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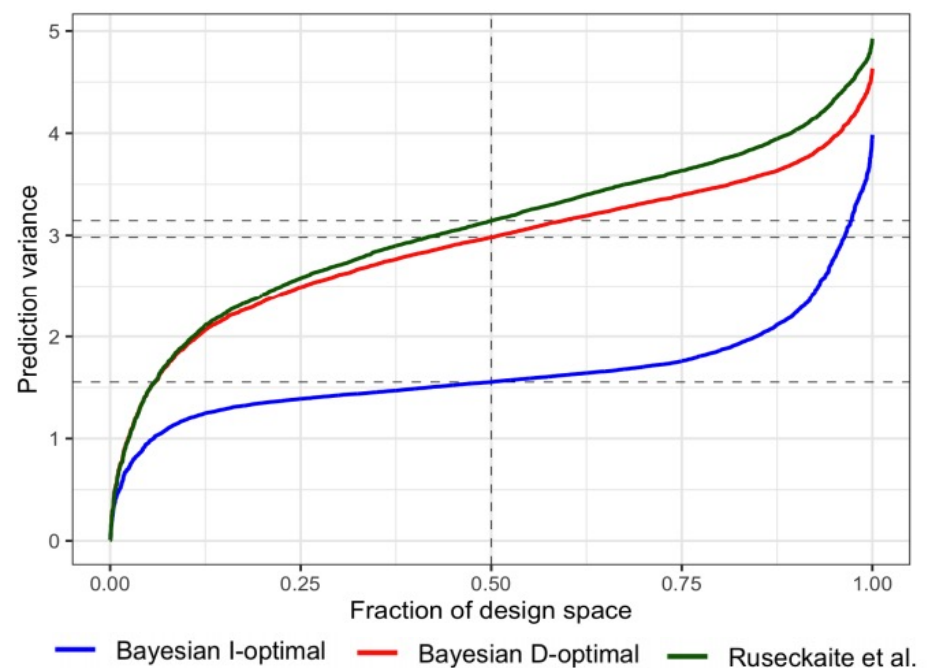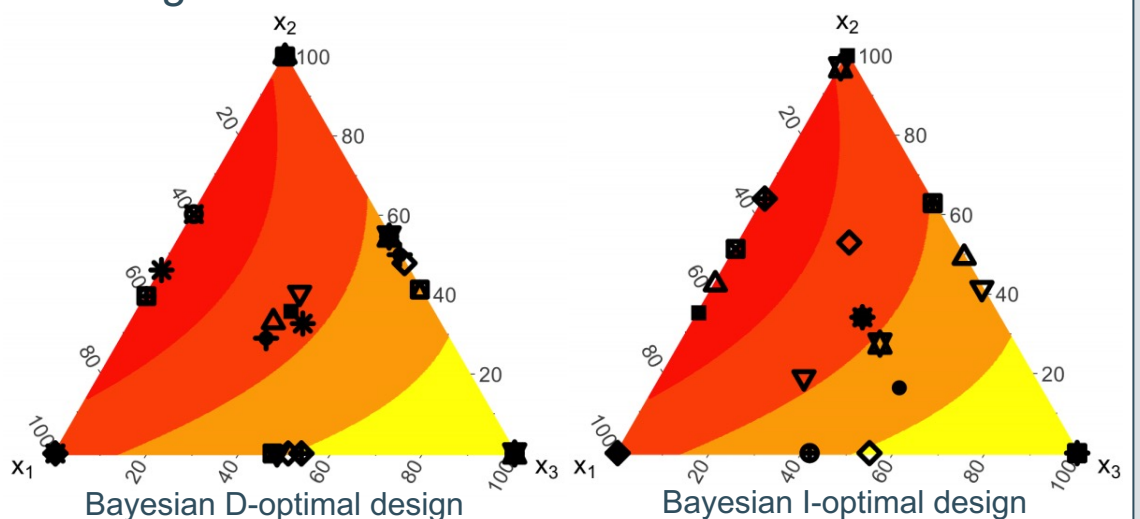# Bayesian optimal designs for choice experiments with mixtures

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.

Bayesian D-optimal design

Bayesian I-optimal design

Bayesian I-optimal — Bayesian D-optimal — Ruseckaite et al.

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.

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