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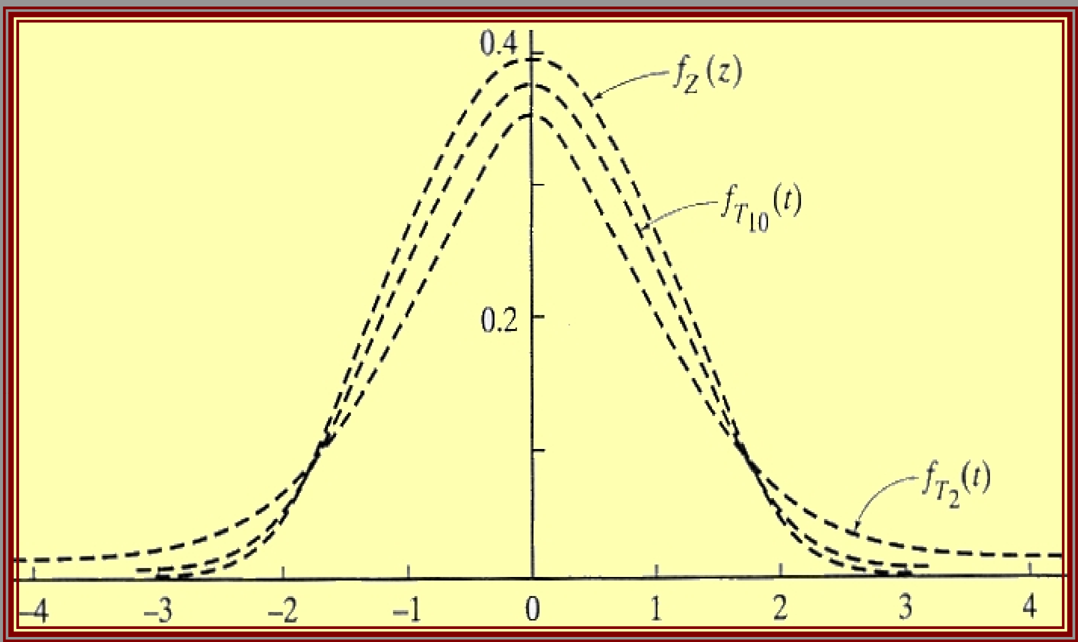
A comprehensive journal of probability and statistics
for theorists, methodologists, practitioners, teachers, and others



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A Comprehensive Journal of Probability and Statistics

for Theorists, Methodologists, Practitioners, Teachers, and Others

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Aims and Scope The ***Journal of Probability and Statistical Science*** (***JPSS***, ISSN 1726-3328) is a modified version of the ***Journal of Propagations in Probability and Statistics*** (***JPPS***, ISSN 1607-7083). ***JPSS***, like its predecessor ***JPPS***, is a multipurpose and comprehensive journal of probability and statistics that publishes papers of interest to a broad audience of theorists, methodologists, practitioners, teachers, and any other users of probability and/or statistics. The scope of ***JPSS*** is intended to be quite broad, including all the major areas of probability and statistics. Research papers involving probability and/or statistics, either theoretical or applied in nature, will be seriously considered for publication. Additionally, papers involving innovative techniques or methods in teaching probability and/or statistics will also be considered. Papers submitted for publication consideration will be peer reviewed. Initially, we will publish semiannually, one issue each in February and August. Hopefully, as time accrues, we will be able to publish quarterly. It is the goal of ***JPSS*** to publish a wide range of works involving probability and/or statistics (theoretical and/or applied in nature) and provide widespread availability of such to a broad audience of people interested in probability, statistics and biostatistics.

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Editorial Note

There are eight articles on the theory, methods and applications in this issue. The first article considers the estimation of the conditional quantile by the kernel method, in the case of response missing at random and when explanatory variable takes its values in a space of infinite dimension. A new zero inflated distribution named Zero Inflated Negative Binomial-Sushila distribution is proposed in second article. Different distributional properties and estimation of the parameters of the proposed distribution along with some real life applications are given in this article. Some new classification based ridge regression estimators for estimating the ridge parameter have been proposed in article three. A simulation study has been conducted to evaluate the performance of these estimators and conclusions are made based on the smaller MSE sense. Article four introduces a new class of lifetime distribution, namely the two-sided Topp-Leone (TSTL) family of distribution. It also proposes a new lifetime distribution, namely two-sided Topp-Leone Weibull (TSTLW) distribution. Some properties of these distributions along with parameters estimation are discussed. Three real datasets are analyzed to expose the efficiency of the purposed distribution compared with the TLGW and TSGW distributions. A new family of lifetime distributions, called, Topp-Leone generalized exponential power series (TLGEPS) distribution is proposed in article five. Some useful mathematical properties of the proposed distribution are discussed. Parameters of the proposed distribution are estimated using MLE method. Two real life data are analyzed. Article six considers the problem of estimation of the population mean in successive sampling and proposed a new estimator. Optimum replacement policy and efficiency of the proposed estimator have been discussed. A new method for the construction of supersaturated design using cyclic type partially balanced incomplete block designs is suggested in article seven. The construction of the design is also demonstrated with suitable example. The last but not the least, article eight considers the Bayesian inference of the unknown parameters of bivariate generalized exponential distribution. A simulation study is conducted to test the performance of Bayesian estimators and two real data sets are introduced to illustrate the proposed study. This article concludes that the Bayesian analysis has the ability to significantly reduce the bias and mean square error in the estimation procedure by choosing the appropriate prior distribution for the parameters to obtain more accurate estimators.

