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# Adaptive sequential sampling for surrogate model generation with artificial neural networks

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Surrogate models – simple functional approximations of complex models – can facilitate engineering analysis of complicated systems by greatly reducing computational expense. The construction of a surrogate model requires evaluation of the original model to gather the data necessary for building the surrogate. Sequential sampling procedures are proposed for determining and minimizing the required number of samples for efficient global surrogate construction. In this paper, two new adaptive sampling algorithms – one purely adaptive and one combining adaptive and space-filling characteristics – are proposed and compared to a purely space-filling approach. Our analysis suggests a mixed adaptive sampling approach for constructing surrogates for systems where the behavior of the underlying model is unknown. Results of the case study, optimization of carbon dioxide capture process with aqueous amines, revealed that the mixed adaptive sampling algorithm may reduce the required sample size by up to 40% compared to a purely space-filling design.

**Keywords:** adaptive sampling, space-filling design, artificial neural networks, surrogate models

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