ADVANCES AND CHALLENGES IN MODELLING ANIMAL MOVEMENT DATA

Jay M. Ver Hoef[1], Devin S. Johnson[1]

[1]NOAA National Marine Mammal Lab, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA, USA

In this paper, we discuss several challenges in modelling satellite telemetry data from animals. The data sets are often massive collections of space-time locations on multiple animals. We review several methods that we have developed recently. One is for generalized linear models of time series data, where we have developed an estimation algorithm whose time increases linearly with sample size. For most commercial software, computing time increases as the cube of sample size because of covariance matrix inversion. This model is applied to binary data recorded from satellite telemetry, such as when seals haul out. A second model is an animal movement model that is derived from a continuous time Ornstein-Uhlenbeck velocity process that is integrated to form a position process. This continuous-time model is placed into a discrete state-space framework and uses a Kalman filter for fast parameter estimation and location predictions from animal locations obtained at nonuniform times. Finally, we discuss a Bayesian hierarchical model for resource selection that incorporates animal movement. This has been a challenging model because of the large sample sizes, space-time autocorrelation, and the need to integrate over spatially-explicit habitat variables. New approaches for fast integration and parallel processing are explored.