Improving MLE via a Non-extensive Information Measure

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Abstract

Although the maximum likelihood estimator enjoys asymptotic optimality properties, its finite-sample performance for a small or moderate sample size can be much improved when the Log-Likelihood is replaced by a Lq-Likelihood, which is motivated from a non-extensive measure of information (in contrast to the additive Kullback-Leiber information).

The properties of the resulting estimator, MLqE, are studied via asymptotic analysis and computer simulations. The behavior of the MLqE is characterized by the degree of distortion q applied to the assumed model to amplify or diminish the density value. When q is properly chosen for small and moderate sample sizes, the MLqE successfully trades bias for precision, resulting in a substantial reduction of the mean squared error. When the sample size is large and q tends to 1, a necessary and sufficient condition to ensure a proper asymptotic normality and efficiency of MLqE is established. The advantage of the new estimation method is more clearly seen for higher dimensional estimations. The talk is based on joint work with Davide Ferrari.