

Package ‘Keng’

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Title Knock Errors Off Nice Guesses

Version 2026.9.0

Description Miscellaneous functions and data used in psychological research and teaching. Keng currently has four built-in datasets, and could (1) scale a vector; (2) divide a vector into three groups, (3) compute the cut-off values of Pearson's r with known sample size; (4) test the significance and compute the post-hoc power for Pearson's r with known sample size; (5) conduct a priori power analysis and plan the sample size for Pearson's r ; (6) compare `lm()`'s fitted outputs using R-squared, `f_squared`, post-hoc power, and PRE (Proportional Reduction in Error, also called partial R-squared or partial Eta-squared); (7) calculate PRE from partial correlation, Cohen's f , or `f_squared`; (8) conduct a priori power analysis and plan the sample size for one or a set of predictors in regression analysis; (9) conduct post-hoc power analysis for one or a set of predictors in regression analysis with known sample size; (10) randomly pick numbers for Chinese Super Lotto and Double Color Balls; (11) assess course objective achievement in Outcome-Based Education.

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assess_coa	<i>Assess course objective achievement</i>
------------	--

Description

Assess course objective achievement

Usage

assess_coa(data, session_weights, objective_weights1, ...)

Arguments

- data** A wide-format data.frame that only contains student's grades of each session. assess_coa assumes the highest score for each session and the final grade is 100, given that weights are assigned by users.
- session_weights** A vector that Weights sessions for the final grade. The length of session_weights is the number of sessions. Typically, the final grade is based on the regular grade and final exam grade, in which condition the length of session_weights is 2. The range of each weight should be 0-1. The sum of session_weights should be 1.
- objective_weights1** A vector that Weights course objectives for session 1. The length of objective_weights1 is the number of course objectives. The range of each weight should be 0-1. The sum of objective_weights1 should be 1.
- ...** objective_weights2, objective_weights3, ... Other vectors that Weight course objectives for session1, session2, ... The number of objective_weights* arguments should be equal to the length of session_weights.

Value

A data.frame containing grades of each session, final grades, and achievements of each objective. This data.frame also has an attribute named "weights" that contains a list of session_weights, objective_weights_matrix, and weighted_objective_weights_matrix

Examples

```
data <- data.frame(
  session1 = 60 + sample.int(40, 100, 1),
  session2 = 60 + sample.int(40, 100, 1),
  session3 = 60 + sample.int(40, 100, 1)
)
session_weights <- c(0.2, 0.3, 0.5)
objective_weights1 <- c(0.1, 0.4, 0.5)
objective_weights2 <- c(0.2, 0.2, 0.6)
objective_weights2 <- c(0.3, 0, 0.7)
coa <- assess_coa(
  data,
  session_weights,
  objective_weights1,
  objective_weights2,
  objective_weights2
)
head(coa)
attr(coa, "weights")
colMeans(coa[row.names(attr(coa, "weights"))[[2]]])
```

calc_PRE

Calculate PRE from Cohen's f, f_squared, or partial correlation

Description

Calculate PRE from Cohen's f, f_squared, or partial correlation

Usage

```
calc_PRE(f = NULL, f_squared = NULL, r_p = NULL)
```

Arguments

f	Cohen's f. Cohen (1988) suggested ≥ 0.1 , ≥ 0.25 , and ≥ 0.40 as cut-off values of f for small, medium, and large effect sizes, respectively.
f_squared	Cohen's f_squared. Cohen (1988) suggested ≥ 0.02 , ≥ 0.15 , and ≥ 0.35 as cut-off values of f for small, medium, and large effect sizes, respectively.
r_p	Partial correlation.

Value

A list including PRE, the absolute value of r_p (partial correlation), Cohen's f_squared, and f.

References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Examples

```
calc_PRE(f = 0.1)
calc_PRE(f_squared = 0.02)
calc_PRE(r_p = 0.2)
```

compare_lm

Compare lm()'s fitted outputs using PRE and R-squared.

Description

Compare lm()'s fitted outputs using PRE and R-squared.

Usage

```
compare_lm(
  fitC = NULL,
  fitA = NULL,
  n = NULL,
  PC = NULL,
  PA = NULL,
  SSEC = NULL,
  SSEA = NULL
)
```

Arguments

fitC	The result of <code>lm()</code> of the Compact model (model C).
fitA	The result of <code>lm()</code> of the Augmented model (model A).
n	Sample size of the model C or model A. Model C and model A must use the same sample, and hence have the same sample size. Non-integer n would be converted to be an integer using <code>as.integer()</code> .
PC	The number of parameters in model C. Non-integer PC would be converted to be an integer using <code>as.integer()</code> .
PA	The number of parameters in model A. Non-integer PA would be converted to be an integer using <code>as.integer()</code> . <code>as.integer(PA)</code> should be larger than <code>as.integer(PC)</code> .
SSEC	The Sum of Squared Errors (SSE) of model C.
SSEA	The Sum of Squared Errors of model A.

Details

`compare_lm()` compares model A with model C using PRE (Proportional Reduction in Error) , R-squared, `f_squared`, and post-hoc power. PRE is partial R-squared (called partial Eta-squared in Anova). There are two ways of using `compare_lm()`. The 1st is giving `compare_lm()` `fitC` and `fitA`. The 2nd is giving `n`, `PC`, `PA`, `SSEC`, and `SSEA`. The 1st way is more convenient, and it minimizes precision loss by omitting copying-and-pasting. Note that the F-tests for PRE and that for R-squared change are equivalent. Please refer to Judd et al. (2017) for more details about PRE, and refer to Aberson (2019) for more details about `f_squared` and post-hoc power.

Value

A matrix with 12 rows and 4 columns. The 1st column reports information for the baseline model (intercept-only model). the 2nd for model C, the third for model A, and the fourth for the change (model A vs. model C). SSE (Sum of Squared Errors), sample size `n`, df of SSE, and the number of parameters for baseline model, model C, model A, and change (model A vs. model C) are reported in rows 1-3. The information in the 4th column are all for the change; put differently, these results could quantify the effect of one or a set of new parameters model A has but model C doesn't. If `fitC` and `fitA` are not inferior to the intercept-only model, R-squared, Adjusted R-squared, PRE, `PRE_adjusted`, and `f_squared` for the full model (compared with the baseline model) are reported for model C and model A. If model C or model A has at least one predictor, F-test with `p`, and post-hoc power would be computed for the corresponding full model.

