A Self-calibrating Method for Heavy Tailed Data Modeling. Application in Neuroscience and Finance

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Abstract

Modeling non-homogeneous and multi-component data is a problem that challenges scientific researchers in several fields. In general, it is not possible to find a simple and closed form probabilistic model to describe such data. That is why one often resorts to non-parametric approaches. However, when the multiple components are separable, parametric modeling becomes again tractable. In this study, we propose a self-calibrating method to model multi-component data that exhibit heavy tails. We introduce a three-component hybrid distribution: a Gaussian distribution is linked to a Generalized Pareto one via an exponential distribution that bridges the gap between mean and tail behaviors. An unsupervised algorithm is then developed for estimating the parameters of this model. We study analytically and numerically its convergence. The effectiveness of the self-calibrating method is tested on simulated data, before applying it to real data from neuroscience and finance, respectively. A comparison with other standard Extreme Value Theory approaches confirms the relevance and the practical advantage of this new method. This is a joint work with N. Debbabi (ESPRIT School of Engineering, Tunis, Tunisia) and M. Mboup (Université de Reims Champagne Ardenne, France)

References

1. N. Debbabi and M. Kratz and M. Mboup. A self-calibrating method for heavy tailed data modeling. Application in neuroscience and finance. ArXiv 1612.03974v2 (Dec.2017).