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2. S. Chakraborty, M. Alizadeh, **L. Handique**, E. Altun and G.G. Hamedani (**2021**). A New Extension of Odd Half-Cauchy Family of Distributions: Properties and Applications with Regression Modeling. ***Statistics in Transition New Series***. Vol-22(4): 77-100 **(ESCI, Web of Science, SCOPUS, UGC-CARE LIST)** (ISSN No: 1234-7655).

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3. **L. Handique**, Muhammad Akbar Ali Shah, Muhammad Mohsin and F. Jamal (2021). Properties and Applications of a New Member of the T-X Family of Distributions. ***Thailand Statistician***. **Vol-19(2):248-260. (ESCI, Web of Science, SCOPUS, UGC-CARE LIST)** (ISSN No: 2351-0676).
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4. **L. Handique,** S. Chakraborty, M.S. Eliwa and G.G. Hamedani (2021). Poisson Transmuted-G family of distributions: Its properties and application. ***Pakistan Journal of Statistics and Operation research***. Vol-17(1): 309-332 **(ESCI, Web of Science, SCOPUS, UGC-CARE LIST)** (ISSN No: 1816-2711).
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5. M. Ibrahim, **L. Handique**, H.M. Yousof and S. Chakraborty. (2021). A New Three-parameter Xgamma Fréchet Distribution with Different Methods of Estimation and Applications. ***Pakistan Journal of Statistics and Operation research***. Vol- 17(1): 291-308 DOI: http://dx.doi.org/10.18187/pjsor.v17i1.2887 **(ESCI, Web of Science, SCOPUS, UGC-CARE LIST)** (ISSN No: 1816-2711).
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6. S. Chakraborty, **L. Handique** and U.M., Rana (2020). A simple extension of Burr-III distribution and its advantages over existing ones in modelling failure time data. ***Annals of Data Science***. Vol-7(1):17-31 **(Springer Nature, SCOPUS, Peer Reviewed).** (ISSN No: 2198-5812).

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8. **L. Handique,** A.L. Ahsan and S. Chakraborty (**2020**). Generalized Modified exponential-G family of distributions: its properties and applications. ***International Journal of Mathematics and Statistics***. Vol-21 (1), 1-17. **(ESCI, SCOPUS, Web of Science, UGC-CARE LIST)** (ISSN No: 0974-7117).

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Pakistan Journal of Statistics and Operation Research

The McDonald Lindley-Poisson Distribution

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Abstract

We propose the McDonald Lindley-Poisson distribution and derive some of its mathematical properties including explicit expressions for moments, generating and quantile functions, mean deviations, order statistics and their moments. Its model parameters are estimated by maximum likelihood. A simulation study investigates the performance of the estimates. The new distribution represents a more flexible model for lifetime data analysis than other existing models as proved empirically by means of two real data sets.

Key Words: Lindley-Poisson distribution; Maximum likelihood estimation; McDonald distribution; Moment; Monte Carlo simulation.

Mathematical Subject Classification: 62E10, 62E15.

1. Introduction

The Poisson distribution has been used to generate several flexible continuous distributions by compounding methods for modeling survival data. Many generalizations based on the Poisson distribution are investigated in recent years. For example, the Conway-Maxwell-Poisson discussed in Minka et al. (1) and Shmueli et al. (2), exponential Poisson proposed by Kus (3), Weibull Poisson studied by Hemmati et al. (4) and exponentiated Burr XII Poisson proposed and studied by Silva et al. (5).

Further, the Lindley distribution was introduced by Lindley (6) to illustrate the difference between fiducial and posterior distributions. Ghitany et al. (7) investigated the properties of the latter distribution and showed that it is a better model than the exponential distribution. The Lindley has also some advantages since to its hazard rate function (hrf) can exhibit bathtub shapes, and then it becomes more versatile and flexible for compounding with other distributions.

Sankaran (8) introduced the Poisson-Lindley distribution by assuming that the Poisson parameter follows a Lindley distribution. Mahmoudi and Zakerzadeh (9) generalized the Poisson-Lindley distribution and showed that their generalization has more flexibility in analyzing count data. Bhati et al. (10) proposed a

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A new extension of Odd Half-Cauchy Family of Distributions: properties and applications with regression modeling

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ABSTRACT

The paper proposes a new family of continuous distributions called the extended odd half Cauchy-G. It is based on the $T-X$ construction of Alzaatreh et al. (2013) by considering half Cauchy distribution for T and the exponentiated $G(x;\xi)$ as the distribution of X. Several particular cases are outlined and a number of important statistical characteristics of this family are investigated. Parameter estimation via several methods, including maximum likelihood, is discussed and followed up with simulation experiments aiming to asses their performances. Real life applications of modeling two data sets are presented to demonstrate the advantage of the proposed family of distributions over selected existing ones. Finally, a new regression model is proposed and its application in modeling data in the presence of covariates is presented.