References

- Aberson, C. L. (2019). *Applied power analysis for the behavioral sciences*. Routledge.
- Judd, C. M., McClelland, G. H., & Ryan, C. S. (2017). *Data analysis: A model Comparison approach to regression, ANOVA, and beyond*. Routledge.

Examples

```
x1 <- rnorm(193)
x2 <- rnorm(193)
y <- 0.3 + 0.2*x1 + 0.1*x2 + rnorm(193)
dat <- data.frame(y, x1, x2)
# Fix the intercept to constant 1 using I().
fit1 <- lm(I(y - 1) ~ 0, dat)
# Free the intercept.
fit2 <- lm(y ~ 1, dat)
compare_lm(fit1, fit2)
# One predictor.
fit3 <- lm(y ~ x1, dat)
compare_lm(fit2, fit3)
# Fix the intercept to 0.3 using offset().
intercept <- rep(0.3, 193)
fit4 <- lm(y ~ 0 + x1 + offset(intercept), dat)
compare_lm(fit4, fit3)
# Two predictors.
fit5 <- lm(y ~ x1 + x2, dat)
compare_lm(fit2, fit5)
compare_lm(fit3, fit5)
# Fix the slope of x2 to 0.05 using offset().
fit6 <- lm(y ~ x1 + offset(0.05*x2), dat)
compare_lm(fit6, fit5)
```

cut_r

Cut-off values of Pearson's correlation r with known sample size n.

Description

Cut-off values of Pearson's correlation r with known sample size n.

Usage

```
cut_r(n)
```

Arguments

n Sample size of Pearson's correlation r. n should be larger than

Details

Given n and p, t and then r could be determined. The formula used could be found in `test_r()`'s documentation.

Value

A data.frame including the cut-off values of r at the significance levels of $p = 0.1, 0.05, 0.01, 0.001$. r with the absolute value larger than the cut-off value is significant at the corresponding significance level.

Examples

```
cut_r(193)
```

depress

Three-wave data from the D research

Description

D refers to Depression. D research is a three-wave longitudinal survey research. Here are four data sets, depress1 only includes data collected at wave 1, depress2 at wave 2, and depress3 at wave 3. depress was created by joining depress1, depress2, and depress3 together. depress has done reverse-coding and has computed variable scores like depr1, which indicates the depression score at wave 1. depress serves to ease users' practicing plotting and statistical analyzing. depress1, depress2, and depress3 serves to support users' practicing data wrangling.

Usage

```
depress
```

Format

```
depress:
```

A three-wave data frame with 185 rows and 323 columns:

date100 Date of the response. The 1 in the hundreds place indicates the 1st-wave survey. The rest variables also follow this naming rule.

id Participant id

gender Gender. 1 = boy, 2 = girl.

age Age in year.

grade Grade.

class Class.

boarder Boarder. 1 = this student lived at school during term time, 2 = this student did not live at school during term time.

cost Cost in yuan per month.

fedu Father education level. 0 = no formal school education, 1 = primary school, 2 = middle school, 3 = high school or equivalent, 4 = college or equivalent, 5 = master's degree, 6 = doctor's degree.

medu Mother education level. The coding scheme is identical to that of fedu.

intervene Intervene. 0 = control group, 1 = intervention group.

- attr112** Attributional style questionnaire (Peterson, 1982). All items in this questionnaire were rated on a 7-point bipolar scale. The 1 in the tens place indicates the 1st situation, positive achievement situation. The 2 in the last place indicates the 2nd item, internal attribution. High scores indicate more internal attribution.
- attr113** Attributional style questionnaire. The 3 in the last place indicates the 3rd item, stable attribution. High scores indicate more stable attribution.
- attr114** Attributional style questionnaire. The 4 in the last place indicates the 4th item, global attribution. High scores indicate more global attribution.
- attr115** Attributional style questionnaire. The 5 in the last place indicates the 5th item, the importance of this situation. High scores indicate more important.
- attr122** Attributional style questionnaire. The 2 in the tens place indicates the 2nd situation, negative interpersonal relationship situation.
- attr132** Attributional style questionnaire. The 3 in the tens place indicates the 3rd situation, positive interpersonal relationship situation.
- attr142** Attributional style questionnaire. The 4 in the tens place indicates the 4th situation, negative achievement situation.
- attr152** Attributional style questionnaire. The 5 in the tens place indicates the 5th situation, positive interpersonal relationship situation.
- attr162** Attributional style questionnaire. The 6 in the tens place indicates the 6th situation, negative achievement situation.
- attr172** Attributional style questionnaire. The 7 in the tens place indicates the 7th situation, positive achievement situation.
- attr182** Attributional style questionnaire. The 8 in the tens place indicates the 8th situation, negative interpersonal relationship situation.
- cope101** Coping inventory (Endler & Parker, 1994). All items in this inventory were rated on a 5-point Likert scale with 1 = rarely, 2 = seldom, 3 = moderately, 4 = often, 5 = very often. The "01" in the last two places indicates item 01. Item 01, as well as item 02, 06, 10, 16, 22, 25, 27, 28, 37, 40, 42, 43, 44, 47, and 48, measured task-oriented coping.
- cope105** Coping inventory. The "05" in the last two places indicates item 05. Item 05, as well as item 07, 08, 14, 15, 17, 18, 20, 23, 26, 29, 31, 34, 35, 39, and 46, measured emotion-oriented coping.
- cope103** Coping inventory. The "03" in the last two places indicates item 03. Item 03, as well as item 04, 09, 11, 12, 19, 21, 24, 30, 32, 33, 36, 38, 41, 45, and 49, measured avoidance-oriented coping.
- cope113** Drinking. A coping strategy added by the D research to coping inventory.
- cope150** Smoking. A coping strategy added by the D research to coping inventory.
- cope201** Coping inventory, Wave 2, item 01.
- cope302** Coping inventory, Wave 3, item 02.
- depr101** Depression scale (Zung, et al., 1965). All items in this scale were rated on a 4-point Likert scale with 1 = rarely, 2 = seldom, 3 = often, 4 = always.
- depr102** Depression scale. Item 02, 05, 06, 11, 12, 14, 16, 17, 18, and 20 has been reverse-coded. High scores indicate severe depression.
- ecr101** Experience in close relationships scale (Fraley, et al., 2011). All items in this scale were rated on a 7-point Likert scale with 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = Neutral, 5 = somewhat agree, 6 = agree, 7 = strongly agree. Item 01, 03, 04, 06, 08, and 09 measured attachment avoidance.

