Spatial Sampling Design using Generalized Neyman-Scott Process

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Abstract: In this paper we introduce a new procedure for spatial sampling design. It is found in previous studies (Zhu and Stein 2006) that the optimal sampling design for spatial prediction with estimated parameters is nearly regular with a few clustered points. The pattern is similar to a generalization of the Neyman-Scott (GNS) process (Loh and Yau 2012) which allows for regularity in the parent process. This motivates the use of a realization of the GNS process as sampling design points. This method translates the high dimensional optimization problem of selecting sampling sites into a low dimensional optimization problem of searching for the optimal parameter sets in the GNS process. Simulation studies indicate that the proposed sampling design algorithm is more computationally efficient than traditional methods while achieving similar minimization of the criterion functions. While the traditional methods become computationally infeasible for sample size larger than a hundred, the proposed algorithm is applicable to a size as large as n=1024. A real data example of finding the optimal spatial design for predicting sea surface temperature in the Pacific Ocean is also considered.

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