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Quantifying uncertainty in home-range overlap: Confidence intervals for the Utilization Distribution Overlap Index (UDOI)

Home-range (HR) estimation and HR overlap are of considerable interest in ecological research. Overlap analyses are commonly employed for different purposes, such as assessing the similarity of multiple HR estimates for a single individual or quantifying the degree of space sharing between individuals. The majority of overlap metrics produce a point estimate for overlap with no associated measure of uncertainty for the estimate. A recent advancement in HR estimation, called Autocorrelated KDE (AKDE), has made quantifying uncertainty in overlap possible. AKDE explicitly accounts for autocorrelation in data by first fitting an autocorrelated movement model. Recent work by Winner et al. (2018) leverages uncertainty in the estimated model parameters to produce approximate confidence intervals (CIs) on the Bhattacharyya Coefficient (BC), a pairwise overlap metric with a formal basis in distributional similarity. However, Fieberg and Kochanny's (2005) classic comparative analysis of pairwise overlap metrics suggests that the UDOI, a generalization of Hurlbert's (1978) E / E_uniform statistic, is preferred over the BC for evaluating overlap between individuals when a measure of space sharing is desired, rather than pure distributional similarity. Our work expands the previously developed inferential framework for the BC to include the UDOI by deriving CIs for the two components that comprise the UDOI: the Average Probability of Encounter (APE) and the area of overlap ($A_{1,2}$). We evaluate the performance of our CIs using simulations and demonstrate their usefulness with an applied example. We further compare these CIs to those obtained by parametric bootstrap and provide recommendations for implementing these intervals in applied ecological research.