Package 'adverseimpact'

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Title Statistical and Practical Significance Testing for Adverse Ampact in Selection Decisions

Version 0.0.0.92

Description This R package provides a suite of functions for assessing adverse impact in employee selection and hiring procedures. Adverse impact occurs when a selection procedure disproportionately excludes members of a protected class, such as race or gender. The package includes functions to compute statistical tests, such as the Z-test and LMP test, as well as practical measures, like the h-statistic, Phi-coefficient, and adjusted shortfall. By offering a comprehensive set of tools, this package helps organizations evaluate their selection procedures and make data-driven decisions to minimize adverse impact and promote fairness in the hiring process.

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Imports stats

R topics documented:

ai_disparity *Adverse Impact Disparity Calculation*

Description

Adverse Impact Disparity Calculation

Usage

```
ai_disparity(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A vector containing the absolute disparity (AD) and absolute impact (AI)

Examples

```
# Test cases
NFmin <- 1771
NPmin <- 338
NFmaj <- 25
NPmaj <- 532

# Calculate the absolute disparity (AD) and absolute impact (AI)
disparity_result <- ai_disparity(NFmin, NPmin, NFmaj, NPmaj)
print(disparity_result)
```

ai_FET *Compute the Fisher's Exact Test (FET) Statistic*

Description

This function calculates the Fisher's Exact Test (FET) statistic, a measure used in adverse impact analysis. The FET is a statistical test used to determine if there are nonrandom associations between two categorical variables.

Usage

```
ai_FET(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	The number of non-favored outcomes for the minority group
NPmin	The number of favored outcomes for the minority group
NFmaj	The number of non-favored outcomes for the majority group
NPmaj	The number of favored outcomes for the majority group

Value

A numeric value representing the FET statistic

Examples

```
NFmin <- 25
NPmin <- 75
NFmaj <- 100
NPmaj <- 300
ai_FET(NFmin, NPmin, NFmaj, NPmaj)
```

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ai_fisher *Fisher's Exact Test (FET) for Selection Procedure Outcomes*

Description

This function calculates Fisher's Exact Test (FET) for a 2x2 contingency table representing selection procedure outcomes for minority and majority groups. It helps to assess the statistical significance of the association between group membership and selection outcomes.

Usage

```
ai_fisher(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A list containing the Fisher's Exact Test results (p-value and odds ratio).

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate Fisher's Exact Test results
result <- ai_fisher(NFmin, NPmin, NFmaj, NPmaj)
result
```

`ai_hstat` *Calculate the H-Statistic*

Description

This function calculates the H-Statistic, a measure of the difference between the arcsine-transformed selection rates of minority and majority groups. The H-Statistic is used to assess disparities in selection rates between the two groups.

Usage

```
ai_hstat(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

`NFmin`	Number of participants failing the selection procedure from the minority group
`NPmin`	Number of participants passing the selection procedure from the minority group
`NFmaj`	Number of participants failing the selection procedure from the majority group
`NPmaj`	Number of participants passing the selection procedure from the majority group

Value

A numeric value representing the H-Statistic.

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate the H-Statistic
result <- ai_hstat(NFmin, NPmin, NFmaj, NPmaj)
result
```

ai_ir *Computes the Impact Ratio (IR) between minority and majority groups*

Description

This function calculates the Impact Ratio (IR) by dividing the selection rate of the minority group (SRmin) by the selection rate of the majority group (SRmaj). The IR helps assess the relative difference in selection rates between the two groups.

Usage

```
ai_ir(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A numeric value representing the Impact Ratio (IR) between the minority and majority groups.

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate the Impact Ratio
result <- ai_ir(NFmin, NPmin, NFmaj, NPmaj)
result
```

ai_LMP *Compute the LMP Test Statistic*

Description

This function calculates the LMP test statistic, which is a measure used in adverse impact analysis. The LMP test is based on the Fisher's Exact Test.

Usage

```
ai_LMP(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	The number of non-favored outcomes for the minority group
NPmin	The number of favored outcomes for the minority group
NFmaj	The number of non-favored outcomes for the majority group
NPmaj	The number of favored outcomes for the majority group

Value

A numeric value representing the LMP test statistic

Examples

```
NFmin <- 25
NPmin <- 75
NFmaj <- 100
NPmaj <- 300
ai_LMP(NFmin, NPmin, NFmaj, NPmaj)
```

---

ai_phi *Calculate the Phi Coefficient*

Description

This function calculates the Phi coefficient, a measure of association between two binary variables. In this context, the Phi coefficient represents the association between group membership (minority or majority) and selection outcome (pass or fail).

Usage

```
ai_phi(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A numeric value representing the Phi coefficient.

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate the Phi coefficient
result <- ai_phi(NFmin, NPmin, NFmaj, NPmaj)
result
```

ai_sf *Calculate the Shortfall (SF) Value*

Description

This function calculates the Shortfall (SF) value, which represents the difference between the expected number of selected minority applicants (based on the majority group's selection rate) and the actual number of selected minority applicants.

Usage

```
ai_sf(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A numeric value representing the Shortfall (SF) value.

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate the Shortfall (SF) value
result <- ai_sf(NFmin, NPmin, NFmaj, NPmaj)
result
```

ai_shortfall *Adjusted Shortfall*

Description

Adjusted Shortfall

Usage

```
ai_shortfall(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A numeric value representing the adjusted shortfall (SFadj) calculated as the shortfall (SF) divided by the total number of minority applicants (Nmin).

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Calculate the adjusted shortfall
result <- ai_shortfall(NFmin, NPmin, NFmaj, NPmaj)
result
```

---

ai_ztest *Z-score and p-value for a two-sample proportion test*

Description

This function calculates the Z-score and associated p-value for a two-sample proportion test comparing the selection rates between minority and majority groups. The test helps assess if there is a significant difference in the selection rates of the two groups.

Usage

```
ai_ztest(NFmin, NPmin, NFmaj, NPmaj)
```

Arguments

NFmin	Number of participants failing the selection procedure from the minority group
NPmin	Number of participants passing the selection procedure from the minority group
NFmaj	Number of participants failing the selection procedure from the majority group
NPmaj	Number of participants passing the selection procedure from the majority group

Value

A data frame containing the z-score and associated p-value.

Examples

```
# Example data
NFmin <- 10 # Number of participants failing the selection procedure from the minority group
NPmin <- 5  # Number of participants passing the selection procedure from the minority group
NFmaj <- 30 # Number of participants failing the selection procedure from the majority group
NPmaj <- 15 # Number of participants passing the selection procedure from the majority group

# Perform the two-sample proportion test
result <- ai_ztest(NFmin, NPmin, NFmaj, NPmaj)
result
```

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