Arash Pourhabib , Oklahoma State University

Local Calibration of Computer Models

Abstract: In computer simulations that model physical systems, attributes that cannot be measured in physical experiments are called calibration parameters. Calibration refers to adjusting the calibration parameters in the computer simulation such that it matches the corresponding physical experiments. Motivated by real examples in engineering, we introduce the notion of local calibration, i.e. calibration when the parameters are a function of inputs, or control variables, in the physical system. We demonstrate that finding calibration parameters in this context is a task of functional approximation. We use kernel interpolation and concepts in Reproducing Kernel Hilbert Spaces to model the functional relationship that exists between the calibration parameters and control variables, which yields a non-parametric approximation for that function. We formulate the problem as a nonlinear optimization which in turn is solved through numerical techniques. We also derive theoretical properties of the estimator found in this framework. Applying the proposed method to both real and synthetic data, we demonstrate that it outperforms both global calibration, which does not consider a functional relationship between control variables and calibration parameters, and the parametric calibration, which imposes a parametric form on the functional relationship.

Bio: Arash Pourhabib received his B.S. in Industrial Engineering from Sharif University of Technology in 2008, and his Ph.D. from the Department of Industrial and Systems Engineering at Texas A&M University in 2014. He is currently an Assistant Professor at the School of Industrial Engineering and Management at Oklahoma State University. His research interests are in the areas of computational statistics and statistical machine learning. He is a member of IEEE, INFORMS and IIE.

All students & faculty

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