Key words: $T-X$ method; regression; simulation; estimation

1. Introduction

Following the $T-X$ construction of Alzaatreh et al. (2013), Cordeiro et al. (2017) proposed a new generator of continuous probability distribution by considering Half-Cauchy for T and exponentiated G (Lehmann alternative-I) for X. They called the family generalized odd Half-Cauchy (GOHC-G(α,ξ)) and investigated its properties and applications.
In the present paper we introduce a new ganerator called extended half Cauchy family of distribution following the same construction by considering exponentiated G (Lehmann alternative-II) for X and T following Half-Cauchy with probability density function (pdf) $q(t)=\frac{2}{\pi(1+t^2)}, t>0$, where $G(x;\xi)$ is the cumulative distribution function (cdf) of the baseline distribution with parameter vector ξ. Now, following Alzaatreh et al. (2013) we define

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Properties and Applications of a New Member of the T-X Family of Distributions

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Abstract

In this paper, we introduce a new family of distributions by the use of the so-called T-X transformation defined with the Weibull distribution as generator and a sophisticated transformation involving logarithmic and power functions. We motivate the interest of this family in the fields of probability and statistics by complete theoretical and practical studies. Our theoretical investigations show how the family can be handle analytically, with formula for moments, moment generating function and order statistics. Then, the applied side is considered with a special focus on the member based on the so-called Lomax distribution. The motivation behind this member is to define a new five parameter lifetime distribution having a very flexible probability density function. We apply the related model by the means of two well-known real-life data sets, showing that the new distribution fits better than seven recent competitors.

Keywords: Weibull-X family, Akaike information criterion, Anderson-Darling test, Cramer von-Mises test.

1. Introduction

The recent literature has suggested several ways of extending well-known distributions. A common way consists in defining new classes of univariate continuous distributions by introducing additional shapes parameter(s) to a baseline distribution. The role of this additional parameter(s) is useful in exploring tail properties and also for improving the goodness-of-fit of the generator family. The well-known families are: the beta-G family (B-G) by Eugene et al. (2002) and Jones (2004), Kumaraswamy-G family (Kw-G) by Cordeiro and de Castro (2011), McDonald-G family (Mc-G) by Alexander et al. (2012), gamma-X family by Alzaatreh et al. (2014), gamma-G family (type I) by Zografos and Balakrishanan (2009), gamma-G family (type II) by Ristic and Balakrishanan (2012), gamma-G family (type III) by Torabi and Montazari (2012), log-gamma-G family by Amini et al. (2014), logistic-G family by Torabi and Montazari (2014), transformed-transformer family (T-X) by

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Poisson Transmuted-G Family of Distributions: Its Properties and Applications

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Abstract

In this article, an extension of the transmuted-G family is proposed, in the so-called Poison transmuted-G family of distributions. Some of its statistical properties including quantile function, moment generating function, order statistics, probability weighted moment, stress-strength reliability, residual lifetime, reversed residual lifetime, Rényi entropy and mean deviation are derived. A few important special models of the proposed family are listed. Stochastic characterizations of the proposed family based on truncated moments, hazard function and reverse hazard function, are also studied. The family parameters are estimated via the maximum likelihood approach. A simulation study is carried out to examine the bias and mean square error of the maximum likelihood estimators. The advantage of the proposed family in data fitting is illustrated by means of two applications to failure time data sets.

Key Words: Transmuted-G family; hazard rate function; Maximum likelihood technique; Truncated moments; Simulation.

