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Finding Optimal Designs for Nonlinear Models Using the Imperialist Competitive Algorithm

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Finding optimal designs for nonlinear models is complicated because the optimality criterion usually depends on the model parameters. The simplest approach is to replace the unknown parameters by some initial estimates from a similar study or a pilot study so that the criterion is free of the unknown parameters and can be directly optimized. Such an approach results in optimal designs that depend on the initial estimates, so are called *locally* optimal designs. Locally optimal designs may be inefficient when the initial estimates are far away from the true values of the parameters. if a plausible region for the unknown parameters is available, a *minimax* optimal design may be obtained by minimizing the maximum inefficiency that may arise due to mis-specification in the parameters. Another approach is to elicit a prior distribution for the unknown parameters and optimize the criterion averaged over the prior distribution. The resulting designs are termed *Bayesian* optimal designs.

In this talk, we introduce different versions of the imperialist competitive algorithm [1] (ICA) to find locally, Bayesian and minimax optimal designs in a general framework. ICA is a metaheuristic evolutionary algorithm inspired from the socio-political process of human. Finally, we demonstrate the application of the ICAODR package [2] to solve different types of optimal design problems for nonlinear models.

References

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