

# Package: lhcMR (via r-universe)

September 21, 2024

**Title** Latent Heritable Confounder - Mendelian Randomisation

**Version** 0.0.0.9000

**Description** lhcMR estimates a causal effect between two traits while accounting for a possible latent heritable confounder acting on them, as well as sample overlap.

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.1.1

**Imports** data.table, dplyr, GenomicSEM, magrittr, MASS, mixtools, parallel, rslurm, stats, stringr, TwoSampleMR

**URL** <https://github.com/LizaDarrous/lhcMR>

**BugReports** <https://github.com/LizaDarrous/lhcMR/issues>

**Suggests** rmarkdown, knitr

**VignetteBuilder** knitr

**Repository** <https://mrcieu.r-universe.dev>

**RemoteUrl** <https://github.com/LizaDarrous/lhcMR>

**RemoteRef** HEAD

**RemoteSha** aee7f348744dc7be8b4e7cd52d645ee225cd8b95

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calculate_SP	<i>Calculate starting points to be used in the likelihood function optimisation</i>
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### Description

Calculate starting points to be used in the likelihood function optimisation

### Usage

```
calculate_SP(
  input.df,
  trait.names,
  run_ldsc = TRUE,
  run_MR = TRUE,
  saveRFiles = TRUE,
  hm3 = NA,
  ld = NA,
  nStep = 2,
  SP_single = 3,
  SP_pair = 50,
  SNP_filter = 10,
  SNP_filter_ldsc = NA,
  nCores = 1,
  M = 1e+07
)
```

### Arguments

input.df	The resulting data frame from merge_sumstats(), where the effect size, SE, RSID and other columns are present, in addition to columns representing LD scores, weights and local LD structure
trait.names	Vector containing the trait names in the order they were used in merge_sumstats(): Exposure, Outcome
run_ldsc	Boolean. Whether GenomicSEM::ldsc should be run to obtain the cross trait-intercept (i <sub>XY</sub> ). If FALSE, a random value will be generated. Default value = TRUE
run_MR	Boolean. Whether TwoSampleMR::mr should be run to obtain the bidirectional causal effects (axy <sub>MR</sub> , ayx <sub>MR</sub> ). If FALSE, random values will be generated. Default value = TRUE
saveRFiles	Boolean, whether to write the results of GenomicSEM::ldsc, TwoSampleMR::mr, and the single trait analysis of LHC-MR (returns trait intercept and polygenicity) Default value = TRUE
hm3	Path to the input file (HAPMAP3 SNPs) required by GenomicSEM::ldsc
ld	Path to the input file (LD scores) required by GenomicSEM::ldsc

nStep	Can take two numerical values: 1 or 2. Represents the number of steps the lhcMR analysis will undertake. One single step estimates all 9 parameters simultaneously while fixing only the traits' intercepts iX and iY, while two steps estimates 7 parameters after having estimated traits' intercepts and polygenicity (iX, piX, iY, piY) from the single trait analysis and fixed their values in the likelihood optimisation and parameter estimation
SP_single	Numerical value indicating how many starting points should the single trait analysis use in the likelihood optimisation. Best to range between 3-5, default value = 3
SP_pair	Numerical value indicating how many starting points should the pair trait analysis use in the likelihood optimisation. Best to range between 50-100, default value = 50
SNP_filter	Numerical value indicating the filtering of every nth SNP to reduce large datasets and speed up analysis. Default value = 10
SNP_filter_ldsc	Numerical value indicating the filtering of every nth SNP to reduce large datasets and speed up the LDSC analysis. Set to 1 if no filtering is needed, otherwise default = 10
nCores	Numerical value indicating number of cores to be used in 'mclapply' to parallelise the analysis. If set to NA, then it will be calculated as 2/3 of the available cores, default value = 1 to avoid parallelisation
M	Numerical value indicating the number of SNPs used to calculate the LD reported in the LD file (for genotyped SNPs). Default value = 1e7

### Value

Returns a list containing the filtered dataset (by every `SNP_filter`th SNP), the starting points to be used in the pair trait optimisation, the traits' intercepts, the traits' polygenicity if `nStep = 2`, as well as some extra parameters like the cross-trait intercept and bidirectional causal effect estimated by IVW

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lhc_mr	<i>Main trait pair analysis using LHC-MR</i>
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### Description

Main trait pair analysis using LHC-MR

### Usage

```
lhc_mr(
  SP_list,
  trait.names,
  partition = NA,
  account = NA,
```

```

param = "comp",
para_method = "rslurm",
nCores = NA,
nBlock = 200,
M = 1e+07
)

```

## Arguments

SP_list	List resulting from calculate_SP. Contains the filtered dataset (by every 'SNP_filter'th SNP), the starting points to be used in the pair trait optimisation, the traits' intercepts, the traits' polygenicity if nStep = 2, as well as some extra parameters like the cross-trait intercept and bidirectional causal effect estimated by IVW
trait.names	Vector containing the trait names in the order they were used in merge_sumstats(): Exposure, Outcome
partition	String indicating the partition name to be used for the "rslurm" parallelisation - equivalent to '-p, -partition' in SLURM commands
account	String indicating the account name to be used for the "rslurm" parallelisation - equivalent to '-A, -account' in SLURM commands
param	String indicating which model the likelihood function will be optimised with, either "comp" by default or "U" for a no-confounder model
para_method	String indicating which method to parallelise the optimisation over the number of sets of starting points. "rslurm" will submit the calculation to a SLURM cluster using a 'Slurm' workload manager, "lapply" will parallelise the optimisation using 'mclapply' over a set number of cores but will go sequentially over the sets of starting points and thus take more time.
nCores	Numerical value indicating number of cores to be used in 'mclapply' to parallelise the analysis. If not set (default value = NA), then it will be calculated as 2/3 of the available cores
nBlock	Numerical value indicating the number of blocks to create from the block jackknife analysis, where at each iteration one block is left out and the optimisation is ran again for a single starting point to obtain eventually 'nBlock' estimates and calculate the SE of the parameter estimates
M	Numerical value indicating the number of SNPs used to calculate the LD reported in the LD file (for genotyped SNPs). Default value = 1e7

## Value

Prints out a summary of the results

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merge_sumstats	<i>Merge summary statistics into a single input data frame</i>
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## Description

Merge summary statistics into a single input data frame

## Usage

```
merge_sumstats(  
  input.files,  
  trait.names,  
  LD.filepath,  
  rho.filepath,  
  mafT = 0.005,  
  infoT = 0.99  
)
```

## Arguments

- |             |  |
|-------------|--|
| input.files | • list of data frames, where each data frame contains the summary statistics of a trait to use in the order of Exposure - Outcome          |
| trait.names | • Vector containing the trait names in the order they're found in 'input files'  |
| mafT        | • Minor allele frequency threshold of selection, to be used if a MAF column is found in the summary statistics file. Default value = 0.005 |
| infoT       | • SNP imputation quality threshold, to be used if an INFO column is found in the summary statistics file. Default value = 0.99             |
| LD.file     | • LD scores file, either obtained from Alkes group (1000G) or the one provided in the github (UK10K)                                       |
| rho.file    | • Genotyped SNP-specific (local) LD scores   |

## Value

Returns a data frame where the summary statistics file, the LD file, and the SNP-specific LD file are merged

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