Decision-making for additional sampling/observation planning based on Value of Information

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Abstract

When more sampling or observation information is given, the variance of estimated parameters is reduced, however, quantification of reduction in variance is not enough to make a decision whether the new sampling should be performed or not. For this decision-making problem, we need to estimate the worth of the information content in data, i.e., the value of information. In this research, we seek an efficient method based on the Value of Information (VoI) to make a decision on where additional sampling points should be placed and how many sampling should be collected in a Gaussian random field. The proposed method is applied to additional boring placement for liquefaction countermeasure on embankment along a river. An optimal set of sites for additional boring are evaluated as a solution of optimization problem with respect to VoI by Particle Swarm Optimization, which is one of global optimization methods and inspired by social behavior of bird flocking or fish schooling. Optimal number of sampling is also evaluated from total cost, i.e., sum of observation cost and VoI.