

Design of Experiments in R

Ulrike Grömping

BHT Berlin – University of Applied Sciences, Germany
groemping@bht-berlin.de

Keywords: DoE, fractional factorial experiments, industrial experimentation, GUI, R commander plugin

R has a substantial amount of functionality for Design of Experiments (DoE) that is distributed over various R packages (cf. CRAN Task View, Grömping 2008-2009). However, so far, R has not been very successful in conquering the experimentation community outside of small expert circles. With regard to industrial experimentation, the market for DoE Software is dominated by all-round software companies like Minitab Inc. or Statsoft (Statistica), whose products are relatively simple to use. Such products are widely spread among businesses that adhere to the 6-Sigma quality management process, which involves application of DoE by many subject-matter and business process experts with only limited statistics training. Additionally, there are various specialized software products like e.g. NCSS (NCSS) or Cornerstone (Applied Materials, Inc.). The main inhibitors against usage of R for design and analysis of (industrial) experiments are

- R's steep learning curve for occasional or non-expert users
- gaps in R regarding some areas of experimental design, especially fractional factorial plans.

The talk presents a project that has two missions:

- to extend R's functionality for design and analysis of fractional factorial experiments (by extending R package **FrF2**) to fully meet state-of-the-art possibilities of benchmark software and exceed benchmark software by also incorporating newer research (e.g. Butler and Ramos 2007, Li and Lin 2003)
- to supply an interface to DoE functionality that accepts user inputs as close as possible to subject matter requirements and thus frees users from having to focus on unnecessary programming or mathematical detail. This purpose is attacked by a wrapper package for existing DoE functionality in R that acts as unifying interface and carries out translation from the subject-matter problem to the technical side as far as reasonable. The wrapper package will be usable from the command line, but also comes with a GUI that supports and guides occasional, programming-adverse, or statistically insecure R-users. The GUI will be implemented as an R commander plugin.

The project has just moved from the planning phase to the realization phase and will now be dealt with full time during my sabbatical semester. Rollout of the results to CRAN is scheduled for September 2009. The presentation will focus on the integration of existing functionality into an overall concept, selected aspects of implementing an application-driven interface, and selected aspects of extending R's DoE functionality for fractional factorial experiments. While the project will already be quite advanced, it will still be possible to accomodate useful suggestions from the R community.

References

- Butler, N.A. and Ramos, V.M. (2007). Optimal additions to and deletions from two-level orthogonal arrays.
Journal of the Royal Statistical Society B **69**, 51-61.
- Grömping, U. (2008-2009). CRAN Task View on Design of Experiments.
<http://cran.r-project.org/web/views/ExperimentalDesign.html>.
- Li, W. and Lin, D.K.J. (2003). Optimal Foldover Plans for Two-Level Fractional Factorial Designs.
Technometrics **45**, 142-149.