Mathematical Subject Classification: 60E05, 62E15

1. Introduction

In the last decades, many generalized families of continuous models have been introduced by extending classical probability models and applied to model various phenomena. However, there is a clear need for extended forms of the well-known models by adding one or more parameter(s) in order to obtain greater flexibility for modelling and evaluation different types of data. Shaw and Buckley (2007) proposed the transmuted-G (T-G) family of distributions. The cumulative distribution function (cdf, for short) and probability density function (pdf, for short) of the T-G family can be expressed respectively as follows

$$G^{\text{T-G}}(x;\alpha) = G(x)[1+\alpha-\alpha G(x)] \quad (1)$$

and

$$g^{\text{T-G}}(x;\alpha) = g(x)[1+\alpha-2\alpha G(x)], \quad (2)$$

where $G(x)$ and $g(x)$ are the baseline cdf and pdf, respectively. For $\alpha = 0, (|\alpha| \le 1)$, Eq. (1) gives the baseline distribution. Chakraborty *et al.* (2020) introduced the Kumaraswamy Poisson-G family, where generalized the Poisson-G (P-G) family of distributions. The cdf of the P-G family can be formulated as follows

$$F^{\text{P-G}}(x;\beta) = \frac{1-e^{-\beta F(x)}}{1-e^{-\beta}}, \beta \in R-\{0\}. \quad (3)$$

The pdf corresponding to Eq. (3) is given by

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A New Three-parameter Xgamma Fréchet Distribution with Different Methods of Estimation and Applications

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Abstract
In this article an attempt is made to introduce a new extension of the Fréchet model called the Xgamma Fréchet model. Some of its properties are derived. The estimation of the parameters via different estimation methods are discussed. The performances of the proposed estimation methods are investigated through simulations as well as real life data sets. The potentiality of the proposed model is established through modelling of two real life data sets. The results have shown clear preference for the proposed model compared to several know competing ones.

Key Words: Xgamma Model; Fréchet Model; Simulations; Least Squares; Cramer-Von-Mises; Maximum Product Spacing Distance; Bootstrapping.

Mathematical Subject Classification: 62N01; 62N02; 62E10.

1. Introduction and genesis

The probability density function (PDF) and cumulative distribution function (CDF) of Fréchet (Fr) distribution are given, respectively, by

$$g_{a,b}(x) = ba^b x^{-(b+1)} e^{-\left(\frac{a}{x}\right)^b} |_{x\geq 0}, \tag{1}$$

and

$$G_{a,b}(x) = e^{-\left(\frac{a}{x}\right)^b}, \tag{2}$$

where $a > 0$ is a scale parameter and $b > 0$ refers to the shape parameter. Recently, Yousof et al. (2018c) investigated and new family called the extended odd Fréchet family of distributions based on (2). Due to Cordeiro et al. (2020), the CDF of the Xgamma Fréchet (XG-Fr) model can be expressed as

$$F_{\theta,a,b}(x) = \left[1 - \frac{1}{1+\theta}\left[1 - e^{-\left(\frac{a}{x}\right)^b}\right]^\theta \left(\begin{array}{c} 1 + \theta - \theta \log\left[1 - e^{-\left(\frac{a}{x}\right)^b}\right] \\ + \frac{1}{2}\theta^2 \left\{\log\left[1 - e^{-\left(\frac{a}{x}\right)^b}\right]\right\}^2 \end{array}\right)\right] |_{\theta>0}. \tag{3}$$

The PDF corresponding to (3) reduces to

$$f_{\theta,a,b}(x) = \frac{\theta}{1+\theta} ba^b x^{-(b+1)} e^{-\left(\frac{a}{x}\right)^b} \left[1 - e^{-\left(\frac{a}{x}\right)^b}\right]^{\theta-1} \left(\theta + \frac{1}{2}\theta^2 \left\{\log\left[1 - e^{-\left(\frac{a}{x}\right)^b}\right]\right\}^2\right). \tag{4}$$

For $a = 1$, the XG-Fr reduces to the two-parameter XG-Fr distribution (Yousof et al. (2020)). The XG-Fr density in (4) can be expressed as

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A Simple Extension of Burr-III Distribution and Its Advantages over Existing Ones in Modelling Failure Time Data

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Abstract
In this article we consider a four parameter extended Burr-III distribution and study some distributional, reliability properties and parameter estimation. Performance of estimation technique used for model parameters estimation is numerically investigated employing Monte Carlo simulation with different sample sizes and parameter values. Efficacy of this distribution in modelling one failure time data is evaluated in comparison to some existing extensions of Bur-III distribution employing well known goodness of fit tests and model selection criteria. Our findings show the proposed distribution as the best among the all the other extensions of Burr-III distribution considered in this study.