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16(2), 131-149, Aug. 2018

Estimation of the Conditional Quantile for Functional Stationary Ergodic Data with Responses Missing at Random

Nesrine Hamidi and Boubaker Mechab
University Djillali Liabes

ABSTRACT The purpose of this paper consists in estimating the conditional quantile by the kernel method, in the case of response missing at random and when explanatory variable takes its values in a space of infinite dimension. Under the ergodicity condition, we study the asymptotic properties of the proposed estimator by establishing its rate of almost sure convergence as well as its asymptotic normality by taking into account the missing data.

Keywords Conditional quantile; Functional ergodic data; Kernel estimation; Missing at random.

1. Introduction

The estimation of the conditional quantile is a very important subject in statistics. This estimate is used for the construction of predictive intervals, the determination of reference curves or as a forecasting tool when it appears that the regression is not very adapted to certain situations in order to better predict the impact of explanatory variable X on the response variable Y.

Historically, Stone [27] seems to be the first one approached the estimation of the conditional quantile. He obtained the convergence in probability of an estimator based on the empirical estimation of the conditional distribution function. In 1989, Samanta [26] established the asymptotic normality and the uniform convergence of the kernel estimator of the conditional quantile in the i.i.d. case (see also Roussas [25] and Berlinet *et al*. [2]).

□Received July 2017, revised November 2017, in final form December 2017.
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Zero Inflated Negative Binomial-Sushila Distribution: Some Properties and Applications in Count Data with Many Zeros

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Winai Bodhisuwan / *Kasetsart University*
Katechan Jampachaisri / *Naresuan University*
Andrei Volodin / *University of Regina*

ABSTRACT In this work, a new zero inflated distribution is proposed which is called Zero Inflated Negative Binomial-Sushila distribution. A method of constructing this distribution is presented. Some properties of the proposed distribution are derived including probability mass function, moments about origin, variance, skewness and kurtosis. Furthermore, its special case is discussed. The maximum likelihood method is also implemented for parameter estimation of the proposed distribution. In addition, the Zero Inflated Negative Binomial-Sushila distribution is applied for some real data sets. The results show that the proposed distribution can be used as an alternative model for count data with too many zeros and over-dispersion.

Keywords Excessive zero counts; Negative binomial-Sushila distribution; Overdispersion; Zero inflated distribution.

1. Introduction

Modeling of count data is used to explain a random phenomenon in many fields. The Poisson distribution has been often used for modeling the distribution of the count data observations, see, for example [1]. The main problem with an application of the Poisson distri-

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Classification-Based Ridge Estimation Techniques of Alkhamisi Methods

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Okunola A. Oluyemi / *University of Medical Sciences*
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Onate A. Clement / *Landmark University*

ABSTRACT Following Lukman and Ayinde [9]: review and classification of methods of estimating ridge parameters into different forms and various types, this study proposed some new ridge parameter estimation using the idea of Alkhamisi *et al*. [1]. The performance of the techniques was evaluated by conducting Monte-Carlo experiments under certain conditions and compared using relative efficiency. Results show that increase in the strength of multicollinearity resulted in increase in mean square error (MSE), which decreases as the sample size increases. Furthermore, the most preferred technique is generally in the different forms in the original and square root types. Moreover, Fixed Maximum Original (FMO) for Alkhamisi *et al*. [1], the proposed Varying Maximum Original (VMO) for AL4, VMO for AL6 and Harmonic Mean Original (HMO) for AL5 competes favorably.

Keywords Mean square error; Monte-Carlo experiment; Ridge parameter; Relative efficiency.

