Package 'HW.pval'

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Type Package

Title Testing Hardy-Weinberg Equilibrium for Multiallelic Genes

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Description HW.pval calculates plain and fully conditional root-mean-square, chi-square, and log likelihood-ratio P-values for the user-provided genotypic counts to be consistent with the Hardy-Weinberg equilibrium model. For further information on the Hardy-Weinberg equilibrium model and the pseudocode, refer to the paper ``Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic" by Rachel Ward.

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HW.pval-package *Testing Hardy-Weinberg Equilibrium for Multiallelic Genes*

Description

Tests Hardy-Weinberg equilibrium for a multiallelic gene by displaying plain and/or fully conditional P-values.

Details

Package:	HW.pval
Type:	Package
Version:	1.0
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License:	GPL-3

Tests a matrix of observed genotype counts for a multiallelic gene and returns plain and/or fully conditional P-values. The P-values are found by running the function HW.pval(). The P-values for the following test statistics are returned: Root Mean Square, Chi Square, and the Log Likelihood Ratio.

The matrix of observed genotype counts is a matrix of dimension r by r, where r is the number of alleles A_1, A_2,...,A_r. The (j,k)-th entry of the matrix is the observed number of genotypes (A_j,A_k).

Author(s)

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References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic" by Rachel Ward.

See Also

HW.pval

create.model *Creating the Hardy-Weinberg model distribution from a given lower-triangular array of genotype counts*

Description

Creates maximum-likelihood Hardy-Weinberg equilibrium model distribution from the observed genotype count matrix.

Usage

```
create.model(observed, n)
```

Arguments

observed	The genotype count matrix from which the Hardy-Weinberg equilibrium model distribution is created
n	Total number of genotypes.

Details

This function is called by HW.pval() and HW.plain() to create a model distribution.

Author(s)

Shubhodeep Mukherji <deep.mukherji@utexas.edu>

References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic," by Rachel Ward

See Also

HW.pval, HW.plain

HW.cond *Computing the fully conditional P-value for a given lower-triangular array of genotype counts*

Description

Computes the fully conditional P-Value associated to the provided lower-triangular array of genotype counts to be consistent with the Hardy-Weinberg equilibrium model

Usage

```
HW.cond(obs_dist, model_dist, rms, chisq, gsq, T, n)
```

Arguments

obs_dist	Observed genotype count matrix
model_dist	Hardy-Weinberg equilibrium model distribution for the observed genotype count matrix determined in HW.pval(). Calculated via the function create.model()
rms	Root-Mean-Square test statistic determined in HW.pval()
chisq	Chi-Square test statistic determined in HW.pval()
gsq	Log Likelihood-Ratio test statistic determined in HW.pval()
T	Number of Monte-Carlo simulations desired
n	Total number of observed genotypes

Details

Determines the fully-conditional P-value via Monte-Carlo simulation as described in Algorithm 5.2 of the referenced paper

Returns fully conditional P-values associated to the root-mean-square, chi-square, and log likelihood-ratio statistics.

Author(s)

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References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic" by Rachel Ward.

See Also

HW.pval, create.model, test.rms, test.chisq, and test.gsq

HW.plain *Computing the plain P-Value for a given lower-triangular array of genotype counts*

Description

Computes the plain P-Value associated to the provided lower-triangular array of genotype counts to be consistent with the Hardy-Weinberg equilibrium model

Usage

```
HW.plain(model_dist, rms, chisq, gsq, T, n)
```

Arguments

model_dist	Model distribution for the input genotype count matrix determined in HW.pval(). Calculated via the function create.model()
rms	Root Mean Square test statistic determined in HW.pval()
chisq	Chi-Square test statistic determined in HW.pval()
gsq	Log Likelihood-Ratio test statistic determined in HW.pval()
T	Number of Monte-Carlo simulations desired.
n	Total count of observed genotypes

Details

Determines the plain P-value via Monte-Carlo simulation as described in Algorithm 5.1 of the referenced paper

Returns plain P-values associated to the root-mean-square, chi-square, and log likelihood-ratio statistics.

