Figures for Nested Data Paper

```r
# Library ----

library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
library(iMRMC)
library(mvtnorm)
library(NestMRMC)
library(doParallel)
```

```
## Loading required package: foreach

## Loading required package: iterators

## Loading required package: parallel
```

```r
library(ggplot2)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':
##
##     combine
```

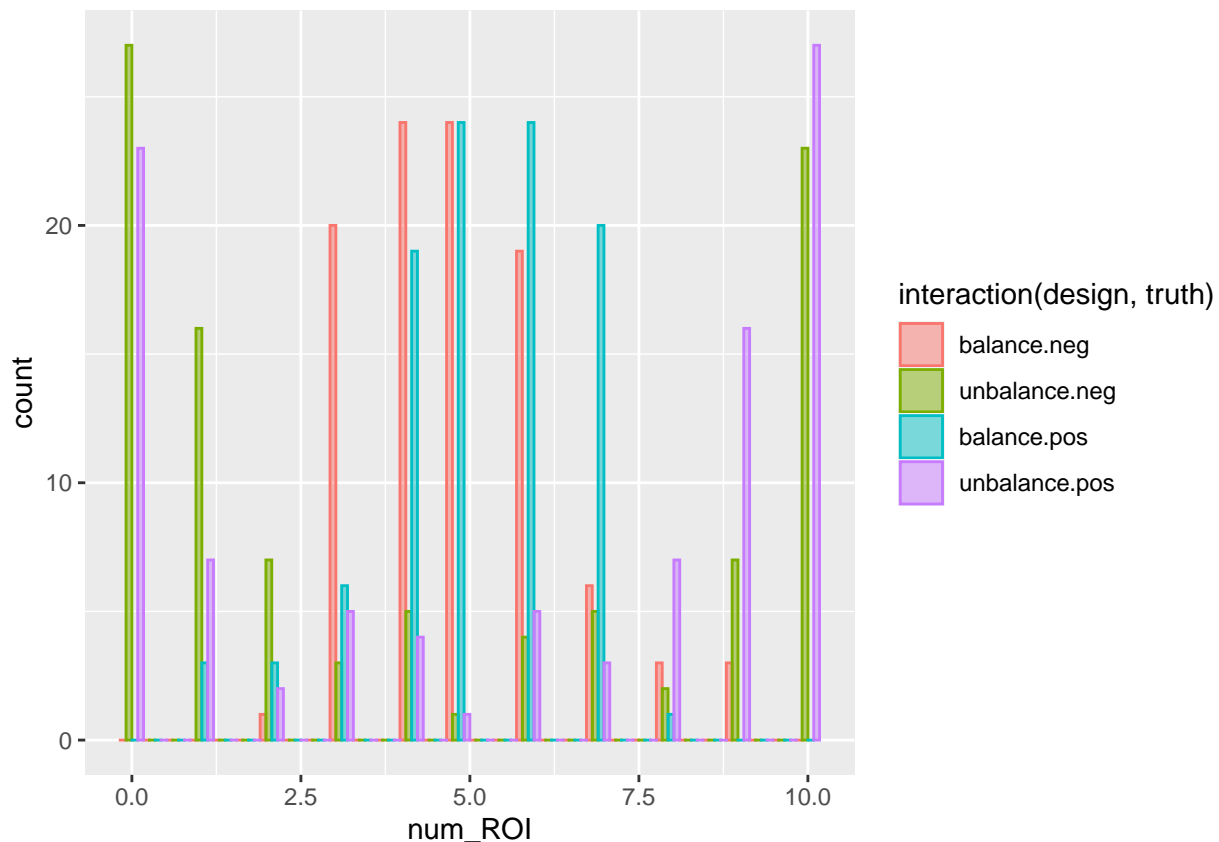**Figure 3 in the paper–histogram of number of positive and negative ROIs in balance and unbalance design**

Figure 4

Data description for Figure 4

- The results in these files assume that the truth labels of positive and negative ROIs are fixed across the 10,000 simulations, hence fixed is in the name of the file.