1. Introduction

Consider the standard linear regression model:

$$\boldsymbol{Y} = \boldsymbol{X\beta} + \boldsymbol{U} \tag{1}$$

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Characterization of Two-Sided Topp-Leone Family and Its Applications

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Kasetsart University *University of Regina*

ABSTRACT In this article, we introduce a new family of lifetime distributions, called the two-sided Topp-Leone generated family of distributions. A special case of the new family is the two-sided Topp-Leone Weibull distribution. This distribution uses the two-sided Topp-Leone distribution as a generator. The two-sided Topp-Leone Weibull distribution can obey several shapes: decreasing, unimodal and bimodal. This makes this distribution more flexible than the Weibull distribution. Its quantile, hazard rate and moment functions are derived. The parameter estimation procedure by the method using maximum likelihood estimation is discussed. The proposed distribution can be applied for the remission times of bladder cancer patients, time to failure of turbocharger and strength data set. We compare the proposed distribution to the Topp-Leone generated Weibull and two-sided generalized Weibull distribution. In conclusion, the two-sided Topp-Leone Weibull distribution and two-sided generalized Weibull distribution have better fit to the dataset comparing to the Topp-Leone generated Weibull.

Keywords Lifetime data Analysis; Parameter-adding method; Topp-Leone family; Two-sided family.

1. Introduction

The Weibull distribution is the lifetime distribution which has been widely used in reliability analysis. It can be used to model a variety of failure characteristics such as increasing, decreasing, and bathtub shapes. If X has Weibull distribution with parameters $\lambda \geq 0$ and $k \geq 0$, then the cumulative distribution function (cdf) and probability density function (pdf) are

$$F(x;\lambda,k) = 1 - \exp\{-(x/\lambda)^k\}, \quad x \geq 0$$

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The Topp-Leone Generalized Exponential Power Series Distribution with Applications

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Kasetsart University *University of Regina*

ABSTRACT In this article, a new family of distributions is introduced. It is gained by compounding a lifetime distribution with discrete distributions. It is called the Topp-Leone generalized exponential power series distribution. The distributions are utilized for reliability of parallel process with independent and identically distributed components, where the lifetime of each component shows the characteristic of the Topp-Leone generalized exponential distribution. The proposed distribution can be composed by several lifetime models. There are some special cases such as the Topp-Leone generalized exponential Poisson, Topp-Leone generalized exponential geometric, Topp-Leone generalized exponential binomial, and Topp-Leone generalized exponential logarithmic distributions. Some statistical properties of the proposed distributions are presented including the survival function, distribution function, hazard function and moments. The hazard function of the proposed distributions is categorized as decreasing, increasing, and V shaped. In this study, the maximum likelihood estimation is employed to estimate the parameter. Some real datasets are used to illustrate the goodness-of-fit depended on the generalized exponential, Topp-Leone generalized exponential, Topp-Leone generalized exponential geometric, and Topp-Leone generalized exponential Poisson distribution. The results show that its sub-model of the proposed distribution is better than selected distributions.

Keywords Maximum likelihood method; Parallel system; Power series class of distributions; Topp-Leone generalized exponential distribution

1. Introduction

The lifetime model has become well-known in many fields such as medicine, engineering, and biological organisms. Recently, various distributions have been presented for lifetime data.

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Generalized Estimator for Estimating the Population Mean in Successive Sampling

Vishwantra Sharma and Sunil Kumar
University of Jammu

ABSTRACT This paper addresses the problem of estimation of the population mean of the study variable over two occasion successive sampling. Based on the information available from both the occasions a generalized class of estimator has been proposed for estimating the population mean of the study variable in current occasion. The expressions for the bias and the mean square error of the estimators have been developed. Relative comparisons of efficiencies of the proposed estimator with sample mean estimator and optimal successive estimator when no auxiliary information is used. The study of the proposed estimator has been supported and enhanced by optimal replacement policy. Empirical study has been carried out to examine the performance of the proposed estimator.

Keywords Auxiliary variable; Mean square error; Optimal replacement policy; Study variable; Successive sampling.

1. Introduction

There are many cases where the survey often needs to be repeated many times. The purpose of rotation sampling is to allow one or more items to be monitored over time. The sampling on two occasions is applied when the same variables are measured on two different occasions. In successive sampling, it is common to use the full information collected on previous occasion to improve the accuracy of the estimator on current occasions. The main purpose of successive sampling is to estimate certain population parameters such as population mean, ratio, product etc. for both the occasion. In the study of sample survey, information about the auxiliary variables associated with principal variables under study was available or made available to estimate on current occasion. Such information increases the precision of the

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Construction of Supersaturated Design Using Cyclic Type PBIBD

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ABSTRACT In this paper, a new method for the construction of supersaturated design using cyclic type partially balanced incomplete block designs is proposed. The $E(s^2)$ value of the design are also derived. The construction is also illustrated with suitable example. An attempt is also made to compare these design and some remarks are made.

