Wasserstein and Convex Gaussian Approximations for Non-stationary Time Series of Diverging Dimensionality

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Abstract. The central limit theorem (CLT) and its extensions, such as the Berry-Esseen theorem, are among the most useful results in classic statistics. In high dimensions, the analogous results to the CLT are Gaussian approximation (GA) schemes under various distance measures or on various collections of subsets of the multi-dimensional Euclidean space. In this talk, by considering the 2-Wasserstein distance and the collection of all convex sets, we establish general GA theory for a very general class of high-dimensional non-stationary (HDNS) time series. Our approximation rates are nearly optimal with respect to both dimension and time series length. A block multiplier bootstrap procedure is theoretically verified for the implementation of our GA theory. We demonstrate by applications the use of the GA and bootstrap theory as a unified tool for a wide range of statistical inference problems of HDNS time series.