

A normal hierarchical model and minimum contrast estimation for random intervals

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Abstract Many statistical data are imprecise due to factors such as measurement errors, computation errors, and lack of information. In such cases, data are better represented by intervals rather than by single numbers. Existing methods for analyzing interval-valued data include regressions in the metric space of intervals and symbolic data analysis, the latter being proposed in a more general setting. However, there has been a lack of literature on the parametric modeling and distribution-based inferences for interval-valued data. In an attempt to fill this gap, we extend the concept of normality for random sets by Lyashenko and propose a Normal hierarchical model for random intervals. In addition, we develop a minimum contrast estimator (MCE) for the model parameters, which is both consistent and asymptotically normal. Simulation studies support our theoretical findings and show very promising results. Finally, we successfully apply our model and MCE to a real data set.

Keywords Random intervals · Uncertainty · Normality · Choquet functional · Minimum contrast estimator · Strong consistency · Asymptotic normality