Master thesis project "Optimal designs for sub-regions' effects in multi-environment crop variety testing"

Background:

Crop varieties are nowadays extensively tested in multi-environment trials in order to obtain a basis for recommendations to farmers. In case of a large and heterogeneous target population of environments, a division into sub-regions is usually very helpful. When designing such trials, the question arises how to allocate trials to the different sub-regions. Optimal allocation of trials with respect to random genotype effects have been recently discussed in Prus and Piepho (2021). However, the main focus may also lay on sub-regions' effects. These effects are usually assumed to be fixed and the related designs may be far from those for the genotype effects.

Aims/Research Questions:

1) Determine the best linear unbiased estimator and its covariance matrix for the sub-regions' effects in the underlined linear mixed model.
2) Formulate and analyze the related design criteria (standard and weighted A-criteria, which minimize the trace of the (adjusted) covariance matrix of the BLUE).
3) Compute optimal designs – optimal numbers of allocations to sub-regions – using the OptimalDesign package (see Harman and Filová (2019) in R or analytically (in simple cases) for the proposed real data example.

Data:

The proposed data example comes from Kleinknecht et al. (2013). The original data itself is not available. The variance parameters, variance-covariance matrices for the random, effects are computed and presented in the paper.

Literature:

Harman, R. and Filová, L. (2019). Package 'OptimalDesign'. https://cran.rproject.org/web/packages/OptimalDesign/index.html.

Kleinknecht, K., Möhring, J., Singh, K., Zaidi, P., Atlin, G., and Piepho, H.-P. (2013). Comparison of the performance of blue and blup for zoned indian maize data. Crop Science, 53, 1384–1391.

Prus, M. and Piepho, H.-P. (2021) Optimizing the allocation of trials to sub-regions in multi-environment crop variety testing, JABES, https://doi.org/10.1007/s13253-020-00426-y.

Prerequisites:

- Basic knowledge and interest in matrix algebra
- Basic knowledge of R programming

Researcher:

Maryna Prus, STIMA, Linköping University

Contact and application:

Maryna Prus maryna.prus@liu.se, maryna.prus@ovgu.de