Mathematics > Functional Analysis

Interpolating Thin-Shell and Sharp Large-Deviation Estimates For Isotropic Log-Concave Measures

Olivier Guédon, Emanuel Milman

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Given an isotropic random vector X with log-concave density in Euclidean space $\Real^n$, we study the concentration properties of $|X|$. We show in particular that: \[\P(|X| \geq (1+t) \sqrt{n}) \leq \exp(-c n^{1/2} \min(t^3,t)) \;\;\; \forall t > 0 ~, \] for some universal constant $c>0 $. This improves the best known deviation results above the expectation on the thin-shell and mesoscopic scales due to Fleury and Klartag, respectively, and recovers the sharp large-deviation estimate of Paouris. Another new feature of our estimate is that it improves when X is ψ_α ($\alpha \in (1,2]$), in precise agreement with the sharp Paouris estimates. The upper bound on the thin-shell width $\sqrt {\Var(|X|)}$ we obtain is of the order of $n^{1/3}$, and improves down to $n^{1/4}$ when X is ψ_2. Our estimates thus continuously interpolate between a new best known thin-shell estimate and the sharp Paouris large-deviation one.

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