The Ratio-Plot in the Practice of Capture-Recapture Studies and Analysis

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Statistical graphics are a fundamental, yet often overlooked, set of components in the repertoire of data analytic tools. Graphs are quick and efficient, yet simple instruments of preliminary exploration of a dataset to understand its structure and to provide insight into influential aspects of inference such as departures from assumptions and latent patterns. In this talk, we present and assess a graphical device for choosing a method for estimating population size in capture-recapture studies of closed populations. The basic concept is derived from a homogeneous Poisson distribution where the ratios of neighbouring Poisson probabilities multiplied by the value of the larger neighbour count are constant. This property extends to the zero-truncated Poisson distribution which is of fundamental importance in capture-recapture studies. In practice however, this distributional property is often violated. The graphical device developed here, the ratio plot, can be used for assessing specific departures from a Poisson distribution. For example, simple contaminations of an otherwise homogeneous Poisson model can be easily detected and a robust estimator for the population size can be suggested. More systematic departures can also easily be detected using the ratio plot. In this talk, the focus is on Gamma-mixtures of the Poisson distribution which leads to a linear pattern (called structured heterogeneity) in the ratio plot. More generally, the talk shows that the ratio plot is monotone for arbitrary mixtures of power series densities.