Progress report 3/9/23

Load libraries and the results

```
library(tidyverse)
```

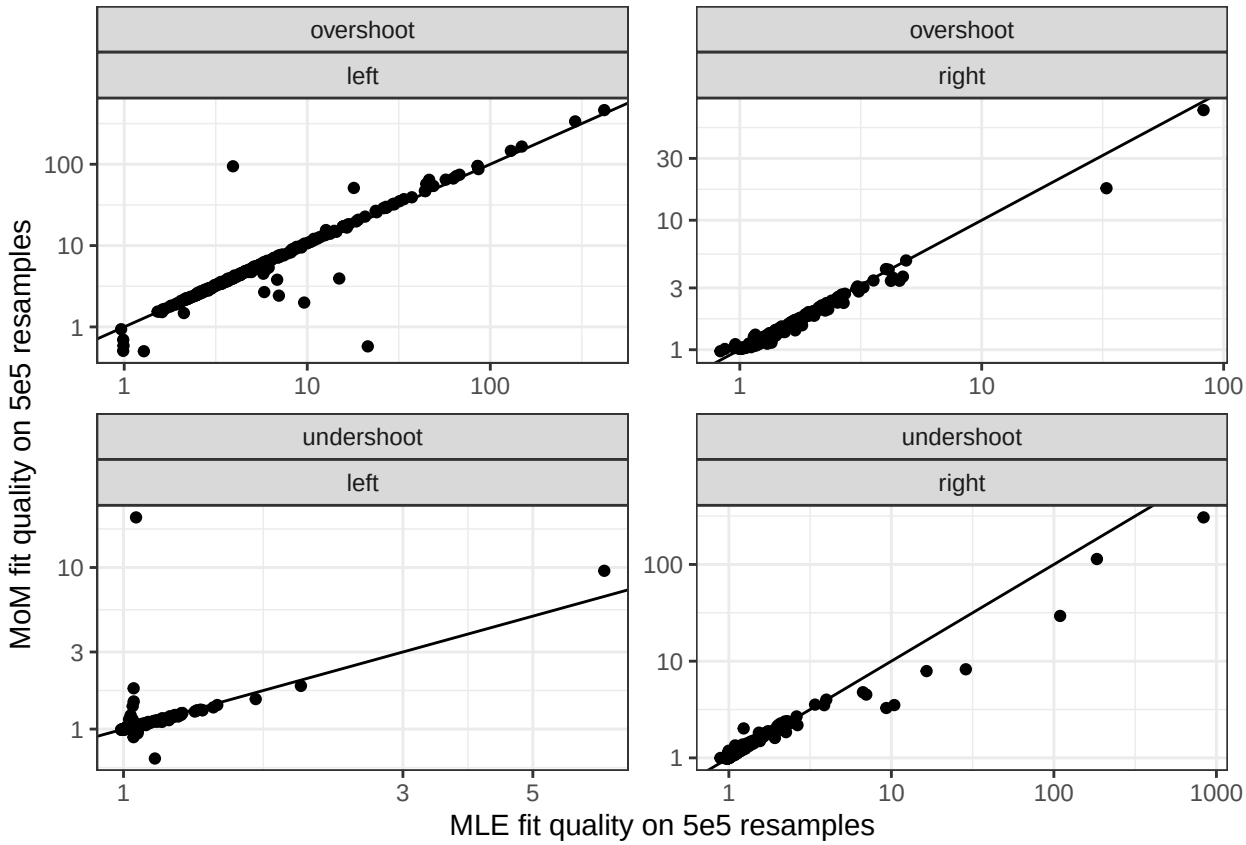
```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.1      v purrr   1.0.1
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.3.0      v stringr 1.5.0
## v readr   2.1.2      v forcats 0.5.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
# full analysis for 5690 resamples
full_results <- readRDS("full_nc_results.rds")
# subsampling analysis
subsampling_results <- readRDS("subsampling_nc_results.rds")
# full analysis for 5e5 resamples
groundtruth_results <- readRDS("ground_truth_nc_results.rds")
```

