Multi-output Local Gaussian Process Regression for the Solution of Stochastic PDEs

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Abstract

We develop an efficient, Bayesian Uncertainty Quantification framework using a novel treed Gaussian process model. The tree is adaptively constructed using information conveyed by the observed data about the length scales of the underlying process. On each leaf of the tree, we utilize Bayesian Experimental Design techniques in order to learn a multi-output Gaussian process. The constructed surrogate can provide analytical point estimates, as well as error bars, for the statistics of interest. We numerically demonstrate the effectiveness of the suggested framework in identifying discontinuities, local features and unimportant dimensions in the solution of stochastic differential equations.