Integration of Science and Statistics in Teaching and Research of Stochastic Processes

By

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Abstract

The topic of stochastic processes has long been a theoretical subject in statistics or applied probability. Very few practical applications have been used in research and teaching. This presentation will demonstrate applications of stochastic processes in scientific investigation and how they are incorporated in class teaching. In the first example, a stochastic model is used to better understand the dynamics of behavioral stage changes- a well-known trans-theoretical model in behavioral sciences. A Bayesian approach to evaluate the covariate effects on a stochastic model through a log-linear regression link, was developed. In the second example, a continuous-time Markov chain (CTMC) is applied to study Alzheimer's disease caregiver stress levels, where one level is subject to misclassification. Covariate effects of this hidden Markov process and misclassification probabilities of the hidden state are estimated without information from a 'gold standard' as comparison. Parameter estimates are obtained using a modified expectation-maximization (EM) algorithm, and identifiability and estimability of CTMC estimation is addressed.

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