Cluster Kolloquium "Maschinelles Lernen"
Seminarreihe des Exzellenzclusters

Mittwoch 6. November 2019
14:00 - 15:00, anschliessendes Get Together

Hörsaal, AI Research Building
Maria von Linden-Str. 6 (Erdgeschoss), 72076 Tübingen

Gaussian Process emulation of tsunami and climate models

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(Host: Motonobo Kanagawa)

We first introduce Gaussian Process emulation of computer models. These are surrogates of simulators that efficiently mimic the input-output relationship of such complex numerical models. We discuss design of computer experiments as well as input and output dimension reduction to facilitate forward emulation as well as inverse problems or optimization using emulation, with applications to tsunami and climate models.

We then present a new type of emulator of any feed forward multi-disciplinary (or multi-physics) system, with possible internal feedback loops, by integrating out its internal inputs using the Gaussian process emulators of individual disciplines (e.g., simulators). We compare our integrated emulator with the composite emulator, which is the emulator of the entire system using only global inputs and outputs. The integrated emulator exploits the functional relationships across individual disciplines whereas the composite emulator inherently ignores them. As a result, the integrated emulator learns the behaviour of the system better than the composite emulator, with identical training points (even often with a lower number of training points). Furthermore, it allows a new designing strategy that appreciates the heterogeneous functional complexity of disciplines. Computational gains could be obtained significantly in some systems where simple disciplines are expensive to evaluate. We demonstrate the skills of the integrated emulator in a series of synthetic experiments, and a multi-disciplinary problem; we also discuss potential applications to tsunami and climate models.