

Design and Analysis for Computer Experiments With Both Qualitative and Quantitative Variables

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Computer experiments have received a great deal of attention in many fields of science and technology. The premises in most literature assume that all the input variables are quantitative. However, researchers often encounter computer experiments involving mixed input variables: both quantitative and qualitative variables. In this paper, we propose a new type of design, called clustered-sliced Latin hypercube design, which is one kind of sliced Latin hypercube design with points clustered in the design region. Using such designs for computer experiments with both qualitative and quantitative variables helps to capture the correlations between responses of different level-combinations in the qualitative variables. Further, an adaptive analysis strategy intended for the proposed designs is developed, which automatically extracts useful information from all auxiliary responses to increase the prediction accuracy of the target response. The proposed designs are shown to be effective, via simulation examples.

KEY WORDS: Correlation; Cross-validation; Gaussian process model; Kriging; Latin hypercube design.