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

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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: $|P(|X| geq (1+t) sqrt{n}) |eq exp(-c n^{1/2} min(t^3,t)) ;;; forall <math>t > 0 \sim$,] 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 ρsi_alpha ($\rhoalpha \in 0, 1, 2$), in precise agreement with the sharp Paouris estimates. The upper bound on the thin-shell width $\rhoart {Var(|X|)}$ we obtain is of the order of $n^{1/3}$, and improves down to $n^{1/4}$ when X is ρsi_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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