- ecr102** Experience in close relationships scale. Item 02. Item 02, 05, and 07 measured attachment anxiety.
- ecr103** Experience in close relationships scale. Item 03. Item 03, 04, 06, and 09 has been reverse-coded.
- na_waves** Not-available waves, ranging from 1 to 3.
- attach_anx** Attachment anxiety, computed by averaging corresponding items.
- attach_avo** Attachment aviodance, computed by averaging corresponding items.
- internalP1** Internal attribution for positive situations at wave 1, computed by averaging corresponding items.
- stableP1** Stable attribution for positive situations at wave 1, computed by averaging corresponding items.
- globalP1** Global attribution for positive situations at wave 1, computed by averaging corresponding items.
- internalN1** Internal attribution for negative situations at wave 1, computed by averaging corresponding items.
- internalP2** Internal attribution for positive situations at wave 2, computed by averaging corresponding items.
- cope_task1** Task-oriented coping at wave 1, computed by averaging corresponding items.
- cope_emo1** Emotion-oriented coping at wave 1, computed by averaging corresponding items.
- cope_avo1** Avoidance-oriented coping at wave 1, computed by averaging corresponding items.
- cope_task2** Task-oriented coping at wave 2, computed by averaging corresponding items.
- depr1** Depression at wave 1, computed by averaging corresponding items.

Source

Keng package.

depress1

The 1st wave data from the D research

Description

D refers to Depression. D research is a three-wave longitudinal survey research. Here are four data sets, depress1 only includes data collected at wave 1, depress2 at wave 2, and depress3 at wave 3. depress was created by joining depress1, depress2, and depress3 together. depress has done reverse-coding and has computed variable scores like depr1, which indicates the depression score at wave 1. depress serves to ease users' practicing plotting and statistical analyzing. depress1, depress2, and depress3 serves to support users' practicing data wrangling.

Usage

depress1

Format

depress1:

A data frame with 174 rows and 122 columns at wave 1:

date Date of the response.

id Student id.

ecr01 Experience in close relationships scale, item 01.

ecr03 Experience in close relationships scale, item 03. Item 03, 04, 06, and 09 has NOT been reverse-coded in depress1.

attr12 Attribution style questionnaire, situation 1, item 2.

depr02 Depression Scale, item 02. Item 02, 05, 06, 11, 12, 14, 16, 17, 18, and 20 has NOT been reverse-coded in depress1.

Source

Keng package.

depress2

The 2nd wave data from the D research

Description

D refers to Depression. D research is a three-wave longitudinal survey research. Here are four data sets, depress1 only includes data collected at wave 1, depress2 at wave 2, and depress3 at wave 3. depress was created by joining depress1, depress2, and depress3 together. depress has done reverse-coding and has computed variable scores like depr1, which indicates the depression score at wave 1. depress serves to ease users' practicing plotting and statistical analyzing. depress1, depress2, and depress3 serves to support users' practicing data wrangling.

Usage

depress2

Format

depress2:

A data frame with 173 rows and 104 columns at wave 2:

depr02 Depression Scale, item 02. Item 02, 05, 06, 11, 12, 14, 16, 17, 18, and 20 has NOT been reverse-coded in depress2.

Source

Keng package.

depress3

*The 3rd wave data from the D research***Description**

D refers to Depression. D research is a three-wave longitudinal survey research. Here are four data sets, depress1 only includes data collected at wave 1, depress2 at wave 2, and depress3 at wave 3. depress was created by joining depress1, depress2, and depress3 together. depress has done reverse-coding and has computed variable scores like depr1, which indicates the depression score at wave 1. depress serves to ease users' practicing plotting and statistical analyzing. depress1, depress2, and depress3 serves to support users' practicing data wrangling.

Usage

depress3

Format

depress3:

A data frame with 172 rows and 72 columns at wave 3:

depr02 Depression Scale, item 02. Item 02, 05, 06, 11, 12, 14, 16, 17, 18, and 20 has NOT been reverse-coded in depress3.

Source

Keng package.

divide

*Divide a vector into three groups***Description**

Divide a vector into three groups

Usage

divide(x, criterion = "1sd")

Arguments

x A numeric vector.

criterion A character value "1sd" or a numeric value between 0 and 0.5.

Details

`divide()` divides a vector into three groups using the criterion of 1 SD, or proportions like 0.27. Differing from `cut()`, the medium interval of `divide()` does not include the left and right limits.

Value

An ordered factor with levels "Low < Medium < High".

Examples

```
x <- 1:100
divide(x)
divide(x, 0.27)
```

pick_dcb	<i>Pick Double Color Balls</i>
----------	--------------------------------

Description

Pick Double Color Balls

Usage

```
pick_dcb(size = 1L, verbose = TRUE)
```

Arguments

size	The size of sets of Super Lotto numbers to pick.
verbose	A logical value. Print the numbers picked or not.

Value

Print the numbers picked, and return the invisible `balls` list that stored these numbers.

Examples

```
pick_dcb(10)
out <- pick_dcb(10, verbose = FALSE)
out
```

pick_sl	<i>Pick Super Lotto numbers</i>
---------	---------------------------------

Description

Pick Super Lotto numbers

Usage

```
pick_sl(size = 1L, verbose = TRUE)
```

Arguments

size	An integer. The size of sets of Super Lotto numbers to pick.
verbose	A logical value. Print the numbers picked or not.

Value

Print the numbers picked, and return the invisible balls list that stored these numbers.

