# Autotuning: D-Optimal Designs

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May 14, 2018

## Contents



# 1 Autotuning with D-Optimal Designs and Analysis of Variance

1. Use `optFederov` to find 24 experiments for the full model:

$$\begin{aligned} Y = & \, y\_component\_number + 1/y\_component\_number + \\ & vector\_length + lws\_y + 1/lws\_y + \\ & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number + \\ & threads\_number + 1/threads\_number \end{aligned}$$

2. Use `aov` to fit the full model, spending the 24 evaluations:

$$\begin{aligned} time\_per\_pixel = & \, y\_component\_number + 1/y\_component\_number + \\ & vector\_length + lws\_y + 1/lws\_y + \\ & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number + \\ & threads\_number + 1/threads\_number \end{aligned}$$

3. Identify the most significant factors from the ANOVA summary. In this case, they are *vector_length* and *lws_y*.

4. Use the fitted model to predict the best *time_per_pixel* value in the entire dataset

5. Prune the dataset using the predicted best values for *vector_length* and *lws_y*

6. Use `optFederov` to find 24 experiments for the pruned model. If there are less than or exactly 24 candidates, use the full candidate set.

$$\begin{aligned} Y = & \, y\_component\_number + 1/y\_component\_number + \\ & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number + \\ & threads\_number + 1/threads\_number \end{aligned}$$

7. Use `aov` to fit the pruned model, spending the 24 evaluations:

$$\begin{aligned} time\_per\_pixel = {} & y\_component\_number + 1/y\_component\_number + \\ & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number + \\ & threads\_number + 1/threads\_number \end{aligned}$$

8. Identify the most significant factors from the ANOVA summary. In this case, they are $y\_component\_number$ and $threads\_number$.

9. Use the fitted model to predict the best $time\_per\_pixel$ value in the entire dataset

10. Prune the dataset using the predicted best values for $y\_component\_number$ and $threads\_number$

11. Use `optFederov` to find 24 experiments for the pruned model. If there are less than or exactly 24 candidates, use the full candidate set.

$$\begin{aligned} Y = {} & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number \end{aligned}$$

12. Use `aov` to fit the pruned model, spending the 24 evaluations:

$$\begin{aligned} time\_per\_pixel = {} & load\_overlap + temporary\_size + \\ & elements\_number + 1/elements\_number \end{aligned}$$

13. Identify the most significant factors from the ANOVA summary. In this case, it is $elements\_number$

14. Use the fitted model to predict the best $time\_per\_pixel$ value in the entire dataset

15. Prune the dataset using the predicted best values for $elements\_number$

16. Use `optFederov` to find 24 experiments for the pruned model. If there are less than or exactly 24 candidates, use the full candidate set.

