Higdon, Dave; **Gattiker, James**; **Williams, Brian**; **Rightley, Maria**
Computer model calibration using high-dimensional output. (English) Zbl 05564511
J. Am. Stat. Assoc. 103, No. 482, 570-583 (2008).

Summary: This work focuses on combining observations from field experiments with detailed computer simulations of a physical process to carry out statistical inference. Of particular interest here is determining uncertainty in resulting predictions. This typically involves calibration of parameters in the computer simulator as well as accounting for inadequate physics in the simulator. The problem is complicated by the fact that simulation code is sufficiently demanding that only a limited number of simulations can be carried out. We consider applications in characterizing material properties for which the field data and the simulator output are highly multivariate. For example, the experimental data and simulation output may be an image or may describe the shape of a physical object. We make use of the basic framework of Kennedy and O'Hagan. However, the size and multivariate nature of the data lead to computational challenges in implementing the framework. To overcome these challenges, we make use of basis representations (e.g., principal components) to reduce the dimensionality of the problem and speed up the computations required for exploring the posterior distribution. This methodology is applied to applications, both ongoing and historical, at Los Alamos National Laboratory.

MSC:

62-XX Statistics

Keywords:

computer experiments; functional data analysis; Gaussian process; prediction; predictive science; uncertainty quantification

Software:

fda (R)

Full Text: DOI