Bayesian inverse problems in the presence of model error

Cvetkovic Nada
Eindhoven University of Technology, Netherlands
n.cvetkovic@tue.nl

In inverse problems, one often assumes a model for how the data is generated from the underlying parameter of interest. In experimental design, the goal is to choose observations to reduce uncertainty in the parameter. When the true model is unknown or expensive, an approximate model is used that has nonzero 'model error' with respect to the true data-generating model. Model error can lead to biased parameter estimates. If the bias is large, uncertainty reduction around the estimate is undesirable. This raises the need for experimental design that takes model error into account.

We present a framework for model error-aware experimental design in Bayesian inverse problems. Our framework is based on Lipschitz stability results for the posterior with respect to model perturbations. We use our framework to show how one can combine experimental design with models of the model error in order to improve the results of inference.