Bayesian optimal designs for choice experiments with mixtures

Introduction

➢ Discrete choice experiments are used to quantify consumer preferences by having respondents choose between different alternatives.
➢ Many products and services can be described as mixtures of ingredients, e.g., a cocktail, a sports drink, or a bread.
➢ Choice experiments involving mixtures of ingredients have been overlooked, especially in the optimal design area, and what has been done has focused on D-optimality.
➢ In experiments with mixtures, we need precise predictions because usually the goal is to find the mixture that optimizes the respondents’ utility; hence, I-optimality is more suitable than D-optimality.
➢ D- and I-optimality need the information matrix of the model, which depends on the unknown parameter vector.
➢ Using a prior distribution is useful to solve the circular problem caused by that dependence.

Results

➢ Testing of fruit cocktails made of mango juice, blackcurrant syrup, and lemon juice.
➢ Design of 16 choice sets of size 2.

Contributions

➢ Computationally efficient definition for I-optimality for choice experiments involving mixtures.
➢ Embedded this definition in a coordinate-exchange algorithm to find optimal designs.
➢ Demonstrated that the I-optimal designs perform better than their D-optimal counterparts in terms of the variance of the predicted utility.
➢ Created an accessible and open-source R package with our algorithms.

References: