

Modelling cell generation times using the tempered stable distribution

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The family of tempered stable distributions has considerable potential as a flexible model for cell generation times, which form an essential part of many models of cell populations. This is a class of positively skewed 3-parameter distributions on the positive reals, with the possibility of long right-hand tails. The density may be very flat near the origin, enabling a shifted distribution to be closely approximated without an exact minimum needing to be specified. Special cases include the inverse Gaussian and gamma distributions, the latter of which is probably the most widely used distribution in practice. Numerical inversion of the Laplace transform of the probability density function provides fast and accurate approximations to the tempered stable density, for which no closed form generally exists. We concentrate on an algorithm given in Abate & Whitt (1992, *Queueing Systems*, **10**, 5-88), but many alternative algorithms are available. Several real examples are used to illustrate how the tempered stable distributions can improve upon currently assumed models; we discuss generation times of oligodendrocyte progenitor cells (Hyrien et al., 2006, *Theor. Biol. & Math. Mod.*, **3**:21) and the yeast *Saccharomyces cerevisiae* (Cole et al., 2004, *Math. Med. & Biol.*, **21**, 369-395), both of which currently recommend gamma distributions.