Approximative optimal experimental design in Bayesian inversion

Monday, August 12, 2024 5:00 PM (30 minutes)

Many inverse problems in science and engineering are often subject to uncertainty, especially when the measurement data is complex and indirect. To reduce uncertainty, one needs to find a way to measure the data efficiently. This problem falls under the umbrella of the optimal experimental design (OED). The computational cost of OED, however, is notoriously expensive, so in practice, one inevitably has to work with surrogate models, approximations and alike.

While the approximation problem in Bayesian inverse problems (BIPs) has been studied intensively in the last decade ([3]), their counterparts in OED have only been considered recently. In recent works, we proposed a general framework to study the stability properties of the expected utility function for the optimal experimental design in BIPs. We investigate this problem in a non-parametric setting and provide convergence rates of the expected utility with respect to likelihood perturbations as well as prior perturbations. This talk is based on [1, 2].

\textbf{References}\\

[1] D.-L. Duong, T. Helin and J.R. Rojo-Garcia, Stability estimates for the expected utility in Bayesian optimal experimental design, \textit{Inverse Problems}, Vol. \textbf{39(12)}, 125008, 2023.\\

[2] D.-L. Duong \emph{et al.}, Stability for the Bayesian optimal experimental design under prior perturbations, upcoming, 2024+.\\

[3] A.M. Stuart, Inverse problems: a Bayesian perspective, \textit{Acta numerica}, Vol. \textbf{19}, pp. 451-559, 2010.{Acta numerica}, Vol. \textbf{19}, pp. 451-559, 2010.

Author: DUONG, Duc-Lam (LUT University)

Presenter: DUONG, Duc-Lam (LUT University)

Session Classification: MS 04: Correlation-based passive imaging and optimal experimental design

Track Classification: Minisymposia: MS 04: Correlation-based passive imaging and optimal experimental design