Examples

```
# Example 1
pick_sl(10)
# Example 2
out <- pick_sl(10, verbose = FALSE)
out
# Example 3
# create an empty list
balls <- list(c(front = rep(NA, 5),
                    back = rep(NA, 2))
)
luck <- list(c(front = c(10L, 13L, 14L, 19L, 27L),
                back = c(6L, 10L)))
# limit the max number of draws
max <- 9999
# try
# count the number of draws
i <- 0
while (!identical(balls, luck, max)) {
  i = i + 1
  balls = pick_sl(verbose = FALSE)
  if (identical(balls, luck)) {
    print(i)
    print(balls)
  }
}
else
  if (i == max) {
    cat(i, "failed\n")
```

```

        break}
    }

```

plot.Keng_power	<i>Plot the power against the sample size for the Keng_power class</i>
-----------------	--

Description

Plot the power against the sample size for the Keng_power class

Usage

```

## S3 method for class 'Keng_power'
plot(x, ...)

```

Arguments

x	The output object of power_r() or power_lm().
...	Further arguments passed to or from other methods.

Value

A plot of power against sample size.

Examples

```

plot(power_lm())
out <- power_r(0.2, n = 193)
plot(out)

```

powered_lm	<i>Compute lm's post-hoc power</i>
------------	------------------------------------

Description

Compute lm's post-hoc power

Usage

```

powered_lm(PRE = 0.04, PC = 1L, PA = 2L, n = 200L, sig_level = 0.05)

```

Arguments

PRE	Proportional Reduction in Error. PRE = The square of partial correlation. Cohen (1988) suggested ≥ 0.02 , ≥ 0.13 , and ≥ 0.26 as cut-off values of PRE for small, medium, and large effect sizes, respectively.
PC	Number of parameters of model C (compact model) without focal predictors of interest. Non-integer PC would be converted to be an integer using <code>as.integer()</code> .
PA	Number of parameters of model A (augmented model) with focal predictors of interest. Non-integer PA would be converted to be an integer using <code>as.integer()</code> . <code>as.integer(PA)</code> should be larger than <code>as.integer(PC)</code> .
n	The current sample size. Integer n should be at least $PA + 1L$.
sig_level	Expected significance level for effects of focal predictors.

Value

Integer n, the F_test of PRE at the sample size n with `df_A_C`, `df_A` (the df of the model A at the sample size n), F (the F-test of PRE at the sample size n), p (the p-value of F-test at the sample size n), and the post-hoc power analysis with `lambda` (the non-centrality parameter of F at the sample size n), and `power` (the post-hoc power at the sample size n).

Examples

```
powered_lm()
```

powered_r	<i>Compute r's post-hoc power</i>
-----------	-----------------------------------

Description

Compute r's post-hoc power

Usage

```
powered_r(r = 0.2, n = 200L, sig_level = 0.05)
```

Arguments

r	Pearson's correlation. Cohen(1988) suggested ≥ 0.1 , ≥ 0.3 , and ≥ 0.5 as cut-off values of Pearson's correlation r for small, medium, and large effect sizes, respectively.
n	The current sample size. Non-integer n would be converted to be an integer using <code>as.integer()</code> . n should be at least 3.
sig_level	Expected significance level.

Value

Integer n, the t_test of r at the sample size n with df, SE of r, p (the p-value of t-test), and the post-hoc power analysis with delta (the non-centrality parameter of the t-distribution for the alternative hypothesis), and power (the post-hoc power of r at the sample size n).

References

Aberson, C. L. (2019). *Applied power analysis for the behavioral sciences*. Routledge.
Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Examples

```
powered_r()
```

power_lm	<i>Conduct a priori power analysis, and plan the sample size for regression analysis</i>
----------	--

Description

Conduct a priori power analysis, and plan the sample size for regression analysis

Usage

```
power_lm(  
  PRE = 0.02,  
  PC = 1L,  
  PA = 2L,  
  sig_level = 0.05,  
  power = 0.8,  
  n_ul = 1450000000L  
)
```

Arguments

PRE	Proportional Reduction in Error. PRE = The square of partial correlation. Cohen (1988) suggested ≥ 0.02 , ≥ 0.13 , and ≥ 0.26 as cut-off values of PRE for small, medium, and large effect sizes, respectively.
PC	Number of parameters of model C (compact model) without focal predictors of interest. Non-integer PC would be converted to be an integer using <code>as.integer()</code> .
PA	Number of parameters of model A (augmented model) with focal predictors of interest. Non-integer PA would be converted to be an integer using <code>as.integer()</code> . <code>as.integer(PA)</code> should be larger than <code>as.integer(PC)</code> .
sig_level	Expected significance level for effects of focal predictors.
power	Expected statistical power for effects of focal predictors.
n_ul	The upper limit of the sample size below which the minimum required sample size is searched for. Non-integer n_ul would be converted to be an integer using <code>as.integer()</code> . <code>as.integer(n_ul)</code> should be at least <code>as.integer(PA) + 1</code> .

Details

`n_ul` determines the upper limit of the interval below which `power_lm()` searches for the minimum required sample size, hence the number of rows of the returned power table `priori` and the right limit of the horizontal axis of the returned power plot. When PRE is very small (e.g., less than 0.001) and power is larger than 0.8, a huge increase in sample size only brings about a trivial increase in power, which is cost-ineffective. To make `power_lm()` omit unnecessary searching, you could set `n_ul` to be a value less than $1.45e+09$ (e.g., 10000).

Value

A `Keng_power` class, also a list. If sample size `n` is not given, the following results would be returned: `[[1]]` PRE; `[[2]]` `f_squared`, Cohen's `f_squared` derived from PRE; `[[3]]` PC; `[[4]]` PA; `[[5]]` `sig_level`, expected significance level for effects of focal predictors; `[[6]]` power, expected statistical power for effects of focal predictors; `[[7]]` `n_ul`, the upper limit of sample size; `[[8]]` root, the exact decimal `n` found by internal `uniroot()` to reach the expected power; `[[9]]` minimum, the minimum sample size required for focal predictors to reach the expected statistical power and significance level; `[[10]]` `priori`, a priori power table with increasing sample sizes (`n_i`), and corresponding `df_A_C` (the df of the numerator of the F-test, i.e., the difference of the dfs between model C and model A), `df_A_i` (the df of the denominator of the F-test, i.e., the df of the model A at the sample size `n_i`), `F_i` (the F-test of PRE at the sample size `n_i`), `p_i` (the p-value of `F_i`), `lambda_i` (the non-centrality parameter of the F-distribution for the alternative hypothesis, given PRE and `n_i`), `power_i` (the actual power of PRE at the sample size `n_i`).