Keywords Exponentiated family · Burr-III distribution · Maximum likelihood · K–S test · LR test

Mathematics Subject Classification 60E05 · 62G05 · 62G20

1 Introduction

Burr [6] defined the cumulative distribution function (cdf) and probability density function (pdf) (for $t > 0$) of the Burr-III (BIII) distribution respectively by

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A Simple Extension of Burr-III Distribution and Its Advantages over Existing Ones in Modelling Failure Time Data

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New Extended Burr-III Distribution: Its Properties and Applications

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Abstract

In this article, we consider a three parameter extended Burr-III distribution and study some distributional, reliability properties and parameter estimation. Performance of estimation technique used for model parameters estimation is numerically investigated employing Monte Carlo simulation with different sample sizes and parameter values. Efficacy of this distribution in modeling from two real life data is evaluated in comparison to some existing extensions of Burr-III distribution employing well known goodness of fit tests and model selection criteria. Our findings show the proposed distribution as the best among the all the other extensions of Burr-III distribution considered in this study.

Keywords: Log-logistic-X, stress-strength reliability, stochastic ordering, Akaike information criterion.

1. Introduction

Burr (1942) defined the cumulative distribution function (cdf) and probability density function (pdf) (for $x > 0$) of the Burr-III (BIII) distribution respectively by

$$G^{BIII}(x;\beta,\delta) = (1+x^{-\delta})^{-\beta}, \tag{1}$$

$$f^{BIII}(x;\beta,\delta) = \beta\delta x^{-\delta-1}(1+x^{-\delta})^{-\beta-1}, \tag{2}$$

where $\beta > 0$ and $\delta > 0$ are both shape parameters.

In 2006, Gleaton and Lynch developed a new family of distribution named as generalized log-logistic family of distribution. Later on, this family was called as odd log-logistic family of distribution. The cdf of the odd log-logistic (OLL-X) family of distribution was given as

$$F(x;\alpha,\xi) = \frac{G(x,\xi)^{\alpha}}{[G(x,\xi)^{\alpha} + (1-G(x,\xi))^{\alpha}]}, \tag{3}$$

where $\alpha > 0$ is an additional shape parameter. $G(x,\xi)$ is the cdf of the parent distribution and ξ denotes the parameters of the parent distribution. The corresponding pdf of the OLL-X family is given as

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Generalized Modified Exponential-G Family of Distributions: Its Properties and Applications

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ABSTRACT

A new family of continuous distributions called generalized modified exponential-G family is proposed. The probability density and cumulative distribution function are expressed as infinite linear mixtures of exponentiated-G distribution. Important statistical properties such as moment generating function, distribution of order statistics, power moments, asymptotes and shapes of the proposed family are investigated. The maximum likelihood estimation of the parameters is presented. To check the suitability the proposed model is compared with its submodels and also with a few useful lifetime models by conducting three data fitting experiments with real-life data sets.

Keywords: ME distribution, power moments, AIC, KS test

Mathematics Subject Classification: 62E15, 60E05.

1. INTRODUCTION

Of late, there has been an extraordinary eagerness for introducing more flexible distributions via extension of the classical distributions by inducting additional shape parameter(s) in the baseline distribution. In the process many generalized families of distributions have been proposed and studied in the last two decades for modeling data arising in applied areas such as economics, engineering, biological studies, environmental sciences and medical sciences among others. These generalized distributions are shown to have more flexibility compared to the baseline ones.

Some well-known generalized families are: Generalized Marshall-Olkin Kumaraswamy-G family (Chakraborty and Handique, 2017), Marshall-Olkin Kumaraswamy-G by Handique *et al.*, (2017a), Beta generated Kumaraswamy-G by Handique *et al.*, (2017b), beta generated Kumaraswamy Marshall-Olkin-G by Handique and Chakraborty (2017a), beta generalized Marshall-Olkin-Kumaraswamy G by Handique and Chakraborty (2017b), Odd moment exponential family (Haq *et al.*, 2018), Odd Frechet-G family (Haq and Elgarhy, 2018), Kumaraswamy generalized Marshall-Olkin-G family (Chakraborty and Handique, 2018), exponentiated generalized Marshall-Olkin-G family (Handique *et al.*, 2018) and Zografos-Balakrishnan Burr XII (Haitham *et al.*, 2018) among others.

In the present study, we derive the *generalized modified exponential-G family of distributions* (GME-G) using the generalized moment exponential distribution and study its properties and applications.