University of California, Irvine
Statistics Seminar

Multi-scale Models for Non-stationary Spatial Datasets

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Join via Zoom: https://uci.zoom.us/j/93841331474

To model random fields whose variability changes at differing scales we use multiscale kernel convolution models that rely on nested grids of knots at different resolutions. Thus, lower order terms capture large scale features, while high order terms capture small scale ones. To accommodate the space-varying nature of the variability we consider priors for the coefficients of the kernel expansion that are structured to provide increasing shrinkage as the resolution grows. A tree shrinkage prior auto-tunes the degree of resolution necessary to model a subregion in the domain. In addition, compactly supported kernel functions allow local updating of the model parameters which achieves massive scalability by suitable parallelization. As an alternative, we develop an approach that relies on knot selection, rather than shrinkage, to achieve parsimony, and discuss how this induces a field with spatially varying resolution. We extend shotgun stochastic search to the multi resolution model setting. In addition we consider maximization methods for the estimation of the optimal model. These consist of using a sparsity inducing regularization term that, using an overlapping group penalty incorporates information about the structure of a recursive partitioning of the domain. We emonstrate that the proposed methods are computationally competitive and produce excellent fit to both synthetic and real datasets.