By default, `print()` prints the primary but not all contents of the `Keng_power` class. To inspect more contents, use `print.AsIs()` or list extracting.

References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Examples

```
power_lm()
print(power_lm())
plot(power_lm())
```

power_r

Conduct a priori power analysis, and plan the sample size for r.

Description

Conduct a priori power analysis, and plan the sample size for `r`.

Usage

```
power_r(r = 0.2, sig_level = 0.05, power = 0.8, n_ul = 1450000000L)
```

Arguments

<code>r</code>	Pearson's correlation. Cohen(1988) suggested ≥ 0.1 , ≥ 0.3 , and ≥ 0.5 as cut-off values of Pearson's correlation r for small, medium, and large effect sizes, respectively.
<code>sig_level</code>	Expected significance level.
<code>power</code>	Expected statistical power.
<code>n_ul</code>	The upper limit of the sample size below which the minimum required sample size is searched for. Non-integer <code>n_ul</code> would be converted to be an integer using <code>as.integer()</code> . <code>n_ul</code> should be at least 3L.

Details

`Power_r()` follows Aberson (2019) approach to conduct power analysis. `n_ul` determines the upper limit of the interval below which `power_r()` searches for the minimum required sample size, hence the number of rows of the returned power table `priori` and the right limit of the horizontal axis of the returned power plot. When r is very small and power is larger than 0.8, a huge increase of sample size only brings about a trivial increase in power, which is cost-ineffective. To make `power_r()` omit unnecessary searching, you could set `n_ul` to be a value less than $1.45e+09$ (e.g., 10000).

Value

A `Keng_power` class, also a list. If n is not given, the following results would be returned: `[[1]]` r , the given r ; `[[2]]` d , Cohen's d derived from r ; Cohen (1988) suggested ≥ 0.2 , ≥ 0.5 , and ≥ 0.8 as cut-off values of d for small, medium, and large effect sizes, respectively; `[[3]]` `sig_level`, the expected significance level; `[[4]]` `power`, the expected power; `[[5]]` `n_ul`, the upper limit of sample size; `[[6]]` `root`, the exact decimal n found by internal `uniroot()` to reach the expected power; `[[7]]` `minimum`, the minimum required sample size. `[[8]]` `priori`, a priori power table with increasing sample sizes (n_i), and corresponding `df_i` (the df of t-test at the sample size n_i , $df_i = n_i - 2$), `SE_i` (the SE of r at the sample size n_i), `t_i` (the t-test of r), `p_i` (the p-value of t_i), `delta_i` (the non-centrality parameter of the t-distribution for the alternative hypothesis, given r and n_i), `power_i` (the actual power of r at the sample size n_i);

If sample size n is given, the following results would also be returned: Integer n , the t_{test} of r at the sample size n with df , SE of r , p (the p-value of t-test), and the post-hoc power analysis with `delta_post` (the non-centrality parameter of the t-distribution for the alternative hypothesis), and `power_post` (the post-hoc power of r at the sample size n).

By default, `print()` prints the primary but not all contents of the `Keng_power` class. To inspect more contents, use `print.AsIs()` or list extracting.

References

- Aberson, C. L. (2019). *Applied power analysis for the behavioral sciences*. Routledge.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Examples

```
power_r(0.2)
print(power_r(0.04))
plot(power_r(0.04))
```

print.Keng_power	<i>Print primary but not all contents of the Keng_power class</i>
------------------	---

Description

Print primary but not all contents of the Keng_power class

Usage

```
## S3 method for class 'Keng_power'
print(x, ...)
```

Arguments

x	The output object of power_r() or power_lm().
...	Further arguments passed to or from other methods.

Value

None (invisible NULL).

Examples

```
power_lm()
power_lm(n = 200)
print(power_lm(n = 200))
x <- power_r(0.2, n = 193)
x
```

Scale	<i>Scale a vector</i>
-------	-----------------------

Description

Scale a vector

Usage

```
Scale(x, m = 0, sd = NULL)
```

Arguments

x	The original vector.
m	The expected Mean of the scaled vector.
sd	The expected Standard Deviation (unit) of the scaled vector.

Details

To scale x, its mean, or standard deviation (unit), or both, could be changed. The missing values of x are removed if any.

If m = 0 (default), and sd = NULL(default), x would be mean-centered (default).

If m = NULL, the mean of x would not changed. If m is not NULL, the mean of x would be transformed to sd.

If m = NULL or 0, and sd = 1, x would be standardized to be its z-score with m = 0 and sd = 1. The mean and standardized score are not necessarily 0 and 1.

Value

The scaled vector.

Examples

```
(x <- rnorm(10, 5, 2))
# Mean-center x.
Scale(x)
Scale(x, m = 0)
# Transform the mean of x to 3.
Scale(x, m = 3)
# Transform x to its z-score.
Scale(x, sd = 1)
# Standardize x with m = 100 and sd = 15.
Scale(x, m = 100, sd = 15)
```

test_r	<i>Test the significance, analyze the power, and plan the sample size for r.</i>
--------	--

Description

Test the significance, analyze the power, and plan the sample size for r.

Usage

```
test_r(r = NULL, n = NULL, sig_level = 0.05, power = 0.8)
```

Arguments

r	Pearson's correlation. Cohen(1988) suggested ≥ 0.1 , ≥ 0.3 , and ≥ 0.5 as cut-off values of Pearson's correlation r for small, medium, and large effect sizes, respectively.
n	Sample size of r. Non-integer n would be converted to be a integer using <code>as.integer()</code> . n should be at least 3.
sig_level	Expected significance level.
power	Expected statistical power.

