



Center for Statistical Science Seminar

Proportional inverse Gaussian distribution: A new tool for analyzing continuous proportional data

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Abstract: Outcomes in the form of rates, fractions, proportions and percentages often appear in various fields. Existing beta and simplex distributions are frequently unable to exhibit satisfactory performances in fitting such continuous data. This paper aims to develop the *normalized inverse Gaussian* (N-IG) distribution proposed by Lijoi et al. (2005) as a new tool for analyzing continuous proportional data in $(0, 1)$ and renames the N-IG as *proportional inverse Gaussian* (PIG) distribution. Our main contributions include: (1) To overcome the difficulty of an integral in the PIG density function, we propose a novel *minorization-maximization* (MM) algorithm via the continuous version of Jensen's inequality to calculate the maximum likelihood estimates of the parameters in the PIG distribution; (2) We also develop an MM algorithm aided by the gradient descent algorithm for the PIG regression model, which allows us to explore the relationship between a set of covariates with the mean parameter; (3) Both the robustness researches and the real data analyses show that the PIG distribution has the best robustness performance when comparing with the beta and simplex distributions in terms of the AIC, BIC and the p -value of the Kolmogorov-Smirnov test. In addition, bootstrap confidence intervals and testing hypothesis on symmetry of the PIG density are also presented. Simulation studies are conducted and the hospital stay data of Barcelona in 1988 and 1990 are analyzed to illustrate the proposed methods.

(This is a joint work with Mr. Pengyi LIU, Professor Kam Chuen YUEN, Dr. Chi ZHANG and Professor Man-Lai TANG)

***Date:** *Wednesday, 11 December 2019*

Time: *3:00p.m.-4:00p.m.*

Venue: *Room 1511, Academic Building
(near Lifts no.27/28), HKUST*