

# Package ‘MR.Rerand’

January 8, 2024

**Title** Re-Randomized Inverse-Variance Weighted Estimator in Two-Sample Mendelian Randomization with Summary-Data and Mediation Analysis in Mendelian Randomization with Summary-Data

**Version** 0.0.1

**Description** Conducting rerandomization in two sample GWAS with summary data to estimate the causal effect or in three samples GWAS to estimate the mediation effect.

**Encoding** UTF-8

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.2.3

**Imports** stats,  
MASS,  
msm,

**License** MIT + file LICENSE

**Suggests** knitr,  
rmarkdown

**VignetteBuilder** knitr

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MAGIC	<i>Main function for MAGIC</i>
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## Description

Main function for MAGIC

**Usage**

```
MAGIC(
  beta.exposure,
  beta.mediator,
  beta.outcome,
  se.exposure,
  se.mediator,
  se.outcome,
  Conf.level = 0.95,
  pval.select = c(5e-05, 5e-05),
  eta = c(0.5, 0.5),
  seed = 0
)
```

**Arguments**

<code>beta.exposure</code>	SNP effect size's vector of the exposure variable (GWASI)
<code>beta.mediator</code>	SNP effect size's vector of the mediator variable (GWASIII)
<code>beta.outcome</code>	SNP effect size's vector of the outcome variable (GWASII)
<code>se.exposure</code>	SNP effect size's standard errors of <code>beta.exposure</code>
<code>se.mediator</code>	SNP effect size's standard errors of <code>beta.mediator</code>
<code>se.outcome</code>	SNP effect size's standard errors of <code>beta.outcome</code>
<code>Conf.level</code>	Confidence level. Default is 0.95.
<code>pval.select</code>	A vector of specified pre-screening threshold in the ordering of (exposure, mediator). Default is <code>c(5e-5, 5e-5)</code> . (corresponding lambda is 4.06)
<code>eta</code>	A vector of rerandomized scale in the ordering of (exposure, mediator). Default is <code>c(0.5, 0.5)</code> .
<code>seed</code>	The value of random seed. Default is 0.

**Value**

A list

**theta.hat** Estimated direct effect from exposure to outcome variable  
**tauy.hat** Estimated direct effect from mediator to outcome variable  
**taux.hat** Estimated indirect effect from exposure to mediator variable  
**tau.hat** Estimated mediation effect  
**tau\_total.hat** Estimated total effect  
**theta.se** Standard error of `theta.hat`  
**tauy.se** Standard error of `tauy.hat`  
**taux.se** Standard error of `taux.hat`  
**tau.se** Standard error of `tau.hat`  
**tau\_total.se** Standard error of `tau_total.hat`  
**n.IV.exp** Number of IVs used in exposure dataset  
**n.IV.med** Number of IVs used in mediator dataset  
**Conf.Interval** Confidence interval given `Conf.level`  
**IV.exp** The index of IVs selected in `Sx`  
**IV.med** The index of IVs selected in `Sm`

## References

Rita Qiuran Lyu, Chong Wu, Xinwei Ma, Jingshen Wang (2023). Mediation Analysis with Mendelian Randomization and Efficient Multiple GWAS Integration. <https://arxiv.org/abs/2312.10563>.

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pre_screening	<i>Supplementary function for RIVW</i>
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## Description

Supplementary function for RIVW

## Usage

```
pre_screening(
  gamma1.exp,
  se1.exp,
  etamean = 0.5,
  pthr = 5e-05,
  seed = 0,
  smoothing = FALSE
)
```

## Arguments

gamma1.exp	SNP effect size's vector of the exposure vairable
se1.exp	SNP effect size's standard errors of beta.exposure
etamean	rerandomized scale of exposure variable. Default is 0.5.
pthr	The specified pre-screening threshold. Default is 5e-5. (corresponding lambda is 4.06)
seed	A random seed. Default is 0.
smoothing	Whether to use smoothing to decrease variance . Default is FALSE.

## Value

A list

**filter1** Indexs of selected relevant IVs.

**gamma\_exp1** Effect size in GWAS (I) after Rao-Blackwellization to eliminate the winner's curse

**se1** Standard errors in GWAS (I) after Rao-Blackwellization to eliminate the winner's curse

**weights** The weights for each SNP. If smoothing is False, weights are the same for each SNP.

## References

Xinwei Ma, Jingshen Wang, Chong Wu. (2023). Breaking the Winner's Curse in Mendelian Randomization:Rerandomized Inverse Variance Weighted Estimator <https://projecteuclid.org/journals/annals-of-statistics/volume-51/issue-1/Breaking-the-winners-curse-in-Mendelian-randomi> 10.1214/22-AOS2247.full.

