Generating families of continuous univariate distributions

Markos V. Koutras
Department of Statistics and Insurance Science, University of Piraeus, Greece
mkoutras@unipi.gr

Statistical modelling of empirical data, requires the availability of rich and flexible families of parametric distributions. It is, therefore, not surprising that the search for flexible families of distributions has attracted and keeps motivating a huge number of researchers even today (see e.g. Azzalini (1985), Marshall and Olkin (1997), Azzalini & Capitanio (2014), Jones (2009, 2015).

In this work, we present a wide family of continuous univariate distributions that embraces a vast number of classical and non-classical distributions. Key mathematical properties of the new family including aging, unimodality, probability bounds and tail behavior are discussed and effective methods for estimating the parameters of the distributions are elucidated.

In addition, we present some simple techniques for generating new members of the family by combining two or more of its members. Finally, we discuss how the new framework can be exploited for the generation of new distributions that possess specific desirable properties (e.g. exhibit heavy tails, monotone failure rates etc).

Keywords: Generators, aging, probability bounds, heavy tailed distributions

This is joint work with Spiros D. Dafnis

References

Azzalini A (1985) A class of distributions which includes the normal ones. *Scandinavian Journal of Statistics*, **12**, 171–178.

Azzalini A, Capitanio A (2014). *The Skew-Normal and Related Families*. Cambridge University Press, Cambridge.

Jones MC (2009) Kumaraswamy's distribution: A beta-type distribution with some tractability advantages. *Statistical Methodology*, **6**, 70-81.

Jones, MC (2015) On families of distributions with shape parameters. *International Statistical Review*, **83**,175-192.

Marshall AW, Olkin, I (1997). A new method for adding a parameter to a family of distributions with application to the exponential and Weibull families. *Biometrika*, **84**, 641–652