- In a balanced design each patient has approximately the same number of positive and negative ROIs. In an unbalanced design each patient tends to have unequal number of positive and negative ROIs. Note that for both designs the overall positive and negative ROIs number should be about the same, since the overall probabilities to be positive ROI and negative ROI are 0.5 and 0.5.

- *sim_result_blance_fixed_cov05062021.csv* Contains the summarized statistics from 10,000 simulations results in 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the balanced design and fixed truth labels. The 75 configurations are all the possible combinations of 3 AUC values (0.7, 0.8, 0.9), 5 covariance values (0.1, 0.25, 0.5, 0.75, 0.9) and 5 ρ values (0.1, 0.25, 0.5, 0.75, 0.9). The details of parameters settings in the 75 configurations is available in the **Table 1**.

- *sim_result_unblance_fixed_cov05062021.csv* Contains the summarized statistics from 10,000 simulations for 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the unbalanced design and fixed truth labels. The details of parameters settings in the 75 configurations is available in the **Table 1**.

- There are 16 columns in the both files. The detailed information for each column is given at the end of this file.
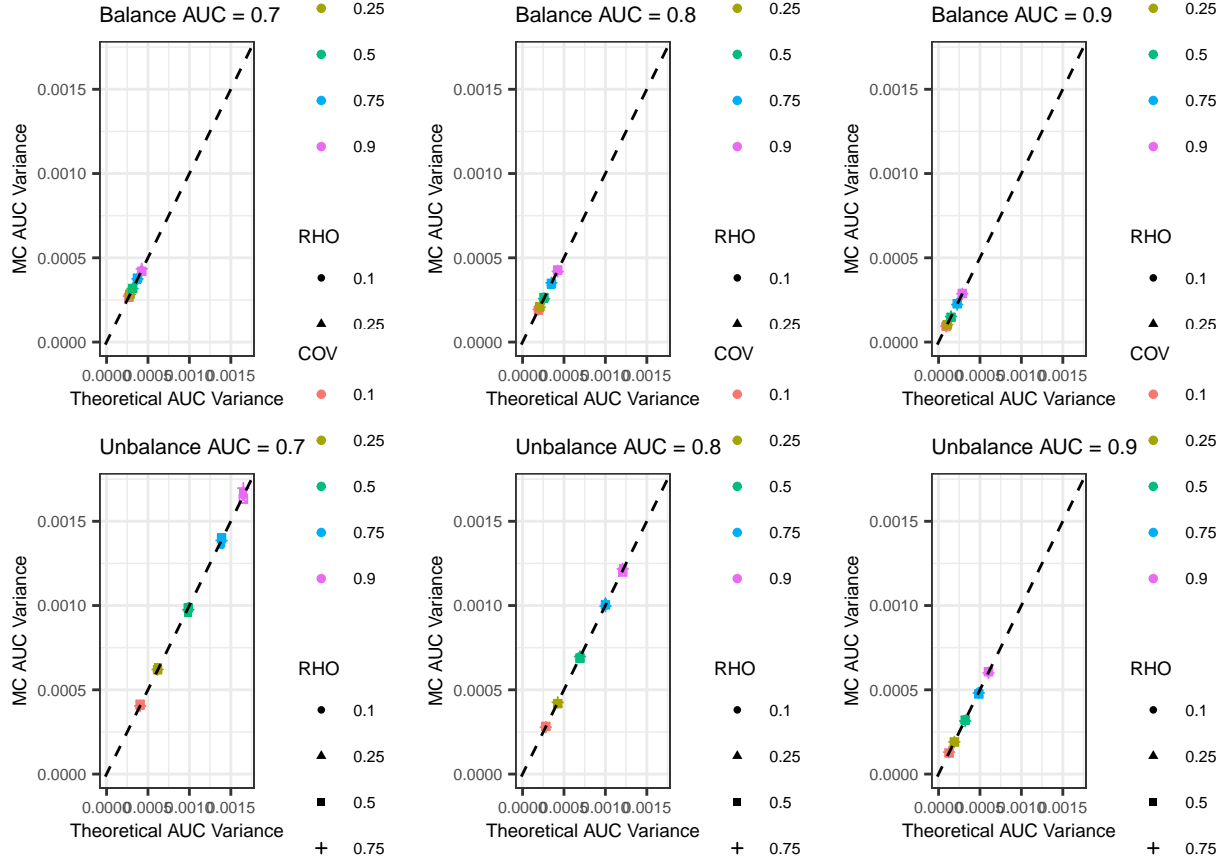
Figure 5

Data description for Figure 5

- The results in these files assume that the truth labels of positive and negative ROIs are randomly assigned across the 10,000 simulations, hence unfixed is in the name of the file.

- In a balanced design each patient has approximately the same number of positive and negative ROIs. In an unbalanced design each patient tends to have unequal number of positive and negative ROIs. Note that for both designs the overall positive and negative ROIs number should be about the same, since the overall probabilities to be positive ROI and negative ROI are 0.5 and 0.5.

- *sim_result_blance_unfixed_cov005182021.csv* Contains the summarized statistics from 10,000 simulations results in 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the balanced design and unfixed truth labels. The 75 configurations are all the possible combinations of 3 AUC values (0.7, 0.8, 0.9), 5 covariance values (0.1, 0.25, 0.5, 0.75, 0.9) and 5 ρ values (0.1, 0.25, 0.5, 0.75, 0.9). The details of parameters settings in the 75 configurations is available in the **Table 1**.

- *sim_result_unblance_unfixed_cov05182021.csv* Contains the summarized statistics from 10,000 simulations for 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the unbalanced design and unfixed truth labels.The details of parameters settings in the 75 configurations is available in the **Table 1**.

- There are 16 columns in the both files. The detailed information is provided in the end.
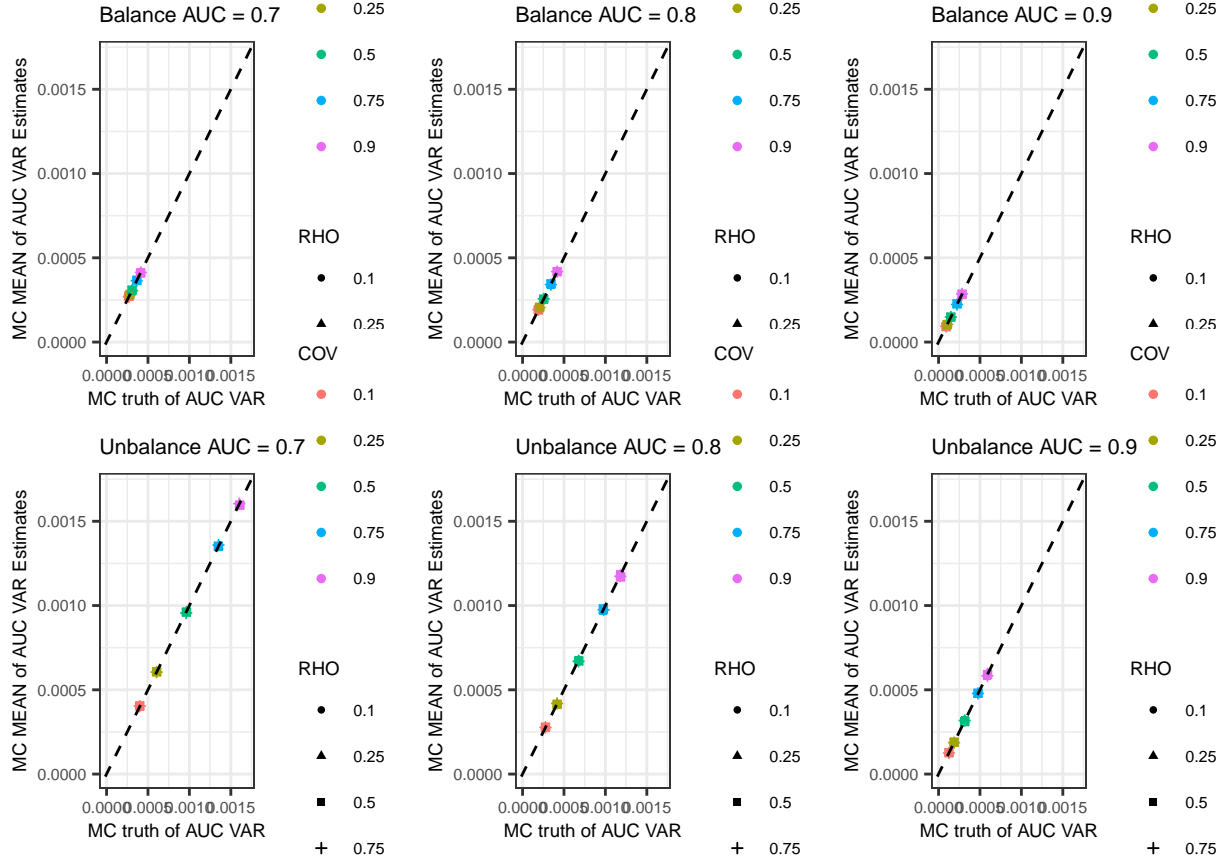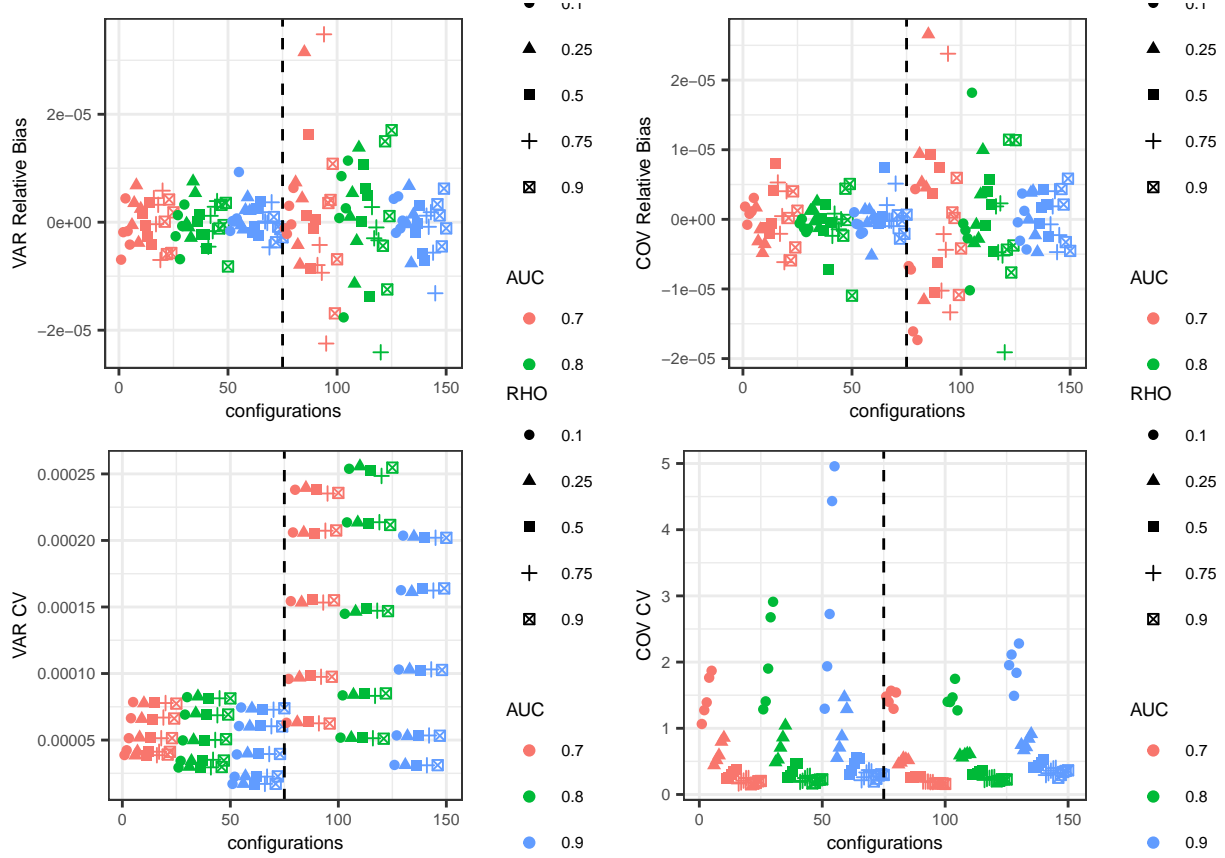
Figure 6

