Package ‘rMOST’

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Title Estimates Pareto-Optimal Solution for Hiring with 3 Objectives

Version 1.0.1

Description Estimates Pareto-optimal solution for personnel selection with 3 objectives using Normal Boundary Intersection (NBI) algorithm introduced by Das and Dennis (1998) <doi:10.1137/S1052623496307510>. Takes predictor intercorrelations and predictor-objective relations as input and generates a series of solutions containing predictor weights as output. Accepts between 3 and 10 selection predictors. Maximum 2 objectives could be adverse impact objectives. Partially modeled after De Corte (2006) TROFSS Fortran program <https://users.ugent.be/~wdecorte/trofss.pdf> and updated from 'ParetoR' package described in Song et al. (2017) <doi:10.1037/apl0000240>. For details, see Study 3 of Zhang et al. (2023).

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Encoding UTF-8

RoxygenNote 7.2.1

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

Imports graphics, grDevices, nloptr, stats

Config/testthat/edition 3

NeedsCompilation no

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`MOST` *MOST*

Description

Optimizes 3 objectives with normal boundary intersection algorithm

Usage

```
MOST(optProb, Rx, Rxy1, Rxy2, Rxy3, sr, prop1, prop2, d1, d2, Spac = 10)
```

Arguments

`optProb`	Optimization problem. "3C" = no adverse impact objectives and three non-adverse impact objectives; "2C_1AI" = one adverse impact objective and two non-adverse impact objectives; "1C_2AI" = two adverse impact objectives and one non-adverse impact objective.
`Rx`	Predictor intercorrelation matrix
`Rxy1`	Needs to specify for all three types of optimization problems (optProb). Predictor criterion-related validity for non-adverse impact objective 1 (i.e., correlation between each predictor and non-adverse impact objective 1)
`Rxy2`	Only specify if optimization problem is "3C" or "2C_1AI". Predictor criterion-related validity for non-adverse impact objective 2 (i.e., correlation between each predictor and non-adverse impact objective 2)
`Rxy3`	Only specify if optimization problem is "3C". Predictor criterion-related validity for non-adverse impact objective 3 (i.e., correlation between each predictor and non-adverse impact objective 3)
`sr`	Only specify if optimization problem is "2C_1AI" or "1C_2AI". Overall selection ratio.
`prop1`	Only specify if optimization problem is "2C_1AI" or "1C_2AI". Proportion of minority1 in the applicant pool; prop1 = (# of minority1 applicants)/(total # of applicants)
`prop2`	Only specify if optimization problem is "1C_2AI". Proportion of minority2 in the applicant pool; prop2 = (# of minority2 applicants)/(total # of applicants)
`d1`	Only specify if optimization problem is "2C_1AI" or "1C_2AI". Vector of standardized group-mean differences between majority and minority 1 for each predictor; d1 = avg_majority - avg_minority1
`d2`	Only specify if optimization problem is "1C_2AI". Vector of standardized group-mean differences between majority and minority 2 for each predictor; d2 = avg_majority - avg_minority2
`Spac`	Determines the number of solutions.

Details

Inputs required by optimization problems Different types of optimization problems require different input parameters: * optProb = "3C": MOST(optProb, Rx, Rxy1, Rxy2, Rxy3) * optProb = "2C_1AI": MOST(optProb, Rx, Rxy1, Rxy2, sr, prop1, d1) * optProb = "1C_2AI": MOST(optProb, Rx, Rxy1, sr, prop1, d1, prop2, d2)

Notes regarding the inputs * For personnel selection applications, all predictor-intercorrelations and criterion-related validity inputs should be corrected for range restriction and criterion unreliability to reflect the relations in the applicant sample. * For optimization problems with 2 adverse impact objectives (i.e., optProb = "1C_2AI"), d1 and d2 should be the standardized mean difference between a minority group and the same reference group (e.g., Black-White and Hispanic-White, not Black-White and female-male)

Optimization * Optimization may take several minutes to run. * Optimization may fail in some applications due to non-convergence.

For more details, please consult the vignette.

Value

Pareto-Optimal solutions with objective values (e.g., C1, AI1) and the corresponding predictor weights (e.g., P1, P2)

Examples

```
# A sample optimization problem with 3 non-adverse impact objectives and 3 predictors
# For more examples, please consult the vignette.

# Specify inputs
# Predictor inter-correlation matrix (Rx)
Rx <- matrix(c(1,  .50, .50,
               .50,  1, .50,
               .50, .50,  1), 3, 3)

# Predictor-objective relation vectors (Rxy1, Rxy2, Rxy3)
# Criterion-related validities
## Criterion 1
Rxy1 <- c(-.30, 0, .30)
## Criterion 2
Rxy2 <- c(0, .30, -.30)
## Criterion 3
Rxy3 <- c(.30, -.30, 0)

# Get Pareto-optimal solutions

out <- MOST(optProb = "3C", Rx = Rx, Rxy1 = Rxy1, Rxy2 = Rxy2, Rxy3 = Rxy3, Spac = 10)
out
```

ParetoR_1C_2AIR — *ParetoR_1C_2AIR*

Description

Command function to optimize 1 non-adverse impact objective and 2 adverse impact objectives via NBI algorithm

Usage

```
ParetoR_1C_2AIR(sr, prop1, prop2, Rx, Rxy1, d1, d2, Spac = 10)
```

Arguments

`sr`	Selection ratio in the full applicant pool
`prop1`	Proportion of minority1 applicants in the full applicant pool
`prop2`	Proportion of minority2 applicants in the full applicant pool
`Rx`	Matrix with intercorrelations among predictors
`Rxy1`	Vector with correlation between each predictor and the non-adverse impact objective
`d1`	Subgroup difference 1; standardized mean differences between minority1 and majority subgroups on each predictor in full applicant pool
`d2`	Subgroup difference 2; standardized mean differences between minority2 and majority subgroups on each predictor in full applicant pool
`Spac`	Number of solutions

Value

out Pareto-Optimal solution with objective outcome values (Criterion) and predictor weights (ParetoWeights)

ParetoR_2C — *ParetoR_2C*

Description

Command function to optimize 2 non-adverse impact objectives via NBI algorithm

Usage

```
ParetoR_2C(Rx, Rxy1, Rxy2, Spac = 10, graph = TRUE)
```

Arguments

`Rx`	Matrix with intercorrelations among predictors
`Rxy1`	Vector with correlation between each predictor and non-adverse impact objective 1
`Rxy2`	Vector with correlation between each predictor and non-adverse impact objective 2
`Spac`	Number of Pareto points
`graph`	If TRUE, plots will be generated for Pareto-optimal curve and predictor weights

Value

out Pareto-Optimal solution with objective outcome values (Criterion) and predictor weights (ParetoWeights)

`ParetoR_2C_1AIR` *ParetoR_2C_1AIR*

Description

Command function to optimize 2 non-adverse impact objectives and 1 adverse impact objective via NBI algorithm

Usage

```
ParetoR_2C_1AIR(Rx, Rxy1, Rxy2, sr, prop1, d1, Spac = 10)
```

Arguments

`Rx`	Matrix with intercorrelations among predictors
`Rxy1`	Vector with correlation between each predictor and non-adverse impact objective 1
`Rxy2`	Vector with correlation between each predictor and non-adverse impact objective 2
`sr`	Selection ratio in full applicant pool
`prop1`	Proportion of minority applicants in full applicant pool
`d1`	Subgroup difference; standardized mean differences between minority and majority subgroups on each predictor in full applicant pool
`Spac`	Number of Pareto points

Value

out Pareto-Optimal solution with objective outcome values (Criterion) and predictor weights (ParetoWeights)

`ParetoR_3C` *ParetoR_3C*

Description

Command function to optimize 3 non-adverse impact objectives via NBI algorithm

Usage

```
ParetoR_3C(Rx, Rxy1, Rxy2, Rxy3, Spac = 10)
```

Arguments

`Rx`	Matrix with intercorrelations among predictors
`Rxy1`	Vector with correlation between each predictor and non-adverse impact objective 1
`Rxy2`	Vector with correlation between each predictor and non-adverse impact objective 2
`Rxy3`	Vector with correlation between each predictor and non-adverse impact objective 3
`Spac`	Number of solutions

Value

out Pareto-Optimal solution with objective outcome values (Criterion) and predictor weights (ParetoWeights)

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