UC3M–ICMAT Seminar – 2014/2015

Applied Probability and Statistics

Statistical dimension, statistical center, and fluctuations of conic intrinsic volumes

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11h30, *ICMAT, Aula Gris I*

Intrinsic volumes of convex sets are natural geometric quantities that also play important roles in applications, such as linear inverse problems with convex constraints, and constrained statistical inference. It is a well-known fact that, given a closed convex cone in a d-dimensional Euclidean space, then its intrinsic volumes determine a probability measure on the finite set $0, 1, \ldots, d$. The aim of the present talk is to describe how one can deduce effective Berry–Esseen bounds for the normal approximation of such a discrete probability measure, in the high-dimensional limit. This bound shows that, in the high-dimensional limit, most conic intrinsic volumes encountered in applications can be approximated by a suitable Gaussian distribution. Our approach is based on a variety of techniques, involving in particular probability, geometry and functional inequalities. Two parameters will play a prominent role, namely the 'statistical dimension' and the 'statistical center' of a given closed convex cone. Our results explicitly connect the sharp phase transitions, observed in many regularised linear inverse problems with convex constraints (e.g. compressed sensing), with the asymptotic Gaussian fluctuations of the intrinsic volumes of the associated descent cones. We will show that our findings complete and further illuminate the recent discoveries by Amelunxen, Lotz, McCoy and Tropp (2014) and McCoy and Tropp (2014) about the concentration of conic intrinsic volumes and its connection with threshold phenomena. Based on a joint work with L. Goldstein and I. Nourdin.

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