Data description for Figure 6

- The results in these files assume that the truth labels of positive and negative ROIs are randomly assigned across the 10,000 simulations, hence unfixed is in the name of the file.

- In a balanced design each patient has approximately the same number of positive and negative ROIs. In an unbalanced design each patient tends to have unequal number of positive and negative ROIs. Note that for both designs the overall positive and negative ROIs number should be about the same, since the overall probabilities to be positive ROI and negative ROI are 0.5 and 0.5.

- *sim_result_blance_unfixed_cov10042021.csv* Contains the summarized statistics from 10,000 simulations results in 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the balanced design and unfixed truth labels. The 75 configurations are all the possible combinations of 3 AUC values (0.7, 0.8, 0.9), 5 covariance values (0.1, 0.25, 0.5, 0.75, 0.9) and 5 ρ values (0.1, 0.25, 0.5, 0.75, 0.9). The details of parameters settings in the 75 configurations is available in the **Table 1**.

- *sim_result_unblance_unfixed_cov10042021.csv* Contains the summarized statistics from 10,000 simulations for 75 configurations for 100 patients and 10 ROIs per patient. All simulations use the unbalanced design and unfixed truth labels. The details of parameters settings in the 75 configurations is available in the **Table 1**.

- *sim_Nancy_blance_unfixed_cov10042021.csv* Contains the summarized statistics from 10,000 simulations for 75 configurations for 100 patients and 10 ROIs per patient based on Nancy's method. All simulations use the balanced design and unfixed truth labels. The details of parameters settings in the 75 configurations is available in the **Table 1**.

- *sim_Nancy_unblance_unfixed_cov10042021.csv* Contains the summarized statistics from 10,000 simulations for 75 configurations for 100 patients and 10 ROIs per patient based on Nancy's method. All simulations use the unbalanced design and unfixed truth labels.The details of parameters settingts in the 75 configurations is available in the **Table 1**.

- There are 16 columns in the above files. The detailed information is provided in the end.

Columns in the above files

- **R1AUC_MEAN**: The mean of reader 1 between-cases AUC estimates among 10,000 simulations.
- **R2AUC_MEAN**: The mean of reader 2 between-cases AUC estimates among 10,000 simulations.
- **R1AUC_VAR**: The variance of reader 1 between-cases AUC estimates among 10,000 simulations.
- **R2AUC_VAR**: The variance of reader 2 between-cases AUC estimates among 10,000 simulations.
- **R1VAR_MEAN**: The mean of reader 1 between-cases AUC variance estimates among 10,000 simulations.
- **R2VAR_MEAN**: The mean of reader 2 between-cases AUC variance estimates among 10,000 simulations.
- **R1VAR_VAR**: The variance of reader 1 between-cases AUC variance estimates among 10,000 simulations.
- **R2VAR_VAR**: The variance of reader 2 between-cases AUC variance estimates among 10,000 simulations.
- **R1R2COV_MEAN**: The mean of reader 1 and reader 2 between-cases AUC covariance estimates among 10,000 simulations.
- **R1R2COV_VAR**: The variance of reader 1 and reader 2 between-cases AUC covariance estimates among 10,000 simulations.
- **TRUE_VAR_MEAN**: The mean of between-cases AUC estimator's theoretical variances among 10,000 simulations.

