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On phase transitions for the trace of squared sample correlation matrices in high dimension

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Abstract

We provide limit theory for the trace of the squared sample correlation matrix $\mathbf{R}$, constructed from n observations of a p-dimensional random vector with iid components. If the entries have finite fourth moment and p and n grow proportionally, it is known that $tr(\mathbf{R^2})$ satisfies a central limit theorem (CLT) and the centering and scaling sequences are universal in the sense that they do not depend on the entry distribution. Under a symmetry and a regular variation assumption with index α and any growth rate of the dimension, we prove that the universal CLT remains valid for $\alpha > 3$. Moreover, for $\alpha \leq 3$ we establish a non-universal CLT with norming sequences depending on the value of α. Our findings are illustrated in a small simulation study.

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