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```
pre_selection
```

*Supplementary function for MAGIC*

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## Description

Supplementary function for MAGIC

## Usage

```
pre_selection(
  gamma1.exp,
  se1.exp,
  gamma2.exp,
  se2.exp,
  etamean1 = 0.5,
  etamean2 = 0.5,
  pthr = c(5e-05, 5e-05),
  seed = 0
)
```

## Arguments

<code>gamma1.exp</code>	SNP effect size's vector of the exposure vairable (GWASI)
<code>se1.exp</code>	SNP effect size's standard errors of <code>beta.exposure</code>
<code>gamma2.exp</code>	SNP effect size's vector of the mediator vairable (GWASIII)
<code>se2.exp</code>	SNP effect size's standard errors of <code>beta.mediator</code>
<code>etamean1</code>	rerandomized scale of exposure variable. Default is 0.5.
<code>etamean2</code>	rerandomized scale of mediator variable. Default is 0.5.
<code>pthr</code>	A vector of specified pre-screening threshold in the ordering of (exposure, mediator). Default is <code>c(5e-5, 5e-5)</code> . (corresponding lambda is 4.06)
<code>seed</code>	a random seed. Default is 0.

## Value

A list

**filter1** Indexs of selected relevant IVs in `Sx`

**filter2** Indexs of selected relevant IVs in `Sm`

**gamma\_exp1** Effect size in GWAS (I) after Rao-Blackwellization to eliminate the winner's curse

**se1** Standard errors in GWAS (I) after Rao-Blackwellization to eliminate the winner's curse

**gamma\_exp2** Effect size in GWAS (III) after Rao-Blackwellization to eliminate the winner's curse

**se2** Standard errors in GWAS (III) after Rao-Blackwellization to eliminate the winner's curse

**gamma\_exp1.carve** Effect size in GWAS (I) after Rao-Blackwellization to eliminate the loser's curse

**gamma\_exp2.carve** Effect size in GWAS (III) after Rao-Blackwellization to eliminate the loser's curse

## References

Rita Qiuran Lyu, Chong Wu, Xinwei Ma, Jingshen Wang (2023). Mediation Analysis with Mendelian Randomization and Efficient Multiple GWAS Integration. <https://arxiv.org/abs/2312.10563>.

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RIVW	<i>Main function for RIVW</i>
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## Description

Main function for RIVW

## Usage

```
RIVW(
  beta.exposure,
  beta.outcome,
  se.exposure,
  se.outcome,
  Conf.level = 0.95,
  smoothing = FALSE,
  pval.select = 5e-05,
  eta = 0.5,
  seed = 0
)
```

## Arguments

<code>beta.exposure</code>	SNP effect size's vector of the exposure vairable (GWASI)
<code>beta.outcome</code>	SNP effect size's vector of the outcome vairable (GWASII)
<code>se.exposure</code>	SNP effect size's standard errors of <code>beta.exposure</code>
<code>se.outcome</code>	SNP effect size's standard errors of <code>beta.outcome</code>
<code>Conf.level</code>	Confidence level. Default is 0.95.
<code>smoothing</code>	Whether to use smoothing to decrease variance. Default is FALSE.
<code>pval.select</code>	The specified pre-screening threshold. Default is 5e-5. (corresponding lambda is 4.06)
<code>eta</code>	A vector of rerandomized scale. Default is 0.5.
<code>seed</code>	The value of random seed. Default is 0.

## Value

A list

**beta.rerand** Exposure dataset effect size after rerandomization.  
**se.rerand** Exposure dataset standard errors after rerandomization.  
**beta.hat** Estimated direct effect from exposure to outcome variable  
**beta.se** Standard error of `beta.hat`  
**n.IV** Number of IVs used in exposure dataset  
**F** The value of F-statistic  
**p.val** The p-value of estimated causal effect  
**Conf.Interval** Confidence interval of the causal effect given `Conf.level`

**References**

Xinwei Ma, Jingshen Wang, Chong Wu. (2023). Breaking the Winner's Curse in Mendelian Randomization: Rerandomized Inverse Variance Weighted Estimator <https://projecteuclid.org/journals/annals-of-statistics/volume-51/issue-1/Breaking-the-winners-curse-in-Mendelian-randomization/fulltext/10.1214/22-AOS2247.full>.

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