Details

To test the significance of the r using the one-sample t-test, the SE of r is determined by the following formula: $SE = \sqrt{(1 - r^2)/(n - 2)}$. Another way is transforming r to Fisher's z using the following formula: $fz = \text{atanh}(r)$ with the SE of fz being $\sqrt{n - 3}$. Fisher's z is commonly used to compare two Pearson's correlations from independent samples. Fisher's transformation is presented here only to satisfy the curiosity of users who are interested in the difference between t-test and Fisher's transformation.

The post-hoc power of r's t-test is computed through the way of Aberson (2019). Other software and R packages like SPSS and pwr give different power estimates due to underlying different formulas. Keng adopts Aberson's approach because this approach guarantees the equivalence of r and PRE.

Value

A list with the following results: `[[1]]` r, the given r; `[[2]]` d, Cohen's d derived from r; Cohen (1988) suggested ≥ 0.2 , ≥ 0.5 , and ≥ 0.8 as cut-off values of d for small, medium, and large effect sizes, respectively. `[[3]]` Integer n; `[[4]]` t-test of r (incl., r, df of r, SE_r, t, p_r), 95% CI of r based on t-test (LLCI_r_t, ULCI_r_t), and post-hoc power of r (incl., delta_post, power_post); `[[5]]` Fisher's z transformation (incl., fz of r, z-test of fz [SE_fz, z, p_fz], and 95% CI of r derived from fz.

Note that the returned CI of r may be out of r's valid range [-1, 1]. This "error" is deliberately left to users, who should correct the CI manually in reports.

References

- Aberson, C. L. (2019). *Applied power analysis for the behavioral sciences*. Routledge.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Examples

```
test_r(0.2, 193)

# compare the p-values of t-test and Fisher's transformation
for (i in seq(30, 200, 10)) {
  cat(c("n = ", i, ", ", difference between ps = ",
        format(
          abs(test_r(0.2, i)[["t_test"]][["p_r"]] - test_r(0.2, i)[["Fisher_z"]][["p_fz"]]),
          nsmall = 12,
          scientific = FALSE)),
    "\n")
}
```

```

    sep = "",
    fill = TRUE)
}

```

well

Three-wave data from the W research

Description

W refers to well-being. W research is a three-wave longitudinal survey research. Here are four data sets, well1 only includes data collected at wave 1, well2 at wave 2, and well3 at wave 3. well was created by joining well1, well2, and well3 together. well has done reverse-coding and has computed variable scores like flourish1, which indicates the flourish score at wave 1. well serves to ease users' practicing plotting and statistical analyzing. well1, well2, and well3 serves to support users' practicing data wrangling.

Usage

```
well
```

Format

well:

A three-wave data frame with 200 rows and 413 columns:

id Participant id

gender100 Gender. 0 = boy, 1 = girl. This variable ends with "100". The 1st digit indicates the wave number, and the last two digits indicate the item number. The rest variables also follow this naming rule.

age100 Age in years, wave 1.

grade100 Grade, wave 1.

income100 Monthly income (RMB) of the family, wave1.

loan300 National student loan in the past year. Reported at wave 3. 0 = Not received, 1 = Received.

cost100 Monthly cost of the participant, wave1. "1" = "<500RMB", "2" = "500-1000RMB", "3" = "1000-1500RMB", "4" = "1500-2000RMB", "5" = "2000-2500RMB", "6" = ">2500RMB".

SSES100 Subjective Socioeconomic Status, wave1. SSES was measured through the 10-step social ladder, with high scores indicating high status.

heema101 HEEMA scale, wave 1, item 01. HEEMA = The Hedonic, Eudaimonic, and Extrinsic Motivations for Activities (Lefebvre & Huta, 2021). HEEMA was rated on a 7-point scale (1 = not at all, 7 = very much). HEEMA measures three kind of motivations: Hedonic (item 01, 04, 06, 07, 09, 16), eudaimonic (item 02, 03, 05, 08, 10), and Extrinsic (item 11, 12, 13, 14, 15).

cssp101 Career Social Support from Parents, wave 1, item 01. CSS investigates four kind of support using a 5-point scale (1 = almost none, 5 = very much; Hou et al, 2010): material (item 01, 02, 03), advice (item 04, 05, 06, 07, 08, 09), emotional (item 10, 11, 12, 13), and information (14, 15, 16, 17, 18, 19, 20).

- csss101** Career Social Support from Siblings, wave 1, item 01.
- csst101** Career Social Support from Teachers, wave 1, item 01.
- cssf101** Career Social Support from Friends, wave 1, item 01.
- cssr101** Career Social Support from Relatives, wave 1, item 01.
- grit101** Grit scale (Wei & Hu, 2017), wave 1, item 01. Grit is rated on a 5-point scale (1 = not at all like me, 5 = very much like me). Item 1, 3, 5, and 6 should be reverse-scored. Grit has two dimensions: perseverance (item 02, 04, 07, 08) and passion (item 01, 03, 05, 06). After reverse scoring, high scores indicate high perseverance and passion.
- CET4100** CET4 score, wave 1. CET4 = College English Test Band 4. 0 = participants had not taken CET4 test.
- flourish101** Flourish scale, wave 1, item 01. Flourish scale (Tong & Wang, 2017) was rated on a 5-point scale (1 = very disagree, 7 = very agree), with high scores indicating high eudaimonic well-being.
- spne101** SPNE scale, wave 1, item 01. SPNE = Scale of Positive and Negative Experience (Tong & Wang, 2017). SPNE measures positive (item 01, 03, 05, 07, 10, 12) and negative (item 02, 04, 06, 08, 9, 11) emotions on a 5-point scale (1 = very rarely or never, 5 = very often or always). High positive emotion and low negative emotion indicate high hedonic well-being.
- flourish1** Flourish, wave 1. All scale scores and dimension scores in this data are computed by averaging corresponding items.
- posEmo1** Positive Emotions, wave 1.
- negEmo1** Negative Emotions, wave 1.
- grit1** Grit, wave 1.
- perseverance1** Perseverance, wave 1.
- passion1** Passion, wave 1.
- hedonic1** Hedonic well-being motivation, wave 1.
- eudaimonic1** Eudaimonic well-being motivation, wave 1.
- extrinsic1** Extrinsic well-being motivation, wave 1.
- csspm1** Career Social Support, Parents, Material, wave 1.
- csspa1** Career Social Support, Parents, Advice, wave 1.
- csspe1** Career Social Support, Parents, Emotional, wave 1.
- csspi1** Career Social Support, Parents, Information, wave 1.
- csssm1** Career Social Support, Siblings, Material, wave 1.
- csstm1** Career Social Support, Teachers, Material, wave 1.
- cssfm1** Career Social Support, Friends, Material, wave 1.
- cssrm1** Career Social Support, Relatives, Material, wave 1.
- cssp1** Career Social Support, Parents, wave 1.
- cssm1** Career Social Support, Material, wave 1.

