Technische Universität Braunschweig

GRK 2075

Vortrag im Gästeprogamm des GRK 2075 -
Modelle für die Beschreibung der Zustandsänderung bei Alterung von Baustoffen

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Low-rank tensor decompositions for sampling of high-dimensional probability distributions

Montag, 27.05.2019, 10:30 Uhr
Institut für Wissenschaftliches Rechnen
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Uncertainty quantification and inverse problems in many variables are pressingly needed tasks, yet high-dimensional functions are notoriously difficult to integrate in order to compute desired quantities of interest. Functional approximations, in particular the low-rank separation of variables into tensor product decompositions, have become popular for reducing the computational cost of high-dimensional integration down to linear scaling in the number of variables. However, tensor approximations may be inefficient for non-smooth functions. Sampling based Monte Carlo methods are more general, but they may exhibit a very slow convergence, overlooking a hidden structure of the function.

In this talk we review tensor product approximations
for the problem of uncertainty quantification and Bayesian inference. This allows efficient integration of smooth PDE solutions, posterior density functions and quantities of interest. Moreover, we can use the low-rank approximation of the density function to construct efficient proposals in the MCMC algorithm for inverse problems. This combined MCMC method is more accurate also if the quantity of interest is not smooth, such as the indicator function of an event.

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