$$Y = load\_overlap + temporary\_size$$

17. Use `aov` to fit the pruned model, spending the 24 evaluations:

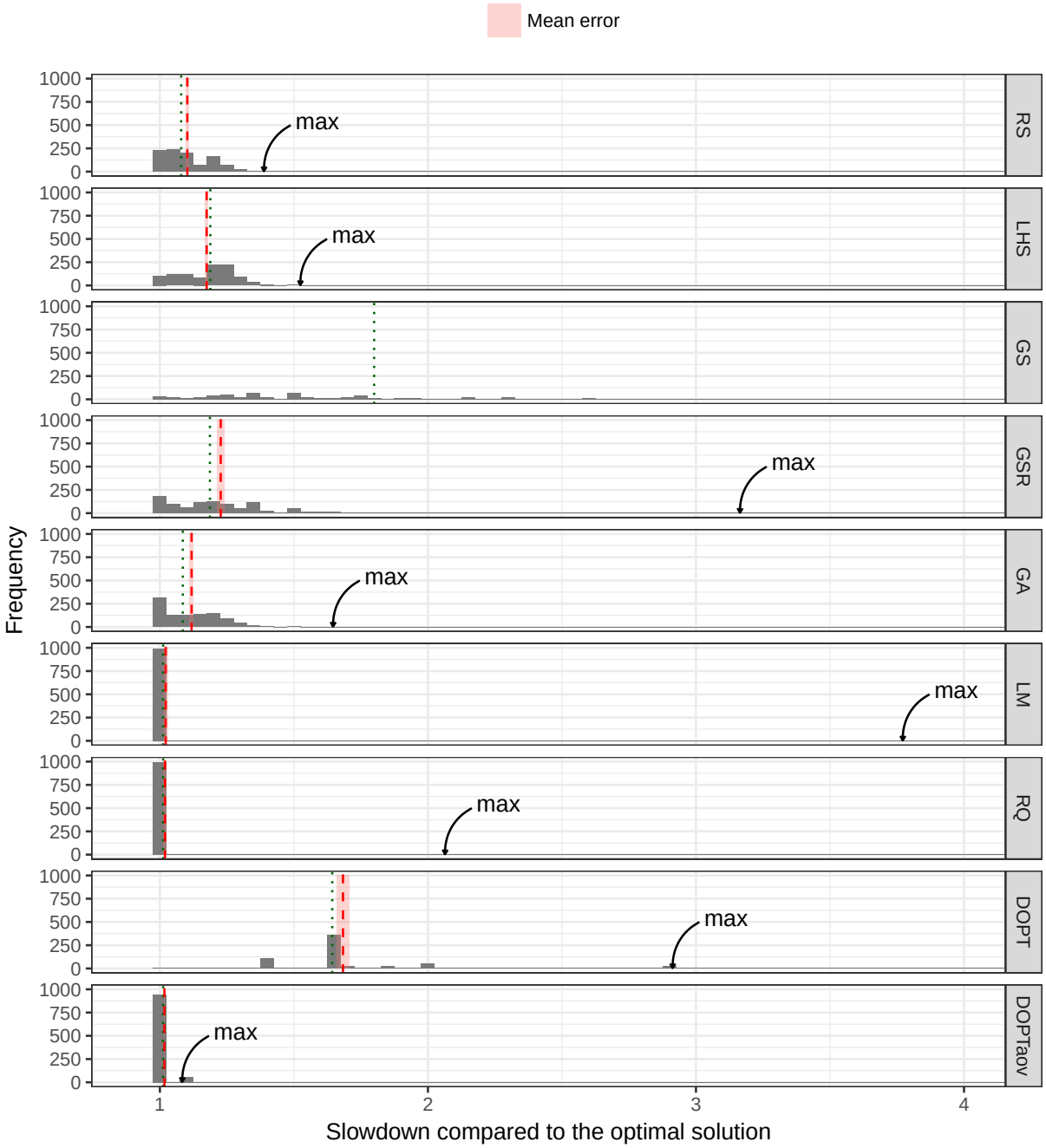
$$time\_per\_pixel = load\_overlap + temporary\_size$$

18. Use the fitted model to predict the best $time\_per\_pixel$ value in the entire dataset

19. Compare the predicted $time\_per\_pixel$ with the global optimum

# 2 Results

## 2.1 Comparing Strategies




| | RS | LHS | GS | GSR | GA | LM | RQ | DOPT | DOPTaov |
|---|---|---|---|---|---|---|---|---|---|
| Min. | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.01 | 1.01 | 1.38 | 1.01 |
| 1st Qu. | 1.03 | 1.09 | 1.35 | 1.07 | 1.02 | 1.01 | 1.01 | 1.64 | 1.01 |
| Median | 1.08 | 1.19 | 1.80 | 1.19 | 1.09 | 1.01 | 1.01 | 1.64 | 1.01 |
| Mean | 1.10 | 1.17 | 6.46 | 1.23 | 1.12 | 1.02 | 1.02 | 1.68 | 1.02 |
| 3rd Qu. | 1.18 | 1.24 | 6.31 | 1.33 | 1.19 | 1.01 | 1.01 | 1.64 | 1.01 |
| Max. | 1.39 | 1.52 | 124.76 | 3.16 | 1.65 | 3.77 | 2.06 | 2.91 | 1.08 |
| Mean Pt. | 120.00 | 98.92 | 22.17 | 120.00 | 120.00 | 119.00 | 119.00 | 120.00 | 68.00 |
| Max Pt. | 125.00 | 125.00 | 106.00 | 120.00 | 120.00 | 119.00 | 119.00 | 120.00 | 68.00 |

Table 1: Summary statistics