Surrogate Tree and Model Forest Extensions to the Multifidelity Ensemble Kalman Filter

Andrey A Popov[*†1] and Adrian Sandu[1]

[1]Department of Computer Science at Virginia Tech – 2202 Kraft Drive Blacksburg, VA 24060, United States

Abstract

Recently, the idea of using a hierarchy of models for sequential data assimilation has been gaining traction. We present an extension of this idea to surrogate trees (and model forests thereof). We present a formal theory of such methods, through a rigorous extension of the theory of linear control variates, and present a hypothetical framework for non-linear coupling.We showcase this methodology on the multifidelity ensemble Kalman filter with surrogate derived from data-driven methods such as POD-Galerkin, and neural-network based autoencoders. We thus aim to provide a convincing argument that such methods can be applied not only on toy models but for operational data assimilation as well.

Keywords: multifidelity, ensemble Kalman filter, surrogate tree, surrogate modeling, neural networks, data driven

---

[*]Speaker
[†]Corresponding author: apopov@vt.edu