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A general sequential fixed-accuracy confidence interval estimation methodology for a positive parameter: illustrations using health and safety data

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Abstract Estimation of positive parameters is important in areas including ecology, biology, medicine, nuclear power, and study of cell membranes. We develop a general structure for a *fixed-accuracy* sequential confidence interval estimation methodology in the spirit of Mukhopadhyay and Banerjee (Sequ Anal, 33:251–285, 2014a) for a positive parameter of an arbitrary distribution which may be discrete or continuous. The confidence interval is constructed using a maximum likelihood (ML) estimator of the unknown parameter. The methodology enjoys attractive properties such as asymptotic consistency and asymptotic first-order efficiency (Theorem 1). Three specific illustrations are included. Comprehensive data analyses from large-scale simulations have been incorporated which substantiate encouraging performances of the proposed estimation methodology. These are followed by real data analyses corresponding to the Bernoulli distribution (odds ratio of poisonous mushrooms), Poisson distribution (radioactive decay of isotopes), and a Normal distribution with the same mean and variance (real-time 911 calls dispatch).

Keywords Ecology · Environmental statistics · First-order properties · Insect count · ML estimator · 911 calls · Odds ratio · Positive parameter · Radioactive decay · Sequential methods

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