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Kolmogorov Berry-Esseen bounds for binomial functionals

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Abstract : We present a new general bound on the Kolmogorov distance between a Gaussian variable and a L^2 functional $\varphi(X)$ in n IID variables $X = (X_1, \dots, X_n)$. It requires to control the inverse variance, and we also present a general method for bounding the variance of such functionals from below. These two bounds are based on two decompositions of $\varphi(X)$, one introduced by Chatterjee in 2008, and the other is a rewriting of Hoeffding's decomposition in terms of difference operators. The Berry-Essen bound much depends on the second-order difference operators, bearing a strong similarity with results obtained by Chatterjee in 2009 in the Gaussian framework, or by Last, Peccati and Schulte (2013) in the Poisson framework.

These bounds seem to be optimal for the Voronoi volume approximation of irregular sets, or for the boolean model with random grain, yielding new rates in both cases. Other functionals, related to random graphs based on connectivity considerations, or on so-called *forbidden regions*, such as nearest-neighbor graph, Gabriel graph, online nearest-neighbor graph, also seem to be within the scope of applications.