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A Hierarchical Approach for Modeling the Dynamics of Emerging Epidemics

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Abstract

The dynamics of emerging epidemics are complex to understand and difficult to model. Moreover, data for rare conditions (over time and space) often include excess zeros which may result in inefficient inference and ineffective prediction for such processes. This is a common issue in modeling rare or emerging diseases or diseases that are not common in specific areas, specific time periods, or those conditions that are hard to detect. A common approach to modeling data with excess zeroes is to use zero-modified models (i.e., hurdle and zero-inflated models). Here, we provide a hierarchical Bayesian modeling approach to effectively model the dynamics of disease spread based on zero-modified modeling approaches. To this end, we incorporate a physical-statistical modeling approach to model the dynamics of disease spread using zero-modified models. The flexibility of the proposed approach allows us to model the dynamics of disease spread for rare conditions that are on the rise (over time and/or space). To demonstrate our work, we provide a case study of modeling the spread of Lyme disease based on confirmed cases of the disease in the United States.

Biography

Dr. Ali Arab is an Associate Professor of Statistics in the Department of Mathematics and Statistics of Georgetown University. His methodological research is in spatio-temporal and spatial statistics, and hierarchical Bayesian modeling. He is interested in statistical modeling for environmental sciences, ecology, and epidemiology as well as business and finance applications (with focus on auditing, price modeling and forecasting).