

中国科学院

随机复杂结构与数据科学重点实验室

# 学术报告

题目: High-dimensional Central Limit Theorems by Stein's Method in the Degenerate Case

报告人: Xiao Fang (香港中文大学)

时间: 2023年6月1日(周四) 10:00-11:00

地点: 数学院 N602

摘要: In the literature of high-dimensional central limit theorems, there is a gap between results for general limiting correlation matrix  $\Sigma$  and the strongly non-degenerate case. For the general case where  $\Sigma$  may be degenerate, under certain light-tail conditions, when approximating a normalized sum of  $n$  independent random vectors by the Gaussian distribution  $N(0, \Sigma)$  in multivariate Kolmogorov distance, the best-known error rate has been  $O(n^{-1/4})$ , subject to logarithmic factors of the dimension. For the strongly non-degenerate case, that is, when the minimum eigenvalue of  $\Sigma$  is bounded away from 0, the error rate can be improved to  $O(n^{-1/2})$  up to a  $\log n$  factor. In this paper, we show that the  $O(n^{-1/2})$  rate up to a  $\log n$  factor can still be achieved in the degenerate case, provided that the minimum eigenvalue of the limiting correlation matrix of any three components is bounded away from 0. We prove our main results using Stein's method in conjunction with previously unexplored inequalities for the integral of the first three derivatives of the standard Gaussian density over convex polytopes. These inequalities were previously known only for hyperrectangles. Our proof demonstrates the connection between the three-components condition and the third moment Berry-Esseen bound. This is joint work with Yuta Koike (UTokyo), Song-Hao Liu (Sustech) and Yi-Kun Zhao (DUT).