model for Los Angeles County*

PI: David Conti, PhD

W.M. Keck Foundation, COVID-19 Rapid Research Fund, **\$70,000**

Role: Co-investigator (full time). My work to develop mathematical models of COVID-19 transmission in Los Angeles County was the basis for this grant. I designed and carried out the data science analysis and modeling approach..

Sep 2021 – Aug 2024 *FoodDecide: Digital Technologies for Food Safety Decision Support*

PI: Matthias Filter, Diplom Biochemiker

German Federal Ministry of Education and Research (BMBF), €450,000

Role: Research Advisor. My postdoctoral work was the basis for this award.

B. Positions, Scientific Appointments and Honors

Fellowships and Awards

Top Poster Award, Health Equity in Action Annual Workshop of the NIMHD Research Coordinating Center to Reduce Disparities in Multiple Chronic Diseases (RCC-RD-MCD)	2022
NIH T32 Postdoctoral Fellowship	2019-2020
Young Scientist Award for Best Satellite at Network Science Society	2019
Bayer Foundation Fellowship	2016-2017
International Association for Food Protection (IAFP) Travel Award	2016
Santa Fe Institute for Complex Systems Summer School Travel Award	2012
MIT Engineering Systems Division Research Award	2011-2013
Rotary Club Ambassadorial Scholarship	2009-2010
UCSB Environmental Studies Department Research Award	2007
UCSB Summer Undergraduate Research Award in Nanotechnology	2006

Selected Synergistic Activities

Associate Director, AI Research for Health Center (AI4Health) 2022-current
USC Information Sciences Institute

Smart and Connected Food System Working Group Member 2022-current

Los Angeles County Food Equity Roundtable, Chief Executive Office

- Sharing expertise on most important areas for improvement and initiatives that involve innovative and new uses of data, technology and smart tools, to help modernize LA County's food system

Epidemiological Modeler 2020-2021

Los Angeles County Department of Public Health (LACDPH)

- Providing estimates of COVID-19 epidemic parameters for LA County and other model-based analyses requested by LACDPH's Chief Science Officer

Co-Director, DataFest, 2020-current

USC Center for Knowledge-Powered Interdisciplinary Data Science

Invited Member, Provost's Research Working Group, Project [Pandemic] Restart,
USC Office of Research

C. Contributions to Science

(ii) Network science and systems modeling for modeling food supply systems. My interest in food systems shaped my PhD research in Engineering Systems at MIT's Institute for Data Systems and Society, which focused on developing network models of large-scale food supply system structure, mathematical models of the transmission of resilience and contamination spread across these networks, and inference approaches for tracing large-scale outbreak sources. The aim of this work was to develop decision models to guide investigators to implement effective interventions. My PhD work attracted the interest of Germany's federal-level food safety research agency, who invited me to develop a source detection approach for risk analysis and outbreak response at their institute. While in Germany I held a concurrent postdoctoral appointment at Kühne Logistics University (KLU) in Hamburg, where I worked with experts in transport engineering and mobility modeling to develop logistic flow models of the food supply system in Germany--from production to consumption--by combining dynamic commodity flow models with data from agriculture, industry, transport, mobility, retail, and surveys. My work in this area was supported by a \$200,000 grant I authored from the Robert Wood Johnson Foundation, a small grant from the German Research Council, a fellowship from the Bayer Foundation; and led to a €450,000 grant from German Federal Ministry of Education and Research.

Key publications:

- **Horn, A.**, Friedrich, H. Locating the source of large-scale outbreaks of foodborne disease. *Journal of the Royal Society Interface*. 2019; 16(151), 20180624. [PMID: 30958197](#)
- Deng, X., Cao, S., **Horn, A.** “Emerging Applications of Machine Learning in Food Safety” *Annual Reviews in Food Science and Technology*, Volume 12, pp.513-538, **2021**. [PMID: 33472015](#).
- Liu*, X, **Horn***, **A.**, Su, J, Jiang, J. A universal measure for network traceability. *Omega: The International Journal of Management Science*. 2018; 87, 191-204. [Not indexed in MEDLINE]
- Schlaich, T., **Horn, A.**, Fuhrmann, M., & Friedrich, H. “A Gravity-Based Food Flow Model to Identify the Source of Foodborne Disease Outbreaks.” *International Journal of Environmental Research and Public Health*, 2020; 17(2), 444. [PMID: 31936507](#).

* Authors contributed equally

(ii) Big data analytics for understanding food environments and eating behaviors in context. The availability of big data from Novel Data Streams (NDS) -- such as longitudinal spatiotemporal mobility data from smartphones, point of interest data, and social media data -- has opened up new opportunities for monitoring, measuring, and modeling food systems and the food environment, how individuals dynamically interact with these systems, and how this may affect their food choices and contribute to disparities in nutritional health, all at a population-scale. My research is leading the integration of NDS and state-of-the-art data science methods to investigate these new opportunities, aiming to inform system-level interventions that can help to improve diets and prevent diet-related diseases including obesity and diabetes.