Assessing the fit quality of MLE and MoM on all 5e5 resamples

```
groundtruth_results |>
  filter(ratio < 1000) |>
  pivot_wider(names_from = method, values_from = ratio) |>
  ggplot(aes(x = MLE, y = MoM)) +
  geom_point() +
  geom_abline() +
  facet_wrap(error_type ~ tail, scales = "free") +
  scale_x_log10() +
  scale_y_log10() +
  labs(x = "MLE fit quality on 5e5 resamples",
       y = "MoM fit quality on 5e5 resamples")
```

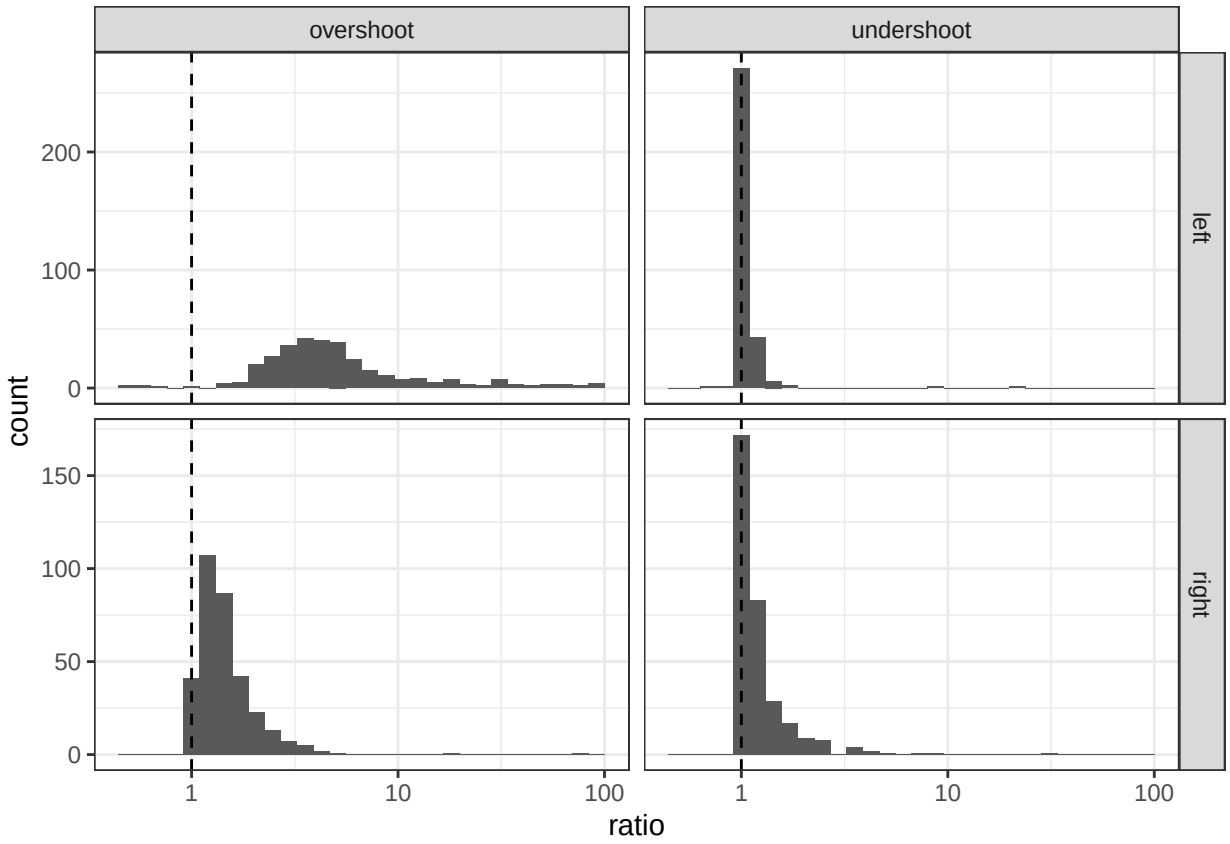
```
## Warning: Removed 4 rows containing missing values (`geom_point()`).
```



