Palombi, Filippo; Toti, Simona

Summary: We present arguments in favor of the inequalities \( \text{var}(X_n^2 \mid X \in B_v(\rho)) \leq 2\lambda_n E[X_n^2 \mid X \in B_v(\rho)] \), where \( X \sim N_v(0, \Lambda) \) is a normal vector in \( v \geq 1 \) dimensions, with zero mean and covariance matrix \( \Lambda = \text{diag}(\lambda) \), and \( B_v(\rho) \) is a centered \( v \)-dimensional Euclidean ball of square radius \( \rho \). Such relations lie at the heart of an iterative algorithm, proposed by F. Palombi, S. Toti and R. Filippini [“Numerical reconstruction of the covariance matrix of a spherically truncated multinormal distribution”, Preprint, arXiv:1202.1838] to perform a reconstruction of \( \Lambda \) from the covariance matrix of \( X \) conditioned to \( B_v(\rho) \). In the regime of strong truncation, i.e. for \( \rho \lesssim \lambda_n \), the above inequality is easily proved, whereas it becomes harder for \( \rho \gg \lambda_n \). Here, we expand both sides in a function series controlled by powers of \( \lambda_n / \rho \) and show that the coefficient functions of the series fulfill the inequality order by order if \( \rho \) is sufficiently large. The intermediate region remains at present an open challenge.

MSC:
60E15 Inequalities; stochastic orderings
41A63 Multidimensional problems
41A60 Asymptotic approximations, asymptotic expansions (steepest descent, etc.)

Keywords:
distributional truncation; covariance matrix reconstruction; fixed point iteration

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References:

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