

Geometrical Smeariness

Friday, September 13, 2019 10:45 AM (20 minutes)

The central limit theorem (CLT) for the mean in Euclidean space features a normal limiting distribution and an asymptotic rate of $n^{-1/2}$ for all probability measures it applies to. We revisit the generalized CLT for the Fréchet mean on hyperspheres. For some probability measures, the sample mean fluctuates around the population mean asymptotically at a scale $n^{-\alpha}$ with exponent $\alpha = 1/6$ with a non-normal distribution. This is at first glance in analogy to the situation on a circle. We show that the phenomenon on hyperspheres of higher dimension is qualitatively different, as it does not rely on topological, but geometrical properties on the space, namely on the curvature, not on probability mass near the cut locus.

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