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Odds Chen Type Generated Family of Distributions

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Abstract

Inspired by *[1]* and *[2]* we introduce the odds Chen type generated family of distributions, and show a sub-model of this broad class of statistical distributions is a good fit to real-life data. Our hope is that readers will consider investigating some properties and applications of this new class of distributions.

Keywords:

Contents

1. The New Family Illustrated

We begin with the following

Definition 1.1: Let T be a random variable with PDF g(t) and CDF G(t), and let X be a random variable with CDF F(x), the odds Chen generated family of distributions ("Odds CT-X" for short) is defined by the following integral for its CDF

$$\int_0^{\frac{F(x)}{1-F(x)}} \frac{\lambda\beta}{1-e^{-\lambda(1-e)}} g(t)G(t)^{\beta-1} e^{G(t)^{\beta}} e^{\lambda(1-e^{G(t)^{\beta}})} dt$$

where λ, β > 0
From the above we have the following

Proposition 1.2. The CDF of Odds CT − X is given by

$$\frac{1-e^{\lambda\left(1-e^{G\left(\frac{F(x)}{1-F(x)}\right)^{\beta}}\right)}}{1-e^{-\lambda(1-e)}}$$

where the random variable T has CDF G, the random variable X has CDF F(x), and λ, β > 0, and x ∈ Supp(F)
For illustrative purposes, let us assume T ~ Exponential(f), and X ~ Normal (c, d), then from the Proposition immediately above we have the following

Theorem 1.3. The CDF of Odds Chen Exponential-Normal is given by

$$\frac{1-\exp\left(\lambda\left(1-\exp\left(\left(1-\exp\left(-\frac{f\,erfc\left(\frac{c-x}{\sqrt{2}d}\right)}{2\left(1-\frac{1}{2}erfc\left(\frac{c-x}{\sqrt{2}d}\right)\right)}\right)\right)^{\beta}\right)\right)\right)}{1-e^{(1-e)\lambda}}$$

where erfc(·) gives the complementary error function, d, f, λ, β > 0, and x, c ∈ R.

Obviously, the PDF can be obtained upon differentiating the CDF above. We write W ~ OCEN(λ, β, f, c, d), if W is an Odds Chen Exponential-Normal random variable. The Odds Chen Exponential Normal distribution is a good fit to real life data as shown Below

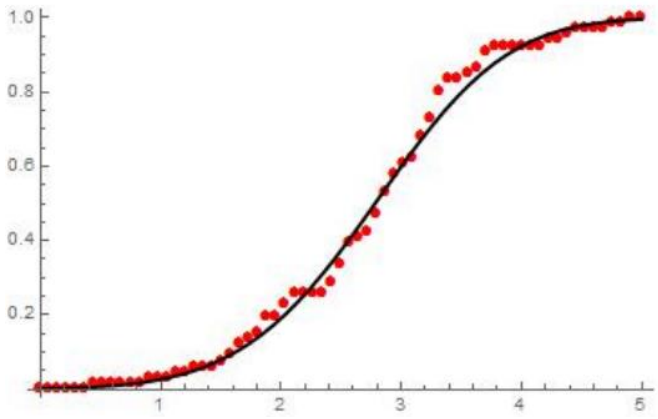

Figure 1: The CDF of OCEN (0.298716, 5.67999, 9.68395, 5.52968, 3.18486) fitted to the empirical distribution of Table 2 *[3]*

References

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3. Alzaatreh A, Lee C, Famoye F (2014) T-normal family of distributions: a new approach to generalize the normal distribution. Journal of Statistical Distributions and