THE EXTENDED ALPHA POWER TRANSFORMED RAYLEIGH DISTRIBUTION

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Abstract:

In this paper, we introduce a new two parameter The Extended Alpha power Transformed Rayleigh Distribution (Ex-APTRD). A new method has been proposed to introduce an extra parameter to a family of distributions for more flexibility.The proposed family may be named as The Extended Alpha Power Transformed Rayleigh Distribution. Zubair Ahmad(2019), introduced The Extended alpha power transformation (Ex-APT) method to add an additional parameter to a family of distributions to increase flexibility in given family The recommended distribution reveals Probability density function, Cumulative distribution function, Hazard function and Survival function.

Key Words: Ex-APT, Probability density function, Cumulative distribution function, Hazard function and Survival function.

INTRODUCTION:

Lord Rayleigh (1880) introduced the Rayleigh distribution in connection with a problem in the field of acoustics. Since then, extensive work has taken place related to this distribution in different areas of science and technology. It has some nice relations with some of the well known distributions like Weibull, Chi-square or extreme value distributions. AbdElfattah (2006) studied the Efficiency of maximum likelihood estimators under different censored sampling schemes for Rayleigh distribution. Dey et al. (2017) introduced the alpha power exponential (APE) and alpha power transformed Weibull (APTW) distributions, respectively. Sai Swathi et al (2020), studied the Estimation of Location (θ) and Scale (λ) for Half Logistic Rayleigh Distribution by Median Rank Regression Method. A new three parameter α Power Transformed Family of Distributions with Application introduced Mahdavi and Kundu (2017). Sai Swathi and Anjaneyulu (2019) studied Half Logistic Rayleigh Distribution: Properties. There are various methods available in literature that could be used to make the distributions richer and flexible to model the real life data.

One of the procedure available in literature is The Extended Alpha Power Transformation (Ex-APT) suggested by Zubair Ahmad(2019), Zubair Ahmad(2019)proposed The Extended Alpha Power weibull distribution based on Ex-APT.

The motivations of using Ex-APTR distribution in the practice are follows:

(i) To improve the flexibility of the existing distributions by using Ex-APT

(ii) To introduce the extended version of the Rayleigh distribution whose closed form of CDF exist.

(iii) To provide better fits than competitive modified models.

This Paper is organized as follows. The new distribution is developed in Section 1.1 and also we define the CDF, density function, in section 1.2 survival and hazard functions of the Alpha Power Transformed Rayleigh (Ex-APTR) distribution.

1.1 Probability density and distribution functions of Ex-APTRD:

A random variable X ~ Ex-APTRD (σ^2,α) has probability density function and is in the form

$$f(x)=\frac{x/\sigma^2 e^{-x^2/2\sigma^2}\log(\alpha)\alpha^{\left(1-e^{-x^2/2\sigma^2}\right)}-e^{\left(1-e^{-x^2/2\sigma^2}\right)}}{\alpha-e} \quad x > 0, (\sigma^2,\alpha) >0$$

σ^2 is scale parameter

α is location parameter

A random variable X ~ Ex-APTRD (σ^2,α) has cumulative distribution function and is in the form

$$F(x)=\frac{\alpha^{\left(1-e^{-x^2/2\sigma^2}\right)}-e^{\left(1-e^{-x^2/2\sigma^2}\right)}}{\alpha-e} \quad x > 0, (\sigma^2,\alpha) >0$$

σ^2 is scale parameter

α is location parameter

1.2 Survival and Hazard Functions of Ex-APTRD :

Survival Function

A random variable X ~ Ex-APTRD (σ^2,α) has Survival function and is in the form

$$s(x)=\frac{\alpha-e-\alpha^{\left(1-e^{-x^2/2\sigma^2}\right)}+e^{\left(1-e^{-x^2/2\sigma^2}\right)}}{\alpha-e}$$

Hazard Functions

A random variable X ~ Ex-APTRD (σ^2,α) has Hazard Function and is in the form

$$h(x)=\frac{x/\sigma^2 e^{-x^2/2\sigma^2}\log(\alpha)\alpha^{\left(1-e^{-x^2/2\sigma^2}\right)}-e^{\left(1-e^{-x^2/2\sigma^2}\right)}}{\alpha-e-\alpha^{\left(1-e^{-x^2/2\sigma^2}\right)}+e^{\left(1-e^{-x^2/2\sigma^2}\right)}}$$

Conclusion:

In this paper we study and introduce Alpha Power Transformed Two Parameters Rayleigh (Ex-APTRD), Probability density function, Cumulative distribution function, Hazard function and Survival function

References:

1. Abd-Elfattah, A. M., Hassan, A. S. & Ziedan, D. M. (2006), Efficiency of maximum likelihood estimators under different censored sampling schemes for Rayleigh distribution. Institute of Statistical Studies & Research, vol. 1, pp. 1-16
2. Mahdavi and D. Kundu, "A new method for generating distributions with an application to exponential distribution," Communications in Statistics—Keory and Methods, vol. 46, no. 13, pp. 6543–6557, 2017.
3. Rayleigh, J.W.S. (1880). On the resultant of a large number of vibrations of the some pitch and of arbitrary phase. Philosophical Magazine, 5-th Series, 10, 73 - 78.
4. S. Dey, V. K. Sharma, and M. Mesfioui, "A new extension of Weibull distribution with application to lifetime data," Annals of Data Science, vol. 4, no. 1, pp. 31–61, 2017.
5. S. Dey, A. Alzaatreh, C. Zhang, and D. Kumar, "A new extension of generalized exponential distribution with application to ozone data," Ozone: Science & Engineering, vol. 39, no. 4, pp. 273–285, 2017.
6. Zubair Ahmad, Muhammad Ilyas, and G. G. Hamedani, "The Extended Alpha Power Transformed Family of Distributions: Properties and Applications", Journal of Data Science, Vol.14, no.4, pp.726-741,2019