Source

Keng package.

References

- Lefebvre, A., & Huta, V. (2021). Age and gender differences in eudaimonic, hedonic, and extrinsic motivations. *Journal of Happiness Studies*, 22, 2299-2321.
- Hou, Z., Bai, R., & Yao, Y. (2010). Development of career social support inventory for Chinese college students. *Chinese Journal of Clinical Psychology*, 18(4), 439-442.
- Wei, Y., & Hu, J. (2017). Grit: Concept, structure, influencing factors, and consequences. *Psychology: Techniques and Applications*, 5(1), 52-61.
- Tong, K. K. & Wang, Y. Y. (2017). Validation of the Flourishing Scale and Scale of Positive and Negative Experience in a Chinese Community Sample. *PLUS ONE*, 12(8), e0181616.

well1

The 1st wave data from the W research

Description

W refers to well-being. W research is a three-wave longitudinal survey research. Here are four data sets, well1 only includes data collected at wave 1, well2 at wave 2, and well3 at wave 3. well was created by joining well1, well2, and well3 together. well has done reverse-coding and has computed variable scores like flourish1, which indicates the flourish score at wave 1. well serves to ease users' practicing plotting and statistical analyzing. well1, well2, and well3 serves to support users' practicing data wrangling.

Usage

well1

Format

well1:

The 1st wave data frame with 200 rows and 152 columns:

id Participant id

gender Gender. 0 = boy, 1 = girl.

age Age in years.

grade Grade.

income Monthly income of the family.

cost Monthly cost of the participant.

SSES Subjective Socioeconomic Status. SSES was measured through the 10-step social ladder, with high scores indicating high status.

heema01 HEEMA scale, item 01. HEEMA = The Hedonic, Eudaimonic, and Extrinsic Motivations for Activities (Lefebvre & Huta, 2021). HEEMA was rated on a 7-point scale (1 = not at all, 7 = very much). HEEMA measures three kind of motivations: Hedonic (item 01, 04, 06, 07, 09, 16), eudaimonic (02, 03, 05, 08, 10), and Extrinsic (item 11, 12, 13, 14, 15).

- cssp01** Career Social Support from Parents, item 01. CSS investigates four kind of support using a 5-point scale (1 = almost none, 5 = very much; Hou et al, 2010): material (item 01, 02, 03), advice (item 04, 05, 06, 07, 08, 09), emotional (item 10, 11, 12, 13), and information (14, 15, 16, 17, 18, 19, 20).
- csss01** Career Social Support from Siblings, item 01.
- csst01** Career Social Support from Teachers, item 01.
- cssf01** Career Social Support from Friends, item 01.
- cssr01** Career Social Support from Relatives, item 01.
- grit01** Grit scale, item 01. Grit (Wei & Hu, 2017) is rated on a 5-point scale (1 = not at all like me, 5 = very much like me). Item 1, 3, 5, and 6 should be reverse-scored. Grit has two dimensions: perseverance (item 02, 04, 07, 08) and passion (item 01, 03, 05, 06). After reverse scoring, high scores indicate high perseverance and passion.
- CET4** CET4 score. CET4 = College English Test Band 4. CET4 = 0 indicates participants had not taken CET4 test.
- flourish01** Flourish scale, item 01. Flourish scale (Tong & Wang, 2017) was rated on a 5-point scale (1 = very disagree, 5 = very agree), with high scores indicating high eudaimonic well-being.
- spne01** SPNE scale, item 01. SPNE = Scale of Positive and Negative Experience (Tong & Wang, 2017). SPNE measures positive (item 01, 03, 05, 07, 10, 12) and negative (item 02, 04, 06, 08, 9, 11) emotions on a 5-point scale (1 = very rarely or never, 5 = very often or always). High positive emotion and low negative emotion indicate high hedonic well-being.

Source

Keng package.

References

- Lefebvre, A., & Huta, V. (2021). Age and gender differences in eudaimonic, hedonic, and extrinsic motivations. *Journal of Happiness Studies*, 22, 2299-2321.
- Hou, Z., Bai, R., & Yao, Y. (2010). Development of career social support inventory for Chinese college students. *Chinese Journal of Clinical Psychology*, 18(4), 439-442.
- Wei, Y., & Hu, J. (2017). Grit: Concept, structure, influencing factors, and consequences. *Psychology: Techniques and Applications*, 5(1), 52-61.
- Tong, K. K. & Wang, Y. Y. (2017). Validation of the Flourishing Scale and Scale of Positive and Negative Experience in a Chinese Community Sample. *PLUS ONE*, 12(8), e0181616.

Description

W refers to well-being. W research is a three-wave longitudinal survey research. Here are four data sets, well1 only includes data collected at wave 1, well2 at wave 2, and well3 at wave 3. well was created by joining well1, well2, and well3 together. well has done reverse-coding and has computed variable scores like flourish1, which indicates the flourish score at wave 1. well serves to ease users' practicing plotting and statistical analyzing. well1, well2, and well3 serves to support users' practicing data wrangling.

Usage

well2

Format

well:

The 2nd wave data frame with 200 rows and 152 columns:

id Participant id

gender Gender. 0 = boy, 1 = girl. This variable ends with "100". The 1st digit indicates the wave number, and the last two digits indicate the item number. The rest variables also follow this naming rule.

age Age in years.

grade Grade.

income Monthly income of the family.

cost Monthly cost of the participant.