- **TRUE_VAR_VAR**: The variance of between-cases AUC estimator's theoretical variances among 10,000 simulations.
- **TRUE_COV_MEAN**: The mean of between-cases AUC estimator's theoretical covariances among 10,000 simulations.
- **TRUE_COV_VAR**: The variance of between-cases AUC estimator's theoretical covariances among 10,000 simulations.
- **R1R2COV_MC**: The covariance between reader 1 and reader 2 between-cases AUC estimates among 10,000 simulations.
- **TRUE_AUC**: The true AUC values for the simulated data.

75 configurations in the simulation

Table 1: 75 configurations

	TRUE_AUC	RHO	COV
Config 1	0.7	0.1	0.1
Config 2	0.7	0.1	0.25
Config 3	0.7	0.1	0.5
Config 4	0.7	0.1	0.75
Config 5	0.7	0.1	0.9
Config 6	0.7	0.25	0.1
Config 7	0.7	0.25	0.25
Config 8	0.7	0.25	0.5
Config 9	0.7	0.25	0.75
Config 10	0.7	0.25	0.9
Config 11	0.7	0.5	0.1
Config 12	0.7	0.5	0.25
Config 13	0.7	0.5	0.5
Config 14	0.7	0.5	0.75
Config 15	0.7	0.5	0.9
Config 16	0.7	0.75	0.1
Config 17	0.7	0.75	0.25
Config 18	0.7	0.75	0.5
Config 19	0.7	0.75	0.75
Config 20	0.7	0.75	0.9
Config 21	0.7	0.9	0.1
Config 22	0.7	0.9	0.25
Config 23	0.7	0.9	0.5
Config 24	0.7	0.9	0.75
Config 25	0.7	0.9	0.9
Config 26	0.8	0.1	0.1
Config 27	0.8	0.1	0.25
Config 28	0.8	0.1	0.5
Config 29	0.8	0.1	0.75
Config 30	0.8	0.1	0.9
Config 31	0.8	0.25	0.1
Config 32	0.8	0.25	0.25
Config 33	0.8	0.25	0.5
Config 34	0.8	0.25	0.75
Config 35	0.8	0.25	0.9
Config 36	0.8	0.5	0.1
Config 37	0.8	0.5	0.25
Config 38	0.8	0.5	0.5

	TRUE_AUC	RHO	COV
Config 39	0.8	0.5	0.75
Config 40	0.8	0.5	0.9
Config 41	0.8	0.75	0.1
Config 42	0.8	0.75	0.25
Config 43	0.8	0.75	0.5
Config 44	0.8	0.75	0.75
Config 45	0.8	0.75	0.9
Config 46	0.8	0.9	0.1
Config 47	0.8	0.9	0.25
Config 48	0.8	0.9	0.5
Config 49	0.8	0.9	0.75
Config 50	0.8	0.9	0.9
Config 51	0.9	0.1	0.1
Config 52	0.9	0.1	0.25
Config 53	0.9	0.1	0.5
Config 54	0.9	0.1	0.75
Config 55	0.9	0.1	0.9
Config 56	0.9	0.25	0.1
Config 57	0.9	0.25	0.25
Config 58	0.9	0.25	0.5
Config 59	0.9	0.25	0.75
Config 60	0.9	0.25	0.9
Config 61	0.9	0.5	0.1
Config 62	0.9	0.5	0.25
Config 63	0.9	0.5	0.5
Config 64	0.9	0.5	0.75
Config 65	0.9	0.5	0.9
Config 66	0.9	0.75	0.1
Config 67	0.9	0.75	0.25
Config 68	0.9	0.75	0.5
Config 69	0.9	0.75	0.75
Config 70	0.9	0.75	0.9
Config 71	0.9	0.9	0.1
Config 72	0.9	0.9	0.25
Config 73	0.9	0.9	0.5
Config 74	0.9	0.9	0.75
Config 75	0.9	0.9	0.9