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Power laws: pinning the tail on the shoulder.

Abstract: The appearance of fat-tailed and scale-free distributions is frequently attributed to an underlying multiplicative stochastic dynamics. The most salient process considered in this context is the “rich get richer” mechanism (aka preferential attachment, Yule process etc.) that involves birth and mutations. Any new agent either joins an existing group with a chance proportional to its size (birth) or creates a new group (mutation). In most cases, however, some “death” process already exists: animals die, leaving species goes extinct and internet connections break down. A universal solution for the birth-death-mutation process will be presented. The new solution allows for much better inference of the underlying process parameters: in particular it allows extracting information from the “shoulder” of the distribution at small values, instead of using only the power-law tail. Examples from various branches of science – ecology, genetics, and social networks - will be discussed