

Package ‘gt4ireval’

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Title Generalizability Theory for Information Retrieval Evaluation

Version 2.0

Description Provides tools to measure the reliability of an Information Retrieval test collection.
It allows users to estimate reliability using Generalizability Theory and map those estimates onto well-known indicators such as Kendall tau correlation or sensitivity.

Depends R (>= 3.2)

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BugReports <https://github.com/julian-urbano/gt4ireval/issues>

URL <https://github.com/julian-urbano/gt4ireval/>

Encoding UTF-8

LazyData true

Suggests testthat, knitr, rmarkdown

RoxygenNote 6.0.1

VignetteBuilder knitr

NeedsCompilation no

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adhoc3	<i>TREC-3 Ad hoc track.</i>
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Description

This is the set of Average Precision scores of the 40 systems submitted to the TREC-3 Ad hoc track, evaluated over 50 topics.

Usage

adhoc3

Format

A data frame with 40 columns (systems) and 50 rows (queries).

References

D. Harman (1994). Overview of the Third Text REtrieval Conference (TREC-3). Text REtrieval Conference.

See Also

<http://trec.nist.gov>

dstudy	<i>D-study (Decision)</i>
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Description

dstudy runs a D-study from the results of a [gstudy](#) and computes, for a certain number of queries, the expected generalizability coefficient Erho2 and index of dependability Phi, possibly with confidence intervals. Alternatively, it can estimate the number of queries needed to achieve a certain level of stability, also with confidence intervals.

Usage

```
dstudy(gdata, queries = gdata$n.q, stability = 0.95, alpha = 0.025)
```

Arguments

gdata	The result of running a gstudy with existing data.
queries	A vector with different query set sizes for which to estimate Erho2 and Phi. Defaults to the number of queries used to compute gdata.
stability	A vector with target Erho2 and Phi values to estimate required query set sizes.
alpha	A vector of confidence levels to compute intervals for Erho2, Phi and query set sizes. This is the probability on each side of the interval, so for a 90% confidence interval one must set alpha to 0.05.

Value

An object of class `dstudy`, with the following components:

<code>Erho2</code> , <code>Erho2.lwr</code> , <code>Erho2.upr</code>	Expected generalizability coefficient, and lower and upper limits of the intervals
<code>Phi</code> , <code>Phi.lwr</code> , <code>Phi.upr</code>	Expected index of dependability, and lower and upper limits of the intervals
<code>n.q_Erho2</code> , <code>n.q_Erho2.lwr</code> , <code>n.q_Erho2.upr</code>	Expected number of queries to achieve the generalizability coefficient, and lower and upper limits of the intervals
<code>n.q_Phi</code> , <code>n.q_Phi.lwr</code> , <code>n.q_Phi.upr</code>	Expected number of queries to achieve the index of dependability, and lower and upper limits of the intervals
<code>call</code>	A list with the <code>dstudy</code> used in this D-study, the target number of queries, and the target stability

Author(s)

Julián Urbano

References

- R.L. Brennan (2001). *Generalizability Theory*. Springer.
- L.S. Feldt (1965). The Approximate Sampling Distribution of Kuder-Richardson Reliability Coefficient Twenty. *Psychometrika*, 30(3):357–370.
- C. Arteaga, S. Jeyaratnam, and G. A. Franklin (1982). Confidence Intervals for Proportions of Total Variance in the Two-Way Cross Component of Variance Model. *Communications in Statistics: Theory and Methods*, 11(15):1643–1658.
- J. Urbano, M. Marrero and D. Martín (2013). On the Measurement of Test Collection Reliability. *ACM SIGIR*, pp. 393-402.

See Also

`gstudy`, `gt2tau`

Examples

```
g <- gstudy(adhoc3)
dstudy(g)

# estimate stability at various query set sizes
dstudy(g, queries = seq(50, 200, 10))
# estimate required query set sizes for various stability levels
dstudy(g, stability = seq(0.8, 0.95, 0.01))
# compute both 95% and 99% confidence intervals
dstudy(g, stability = 0.9, alpha = c(0.05, 0.01) / 2)
# compute 1-tailed 95% confidence intervals
dstudy(g, alpha = 0.05)
```

gstudy

G-study (Generalizability)

Description

gstudy runs a G-study with the given data, assuming a fully crossed design (all systems evaluated on the same queries). It can be used to estimate variance components, which can further be used to run a D-study with [dstudy](#).

Usage

```
gstudy(data, drop = 0)
```

Arguments

data	A data frame or matrix with the existing effectiveness scores. Systems are columns and queries are rows.
drop	The fraction of worst-performing systems to drop from the data before analysis. Defaults to 0 (include all systems).

Value

An object of class gstudy, with the following components:

n.s, n.q	Number of systems and number of queries of the existing data.
var.s, var.q, var.e	Variance of the system, query, and residual effects.
em.s, em.q, em.e	Mean squares of the system, query and residual components.
call	A list with the existing data and the percentage of systems to drop.

Author(s)

Julián Urbano

References

R.L. Brennan (2001). Generalizability Theory. Springer.
J. Urbano, M. Marrero and D. Martín (2013). On the Measurement of Test Collection Reliability. ACM SIGIR, pp. 393-402.

See Also

[dstudy](#)

Examples

```
g <- gstudy(adhoc3)
```

```
# same, but drop the 20% worst systems  
g20 <- gstudy(adhoc3, drop = 0.2)
```

gt2tau

Map GT-based Indicators onto Data-based Indicators

Description

Maps Erho2 and Phi scores from Generalizability Theory onto traditional data-based scores like the Kendall tau correlation, AP correlation, power, minor conflict rate and major conflict rate with 2-tailed t-tests, absolute and relative sensitivity, and rooted mean squared error.

Usage

```
gt2tau(Erho2)  
gt2tauAP(Erho2)  
gt2power(Erho2)  
gt2minor(Erho2)  
gt2major(Erho2)  
gt2asens(Erho2)  
gt2rsens(Phi)  
gt2rmse(Phi)
```

Arguments

Erho2	Vector of generalizability coefficients to map from.
Phi	Vector of indices of dependability to map from.

Details

Take these mappings with a grain of salt. See figure 3 in (Urbano, 20013).

Value

A vector of data-based indicator values.

Author(s)

Julián Urbano

References

J. Urbano, M. Marrero and D. Martín (2013). On the Measurement of Test Collection Reliability. ACM SIGIR, pp. 393-402.

See Also

[dstudy](#)

Examples

```
g <- gstudy(adhoc3)
d <- dstudy(g)
gt2tau(d$Erho2)
gt2rmse(d$Phi)
```

synthetic4

Synthetic dataset no. 4.

Description

This is the Synthetic dataset no. 4 from Table 3.2 on page 73 of Brennan (2001), recasted as a $p \times i$ design, as required on page 182.

Usage

```
synthetic4
```

Format

A data frame with 10 columns (systems) and 12 rows (queries).

References

R.L. Brennan, "Generalizability Theory". Springer, 2001.

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