Author(s)

Shubhodeep Mukherji <deep.mukherji@utexas.edu>

References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic" by Rachel Ward.

See Also

HW.pval, create.model, test.rms, test.chisq, and test.gsq

HW.pval *Testing Hardy-Weinberg Equilibrium for Multiallelic Genes*

Description

Tests Hardy-Weinberg equilibrium for a multiallelic gene by displaying plain and/or fully conditional P-values.

Usage

```
HW.pval(genotype_count, num_simulations = 10000, type = "both")
```

Arguments

genotype_count	A lower triangular matrix of observed genotype counts.
num_simulations	Number of Monte-Carlo simulations desired. The default is 10,000.
type	Determines type of p-value returned. Choices are “plain”, “cond”, and “both”.

Details

The observed genotype counts matrix does not have to be lower triangular, but the code is designed to only read the lower triangle. Thus, the entries in the upper triangle are irrelevant.

Determines the model distribution for the matrix of observed genotype counts by calling the function create.model() and calculates the empirical test statistics between the observed counts and the model counts. The test statistics are determined by calling the functions test.rms(), test.chisq(), and test.gsq(). Then, depending on the type of P-value requested, this function calls on HW.plain() and/or HW.cond() to return the requested P-values, which are calculated by Monte-Carlo simulations.

Value

Returns plain and/or fully conditional P-values associated to the Root Mean Square, Chi-Square, and Log Likelihood-Ratio statistics.

Note

Currently, this function will work properly only if the input genotype_count is a matrix or array.

Author(s)

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References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic" by Rachel Ward.

See Also

HW.pval-package, HW.plain, HW.cond, create.model, test.rms, test.chisq, and test.gsq.

Examples

```
gen <- cbind(c(0,3,5,3),c(0,1,18,7),c(0,0,1,5),c(0,0,0,2))
print(gen)

#The upper triangle is unimportant so it is filled with 0's in this case

HW.pval(gen,num_simulations=10000,type="both")
```

test.chisq *Computing the chi-square test statistic*

Description

Calculates the Chi-Square test statistic between a lower-triangular matrix of genotypic counts and associated Hardy-Weinberg equilibrium model counts

Usage

```
test.chisq(observed, expected)
```

Arguments

observed	Matrix of observed genotypic counts
expected	Matrix of model genotypic counts

Details

Called on by HW.pval(), HW.plain(), and HW.cond().

Author(s)

Shubhodeep Mukherji <deep.mukherji@utexas.edu>

References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic," by Rachel Ward

See Also

HW.pval, HW.plain, and HW.cond.

test.gsq *Computing the log likelihood-ratio test statistic*

Description

Calculates the Log Likelihood-Ratio test statistic between a lower-triangular matrix of genotypic counts and associated Hardy-Weinberg equilibrium model counts

Usage

```
test.gsq(observed, expected)
```

Arguments

observed	Matrix of observed genotypic counts
expected	Matrix of model genotypic counts

Details

Called on by HW.pval(), HW.plain(), and HW.cond().

Author(s)

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References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic," by Rachel Ward

See Also

HW.pval, HW.plain, and HW.cond.

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test.rms *Computing the root-mean-square test statistic*

Description

Calculates the Root Mean Square test statistic between a lower-triangular matrix of genotypic counts and associated Hardy-Weinberg equilibrium model counts

Usage

```
test.rms(observed, expected)
```

Arguments

observed	Matrix of observed genotypic counts
expected	Matrix of model genotypic counts

Details

Called on by HW.pval(), HW.plain(), and HW.cond().

Author(s)

Shubhodeep Mukherji <deep.mukherji@utexas.edu>

References

"Testing Hardy-Weinberg equilibrium with a simple root-mean-square statistic," by Rachel Ward

See Also

HW.pval, HW.plain, and HW.cond.

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