Department of Data Science

Data Science Seminar Series

Artificial Intelligence Solutions for Reliable Epidemic Forecasting

Lijing Wang, Ph.D.
Research Fellow
Harvard Medical School

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Web Link: Zoom Meeting Room Link

Infectious diseases, such as seasonal influenza, Zika, Ebola, and the ongoing COVID-19, can be spread, directly or indirectly, from one person to another leading to an outbreak, an epidemic, or a pandemic. Infectious diseases place a heavy social and economic burden on our society. Producing timely, well-informed, and reliable spatiotemporal forecasts of the epidemic dynamics can help inform policymakers on how to provision limited healthcare resources, develop effective interventions, rapidly control outbreaks, and ensure the safety of the public. Traditional approaches are mainly based on theory-based mechanistic models (e.g., an agent-based SEIR model) and statistical time series models (e.g., autoregressive models). Recent advances in deep learning have significantly improved the state of the art in computer vision, natural language processing, and many other fields. However, they are not well explored in epidemic forecasting. One challenge is the lack of sufficient good-quality training data, particularly during new emerging epidemics. Another challenge is that existing models are seldom designed to consider both spatial and temporal correlations dynamically for capturing disease spread dynamics. A further challenge is that such models rarely consider epidemiological context. Models in the aforementioned cases are prone to be overfitting and are unlikely to provide explanatory power for the underlying phenomena due to the black box nature. Given the challenges, my research focuses on deep learning-based methods that incorporate spatiotemporal features, theory-based mechanistic models, and ensemble techniques for a better understanding of disease spreading and improving forecasting accuracy and explainability. This talk presents several works evolving around artificial intelligence techniques for reliable epidemic forecasting. Particularly, we explore a new research direction that combining theory and data-driven methods for epidemic forecasting. We also investigate machine learning theory and algorithms, with the aim of building more robust, consistent, and accurate AI-based forecasting systems. The talk will conclude with a discussion of promising future directions and opportunities in AI for social good.

Lijing Wang is a research fellow in the Computational Health Informatics Program (CHIP) at Boston Children's Hospital and Harvard Medical School working with Prof. Guergana Savova and Prof. Timothy Miller. She completed her PhD of Computer Science at the University of Virginia working with Prof. Madhav Marathe and Prof. Jiangzhuo Chen. She is interested in the broad topics of computing for social good with an emphasis on applying machine learning, deep learning, and natural language processing for solving problems of diverse domains such as epidemics, clinical analysis, bioinformatics, and public health etc. Her research includes theory and practice. Her works have been published at top conferences and journals such as NeurIPS, AAAI, KDD, CIKM, IAAI, IEEE ICC, Nature Communications, ACM TSAS, and WWWJ. She received student awards from AAAI'19, NeurIPS'20, AAMAS'21, and IJCAI'21 conferences. She also served as PC, TPC, and reviewers at AAAI, IJCAI, CIKM, ICMLA, IEEE BigData, Expert Systems with Applications, Journal of Parallel and Distributed Computing, etc. She recently was nominated by Prof. Richard E. Stearns who received the 1993 ACM Turing Award for participating the 9th Heidelberg Laureate Forum.