

An Interactive Sampling Strategy Based on Information Analysis and Ordinary Kriging for Locating Hot Spot Regions¹

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This study proposes an interactive sampling strategy for locating the hot spot or maximum regions of a concerned attribute in a given area of survey. In the proposed strategy, information analysis is performed based on the ordinary kriging from the existing sample data to suggest a new batch of samples under the criterion of the highest information free energy. The information free energy (F) is a function of information energy (U) and information entropy (S) through $F = U - TS$, where T is information temperature and is used to coordinate the contribution of U and S to F . Information energy is the value of the concerned attribute, and information entropy is the transformed error variance of kriging and therefore measures the evenness and density of coverage of samples over the area under survey. At early sampling batches, information temperature is high and information entropy dominates the information free energy, and samples are suggested to give an even and dense enough coverage of the whole area under investigation. As samples accumulate, information temperature decreases to enlarge the contribution of information energy, and future samples are taken toward the locations with high attribute values. Two examples demonstrate the efficiency and effectiveness of the proposed sampling strategy in locating the hot spot regions of various fields: (1) a heavy metal contaminated site reproduced by modeling on 55 real field data; (2) a simulated two-dimensional field by the random phase volume (RPV) model. The results show that the proposed strategy, a robust interactive sampling procedure, is able to locate hot spot regions without compromising with the overall profile of an under-survey area.

KEY WORDS: information theory, intermediate modeling, multi-stage sampling, random phase volume.

INTRODUCTION

There are a large number of wastes dumping sites in the world, which were formed illegally and in great hurry or legally but without any record of their constitutions.

¹Received 19 August 2003; accepted 27 July 2004.

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