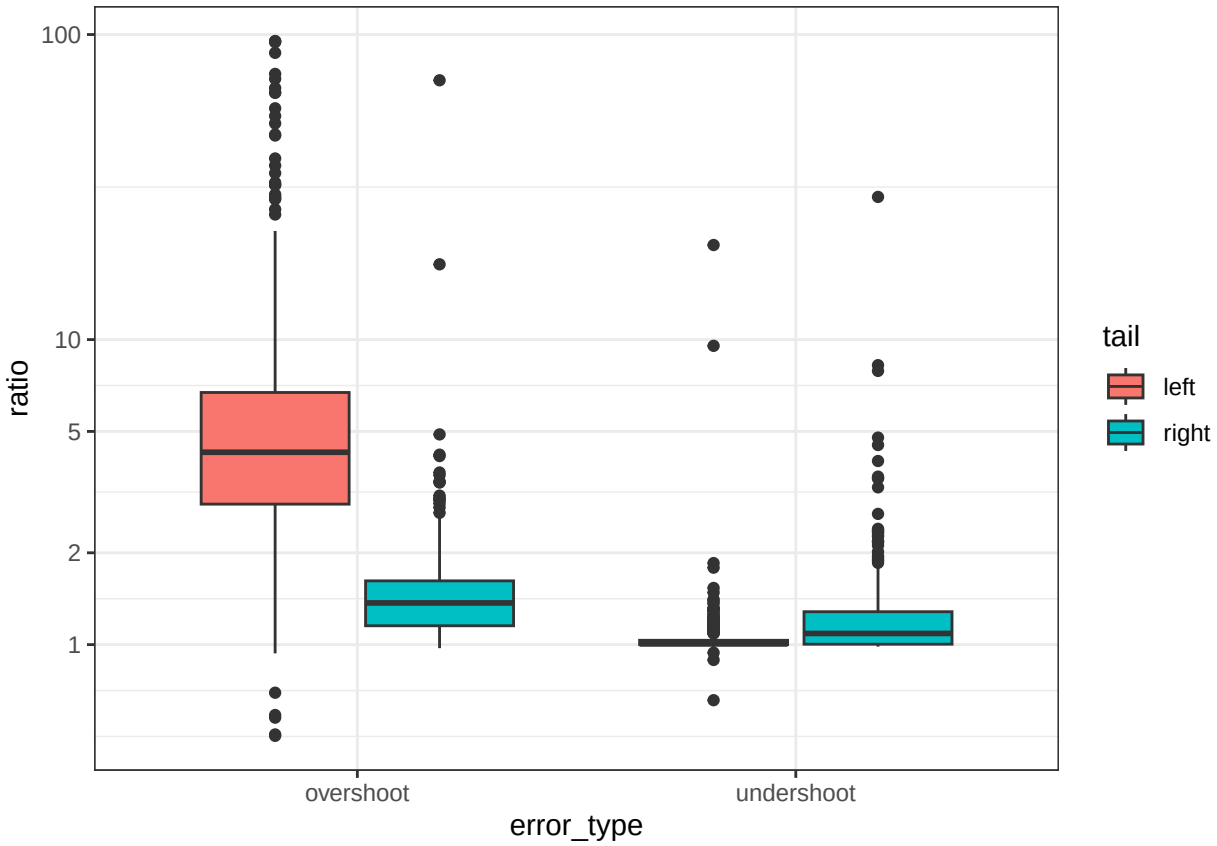
The conclusion here is that MLE and MoM have broadly similar fit quality on 5e5 resamples. Let's take a closer look at the MoM fit quality.

```
groundtruth_results |>
  filter(method == "MoM",
         ratio < 100) |>
  ggplot(aes(x = ratio)) +
  geom_histogram() +
  geom_vline(xintercept = 1, linetype = "dashed") +
  facet_grid(tail ~ error_type, scales = "free_y") +
  scale_x_log10()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```




```
groundtruth_results |>
  filter(method == "MoM",
         ratio < 100) |>
  ggplot(aes(x = error_type, y = ratio, fill = tail)) +
  geom_boxplot() +
  scale_y_continuous(trans = "log10", breaks = c(1, 2, 5, 10, 100))
```




```
groundtruth_results |>
  filter(method == "MoM") |>
  group_by(tail, error_type) |>
  summarise(median = median(ratio), .groups = "drop") |>
  pivot_wider(names_from = tail, values_from = median)
```

```
## # A tibble: 2 x 3
##   error_type  left right
##   <chr>      <dbl> <dbl>
## 1 overshoot   4.34  1.37
## 2 undershoot  1.01  1.09
```

In summary, we see that MoM tends to overshoot more than it undershoots, and that the overshoot problem seems worse in the left tail. The good news is that the extent of the undershoot is fairly low.