Optimal Design of Experiments

Organizer and Chair: Julie Zhou (University of Victoria)

SAUMEN MANDAL, University of Manitoba
Optimal Experimental Design for Maximum Likelihood Estimation

We present a quite flexible methodology to solve a maximum likelihood estimation problem using optimal design theory and simultaneous optimization techniques. We consider a problem of determining maximum likelihood estimates under a hypothesis of marginal homogeneity for data in square contingency tables. This is an optimization problem with respect to variables that satisfy several constraints based on the marginal homogeneity conditions. We first formulate the Lagrangian function and then transform the problem to that of maximizing some functions of the cell probabilities simultaneously. We apply the methodologies in some data sets for which the hypothesis of marginal homogeneity is of interest. The methodologies could be applied to a wide class of optimization problems where constraints are imposed on the parameters.

PETER QIAN, University of Wisconsin-Madison
Samurai Sudoku-Based Space-Filling Designs

The game-board of Samurai Sudoku consists of five overlapping Sudoku grids, for each of which several entries are provided and the remaining entries must be filled subject to no row, column and three-by-three subsquare containing duplicate numbers. By exploiting these uniformity properties, we construct a new type of design, called a Samurai Sudoku-based space-filling design. This design has several attractive properties: (1) the complete design achieves attractive uniformity in both univariate and bivariate margins; (2) it can be divided into groups of subdesigns with overlaps such that each subdesign achieves maximum uniformity in both univariate and bivariate margins; (3) each of the overlaps achieves maximum uniformity in both univariate and bivariate margins. These designs are appealing for meta-analysis and cross-validation.

WENG KEE WONG, University of California Los Angeles
Using Animal Instincts to Find Efficient Experimental Designs

I first present a brief overview of optimal design methodology. Particle swarm optimization (PSO) is then introduced to find optimal designs for potentially any model and any design criterion. The method works quite magically and frequently finds the optimal design or a nearly optimal design in an efficient way. There is virtually no explicit assumption required for the method to perform well and the user only needs to input a few easy tuning parameters in the PSO algorithm.

Using models from the biopharmaceutical sciences as examples, I demonstrate how PSO searches for different types of optimal experimental designs in dose response studies, including mini-max types of optimal designs where effective algorithms to find such designs have remained elusive until now.