Key publications:

- **Horn, A.**, Bell, B., Bulle-Bueno, B., Bahrami, M., Bozkaya, B., Wilson, J., Cui, Y., Pentland, S., Moro, E., de la Haye, K. “Population mobility data provides meaningful indicators of fast food intake and diet related diseases in diverse populations.” *Nature Partner Journals (npj) Digital Medicine*. **2023**; 10.1038/s41746-023-00949-x.
- Bulle-Bueno, B., **Horn, A.**, Bahrami, M., Bell, B.*, Bozkaya, B., de la Haye, K., Pentland, S., Moro, E. “You are where you eat: Effect of mobile food environments on fast food visits.” *medRxiv*, **2022**, <https://www.medrxiv.org/content/10.1101/2022.09.20.22280128v1>
- Seo, D., Horn, A., Abeliuk, A., Burghardt, K. “What’s On the Menu? Towards Predicting the Nutritional Quality of a Restaurant Menu.” *Under review*.
- Liu, I., Abeliuk, A., de la Haye, K., **Horn, A.** “A continuous indicator of food environment nutritional quality.” *Proceedings of August 15 KDD Workshop on Data-driven Humanitarian Mapping, 27th ACM SIGKDD Conference*. ACM, New York, NY, USA, 7 pages, **2021**.
- Lee, B.Y., Ordovás, J.M., ..., **Horn, A.**, ..., Parks, E. Research Gaps and Opportunities in Precision Nutrition: An NIH Workshop Report. *American Journal of Clinical Nutrition*. 2022; 116(6):1877-1900. [PMID: 36055772](#)

(iii) COVID-19 epidemic modeling for quantifying health disparities. I engaged in COVID-19 epidemiological modeling work in Los Angeles County, providing policy-level support in response to requests from the Los Angeles County Department of Public Health (LACDPH)’s Chief Science Officer by using epidemiological models to estimate changes over time in the transmission rate of the pandemic (the “R value”), the percentage of total infections that went unobserved, and the case and infection fatality rates (CFR and IFR) within LAC. I have developed multi-population epidemic models to estimate infection and death rates across race/ethnicity, age, and neighborhood subpopulations in order to evaluate drivers of disparities. I used this modeling framework in policy analyses that forecasted the epidemic’s spread and evaluated the impact of various interventions including testing, vaccination, and social distancing within each risk group. The fine-grained subpopulation-stratified estimates of COVID-19 outcomes produced in this epidemiological modeling work are critical to quantifying our understanding of disparities in the effect of the epidemic on different groups in LAC, and can inform future analyses into targeted policy interventions that protect specific at-risk groups. Towards these objectives, I contributed to project funded by the University of California Institute of Transport Studies that used Agent Based Modeling and a sophisticated transport demand modeling framework to explore the impacts of various intervention efforts on reducing COVID-19 infections in Los Angeles County.

Key publications:

- **Horn, A.**, Jiang, L., Washburn, F., Hvitfeldt, E., de la Haye, K., Nicholas, W., Simon, P., Pentz, M., Cozen, W., Sood, N. and Conti, D.V., 2021. “An integrated risk and epidemiological model to estimate

risk-stratified COVID-19 outcomes for Los Angeles County: March 1, 2020—March 1, 2021” *PLOS One*, 16(6), p.e0253549, 2021. [PMID: 34166416](#)

- C Rodier, **A Horn**, Y Zhang, I Kaddoura, S Müller. “Effectiveness of Nonpharmaceutical Interventions to Avert the Second COVID-19 Surge in Los Angeles County: A Simulation Study.” *Study Report*, 2023. Available at: <https://escholarship.org/uc/item/5f78h654> [Not indexed in MEDLINE]

(iv) Data extraction and machine learning modeling to improve the survival of critically ill patients. I

have developed machine learning based methods to construct classification models to assist in the outcome classification of critically ill septic patients. Like other medical diagnostic decision makers, the task is one of employing multiple features to classify patients as negative or positive cases. In describing the performance of binary classifiers, the percentage of correct classifications (PCC) cannot be considered alone. The sensitivity, or hit rate, and specificity, or true rejection rate, must also be analyzed. In medical diagnosis and in the machine learning community, the standard method for combining these two measures into the evaluation task is in the analysis of the area under the ROC curve (AUC). This work introduces a fuzzy multi-objective optimization function for performance evaluation in feature selection for a knowledge based medical classification task that separately considers specificity and sensitivity. This optimization measure improved the model’s accuracy and also offered new insight into the medical factors connected to what causes risk of death for patients.

Key publications:

- Cismondi, F, **Horn, A**, Fialho, AS, Vieira, SM., Reti, SR, Sousa, J, Finkelstein, S. Fuzzy multi-criteria decision-making to improve survival prediction of ICU septic shock patients. *Expert Systems with Applications*. 2012; 39(16), 12332 - 12339. [Not indexed in MEDLINE]
- **Horn, A**, Cismondi, F, Fialho, A, Vieira, SM, Sousa, JM, Reti, S, Howell, M, Finkelstein, S. Multi-objective performance evaluation using fuzzy criteria: Increasing sensitivity prediction for outcome of septic shock patients. *Proceedings of the 18th International Federation of Automated Control (IFAC) World Congress, Milan, Italy*. 2011. [Reviewed, Not indexed in MEDLINE]

List of Published Work Indexed in MEDLINE in MyBibliography

<https://www.ncbi.nlm.nih.gov/myncbi/abigail.horn.1/bibliography/public/>