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Modelling Heavy Tailed Phenomena Using a LogNormal Distribution Having a Numerically Verifiable Infinite Variance

One-sided heavy tailed distributions have been used in many engineering applications, hanging from teletraffic modelling to financial engineering. In practice, the most interesting heavy tailed distributions are those having a finite mean and a diverging variance. The LogNormal distribution is sometimes discarded from modelling heavy tailed phenomena because it has a finite variance, even when it seems the most appropriate one to fit the data. In this work we provide for the first time a LogNormal distribution having a finite mean and a variance which converges to a well-defined infinite value. This is possible thanks to the use of Non-Standard Analysis. In particular, we have been able to obtain a Non-Standard LogNormal distribution, for which it is possible to numerically and experimentally verify whether the expected mean and variance of a set of generated pseudo-random numbers agree with the theoretical ones. Moreover, such a check would be much more cumbersome (and sometimes even impossible) when considering heavy tailed distributions in the traditional framework of standard analysis.

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