

MASTERS PROJECT MILESTONE REPORT

Name of the student: Jingning Yao

Name of the supervisor(s): Dr. Emi Tanaka and Dr. Katharine Turner

Title of the project (may be tentative): Optimization of Row-Column Designs

Summary:

CURRENT WORK RESULTS

Optimal design is a class of experimental design that is produced from optimizing a particular user-defined criterion. The A-criterion is a popular criterion when the treatment contrasts are of interest. I have focused on understanding, and where possible the search algorithm for the optimal design, basing on Butler (2013). In addition, I have explored the potential of simulated annealing algorithms to further enhance optimization processes.

Inspired by Piepho, Michel, and Williams (2018), I have attempted to use neighbor balance (NB) and evenness of distribution (ED) as criteria to guide the direction of gradient descent. To measure NB, I have constructed adjacency matrices and identified their maximum values. This approach allows for a quantitative assessment of how balanced the neighboring elements are in the design. Furthermore, I have implemented maximum column span and row span of design matrix to evaluate ED across the design field. These values are critical for ensuring that experimental units are evenly distributed, minimizing potential biases.

EXPECTATION FOR THIS SEMESTER

Currently, I am focusing on using pairwise permutations of a design matrix to generate its neighbors and iterate towards optimization. My goal is to enhance this process by incorporating NB and ED as filtering criteria for the permutations. The idea is to apply these parameters during the generation of pairwise permutations to ensure that only permutations maintaining or improving NB and ED are considered.

The expected outcome is that the resulting experimental designs will be optimized for the A-criterion while simultaneously ensuring excellent NB and ED.

I aim to put this algorithm in practice by applying it to some simple row-column experimental designs, and assess its performance. Additionally, I plan to extend this work for a larger simulation study.

REFERENCES

Butler, David. 2013. "On the Optimal Design of Experiments Under the Linear Mixed Model."

Piepho, Hans-Peter, Volker Michel, and Emlyn Williams. 2018. “Neighbor Balance and Evenness of Distribution of Treatment Replications in Row-Column Designs.” *Biometrical Journal* 60 (6): 1172–89.

Student’s signature

Supervisor’s signature

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