SSES Subjective Socioeconomic Status. SSES was measured through the 10-step social ladder, with high scores indicating high status.

heema01 HEEMA scale, item 01. HEEMA = The Hedonic, Eudaimonic, and Extrinsic Motivations for Activities (Lefebvre & Huta, 2021). HEEMA was rated on a 7-point scale (1 = not at all, 7 = very much). HEEMA measures three kind of motivations: Hedonic (item 01, 04, 06, 07, 09, 16), eudaimonic (02, 03, 05, 08, 10), and Extrinsic (item 11, 12, 13, 14, 15).

cssp01 Career Social Support from Parents, item 01. CSS investigates four kind of support using a 5-point scale (1 = almost none, 5 = very much; Hou et al, 2010): material (item 01, 02, 03), advice (item 04, 05, 06, 07, 08, 09), emotional (item 10, 11, 12, 13), and information (14, 15, 16, 17, 18, 19, 20).

csss01 Career Social Support from Siblings, item 01.

csst01 Career Social Support from Teachers, item 01.

cssf01 Career Social Support from Friends, item 01.

cssr01 Career Social Support from Relatives, item 01.

grit01 Grit scale, item 01. Grit (Wei & Hu, 2017) is rated on a 5-point scale (1 = not at all like me, 5 = very much like me). Item 1, 3, 5, and 6 should be reverse-scored. Grit has two dimensions: perseverance (item 02, 04, 07, 08) and passion (item 01, 03, 05, 06). After reverse scoring, high scores indicate high perseverance and passion.

CET4 CET4 score. CET4 = College English Test Band 4. CET4 = 0 indicates participants had not taken CET4 test.

flourish01 Flourish scale, item 01. Flourish scale (Tong & Wang, 2017) was rated on a 5-point scale (1 = very disagree, 5 = very agree), with high scores indicating high eudaimonic well-being.

spne01 SPNE scale, item 01. SPNE = Scale of Positive and Negative Experience (Tong & Wang, 2017). SPNE measures positive (item 01, 03, 05, 07, 10, 12) and negative (item 02, 04, 06, 08, 9, 11) emotions on a 5-point scale (1 = very rarely or never, 5 = very often or always). High positive emotion and low negative emotion indicate high hedonic well-being.

Source

Keng package.

References

- Lefebvre, A., & Huta, V. (2021). Age and gender differences in eudaimonic, hedonic, and extrinsic motivations. *Journal of Happiness Studies*, 22, 2299-2321.
- Hou, Z., Bai, R., & Yao, Y. (2010). Development of career social support inventory for Chinese college students. *Chinese Journal of Clinical Psychology*, 18(4), 439-442.
- Wei, Y., & Hu, J. (2017). Grit: Concept, structure, influencing factors, and consequences. *Psychology: Techniques and Applications*, 5(1), 52-61.
- Tong, K. K. & Wang, Y. Y. (2017). Validation of the Flourishing Scale and Scale of Positive and Negative Experience in a Chinese Community Sample. *PLUS ONE*, 12(8), e0181616.

well3

The 3rd wave data from the W research

Description

W refers to well-being. W research is a three-wave longitudinal survey research. Here are four data sets, well1 only includes data collected at wave 1, well2 at wave 2, and well3 at wave 3. well was created by joining well1, well2, and well3 together. well has done reverse-coding and has computed variable scores like flourish1, which indicates the flourish score at wave 1. well serves to ease users' practicing plotting and statistical analyzing. well1, well2, and well3 serves to support users' practicing data wrangling.

Usage

well3

Format

well:

The 3rd wave data frame with 200 rows and 152 columns:

id Participant id

gender Gender. 0 = boy, 1 = girl. This variable ends with "100". The 1st digit indicates the wave number, and the last two digits indicate the item number. The rest variables also follow this naming rule.

age Age in years.

grade Grade.

loan Received national student loan in the past year.

heema01 HEEMA scale, item 01. HEEMA = The Hedonic, Eudaimonic, and Extrinsic Motivations for Activities (Lefebvre & Huta, 2021). HEEMA was rated on a 7-point scale (1 = not at all, 7 = very much). HEEMA measures three kind of motivations: Hedonic (item 01, 04, 06, 07, 09, 16), eudaimonic (02, 03, 05, 08, 10), and Extrinsic (item 11, 12, 13, 14, 15).

grit01 Grit scale, item 01. Grit (Wei & Hu, 2017) is rated on a 5-point scale (1 = not at all like me, 5 = very much like me). Item 1, 3, 5, and 6 should be reverse-scored. Grit has two dimensions: perseverance (item 02, 04, 07, 08) and passion (item 01, 03, 05, 06). After reverse scoring, high scores indicate high perseverance and passion.

CET4 CET4 score. CET4 = College English Test Band 4. CET4 = 0 indicates participants had not taken CET4 test.

flourish01 Flourish scale, item 01. Flourish scale (Tong & Wang, 2017) was rated on a 5-point scale (1 = very disagree, 5 = very agree), with high scores indicating high eudaimonic well-being.

spne01 SPNE scale, item 01. SPNE = Scale of Positive and Negative Experience (Tong & Wang, 2017). SPNE measures positive (item 01, 03, 05, 07, 10, 12) and negative (item 02, 04, 06, 08, 9, 11) emotions on a 5-point scale (1 = very rarely or never, 5 = very often or always). High positive emotion and low negative emotion indicate high hedonic well-being.

Source

Keng package.

References

- Lefebvre, A., & Huta, V. (2021). Age and gender differences in eudaimonic, hedonic, and extrinsic motivations. *Journal of Happiness Studies*, 22, 2299-2321.
- Hou, Z., Bai, R., & Yao, Y. (2010). Development of career social support inventory for Chinese college students. *Chinese Journal of Clinical Psychology*, 18(4), 439-442.
- Wei, Y., & Hu, J. (2017). Grit: Concept, structure, influencing factors, and consequences. *Psychology: Techniques and Applications*, 5(1), 52-61.
- Tong, K. K. & Wang, Y. Y. (2017). Validation of the Flourishing Scale and Scale of Positive and Negative Experience in a Chinese Community Sample. *PLUS ONE*, 12(8), e0181616.

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