Keywords Cyclic type partially balanced incomplete block designs; $E(s^2)$-optimality; Supersaturated design.

1. Introduction

Supersaturated designs are fractional factorial designs in which the run size (n) is too small to estimate all the main effects. Under the effect sparsity assumption, the use of supersaturated design can provide the low-cost identification of the few, possibly dominating factors (screening). Supersaturated designs are important in various fields including computer experiments, software testing, medical, industrial and engineering experiments, and biometric applications.

Supersaturated designs also form an important class of fractional factorial designs. This is because they can be used to investigate a large number of factors using only a few experimental runs, and thus realize a lower cost than traditional factorial designs. We call a fractional factorial design supersaturated if the number of runs (n) is not enough to estimate all the main effects. SSDs can be separated into two large classes. The first class consists of supersaturated designs with only two-levels. These designs were studied for many years and their properties attracted much of the researcher's attention. Multi-level designs have all their factors consisting of s levels. The mixed-level supersaturated design is a generalization of the

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Bayes Analysis of Bivariate Generalized Exponential Distribution

Fernando A. Moala   Leandro Fernandes Coladello   Sergio Minoru Oikawa
São Paulo State University

ABSTRACT Kundu and Gupta [11] introduced the bivariate Generalized Exponential distribution (BVGE) to model lifetime data. This distribution is suitable to model data in many areas, mainly with lifetime data in medical and engineering. In this paper, we consider the Bayesian inference of the unknown parameters of this distribution. The Bayesian estimators are obtained by using different prior distributions as uniform, gamma distributions and the objective Jeffreys prior. The aim of the present paper is to compare these priors as noninformative. Maximum likelihood estimators are also obtained. A simulation study is illustrated to test the performance of Bayesian estimators and two real data sets are introduced to illustrate the proposed study.

Keywords Bayesian analysis; Bivariate generalized exponential distribution; Jeffreys prior; Likelihood function; MCMC; Noninformative prior.

1. Introduction

A variety of bivariate (multivariate) distributions have been considered in the literature, see for example Kotz, *et al*. [9]. However, most of these distributions are applied to problems under continuous or discrete variables. There are many paired data with ties for a statistical analysis and few bivariate distributions that can be employed for this kind~~y~~ of data.

Marshall and Olkin [14] proposed a Marshall-Olkin bivariate exponential (MOBE) applicable as failure distribution for systems when there exists positive probability of simultaneous failure of components, that is, it is a singular distribution whose marginals are also exponential distributions for each component. Pena and Gupta [16] considered Bayesian estimation of the parameters of MOBE in two situations, when the components are in a series and parallel system. Properties of this Marshall-Olkin model are described in detail in Barlow and

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Appendix

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Corrections to ***JPSS*** **16**(1), pp. 53-68, February 2018

Marshall-Olkin Max-Min Lomax Processes and Count Models

Seetha Lekshmi V
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1) Page 53, line 5 in Introduction Section: It should be "Alice and Jose [3]-[4]" (instead of [2]-[3]).
2) Page 53, line 7 in Introduction Section: It should be "Sankaran and Jayakumar [34]" (instead of [39]).
3) Page 53, line 11 in Introduction Section: It should be "Jayakumar and Mathew [15]" (instead of [17]).
4) Page 53, last line in Introduction Section: It should be "Jose *et al*. [17]" (instead of [22]).
5) Page 54, line 15 in the second paragraph: It should be "Seetha Lekshmi and Catherine [35]-[38]" (instead of Seethalekshmi and Catherine [35-38]).
6) Page 54, line 8 from the bottom: The sentence "Githany *et al*. [12] investigated the properties of a new parametric distribution generated by Marshall and Olkin [30]" should be removed.
7) Page 57, last line in Theorem 3.1: "with tilt parameter θ" should be removed.
8) Page 58, last line in Theorem 3.2: "with tilt parameter $1/\theta$" should be removed.
9) Page 61, last line in the proof of Theorem 4.3: It should be "--- as in Theorem 4.2" (instead of "as in Theorem 5.2").
10) In Reference [4], it should be "---, **1**, 6-17" (instead of "---, **I**, 6-17").
11) In Reference [34], it should be "Sankaran, P. G. and Jayakumar, K. (2006)" (instead of "Sankaran, P. G, Jayakumar, K. (2008)").
12) In Reference [36], it should be "---, **20**(2), 149-157" (instead of "---, **20**(2), 149").

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