

# Collective Nonparametric Density and Spectral Density Estimation with Applications in Clustering

Mehdi Maadooliat

Dept. of Math. Stat. & Comp. Sci. (MSCS)  
Marquette University  
e-mail: mehdi@mscs.mu.edu

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This paper develops a method for simultaneous estimation of spectral density functions (SDFs) for a collection of stationary random fields (spatial processes or time series) that share some common features. Due to the similarities among the SDFs, the log-SDF can be represented using a common set of basis functions. The basis shared by the collection of the log-SDFs is estimated as a low-dimensional manifold of a large space spanned by a pre-specified rich basis. Collective estimation approach allows pooling information and borrowing strength across SDFs to achieve better estimation efficiency. Also, each estimated spectral density has a concise representation using the coefficients of the basis expansion and these coefficients can be used for visualization, clustering, and classification purposes. Whittle pseudo-maximum likelihood approach is used to fit the model and an alternating blockwise Newton-type algorithm is developed for computation.