Package 'powerAnalysis'

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Title Power Analysis in Experimental Design

Description Basic functions for power analysis and effect size calculation.

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ES.anova.oneway *Calculating effect size (Cohen's f) of one-way anova for means with equal observations in each group*

Description

Calculating effect size (Cohen's f) of one-way anova for means with equal observations in each group

Usage

```
ES.anova.oneway(data = NULL, sst = NULL, ssb = NULL)
```

Arguments

data	a matrix or data frame
sst	total sum of squares
ssb	sum of squares between groups

Examples

```
set.seed(9);x=rnorm(50);y=rnorm(50)
z=rnorm(50);d=data.frame(x,y,z)
ES.anova.oneway(data=d)

ES.anova.oneway(sst=50,ssb=1)
```

ES.chisq.assoc *Compute effect size of chi-squared test of association*

Description

Compute effect size of chi-squared test of association

Usage

```
ES.chisq.assoc(ct = NULL, chisq = NULL, p = NULL, n = NULL, df = NULL,
  mindf = NULL)
```

Arguments

ct	a m x n Contingency Table (matrix with m rows and n columes)
chisq	the value the chi-squared test statistic
p	p value for the chi-squared test
n	total number of observations (sample size)
df	degree of freedom (e.g., df=(m-1)*(n-1))
mindf	the degrees of freedom for the variable with the smaller number of levels, if m > n, mindf=n-1, otherwise, mindf=m-1

See Also

ES.chisq.gof

Examples

```
counts <- matrix(c(225,125,85,95),nrow=2,byrow=TRUE)
ES.chisq.assoc(ct=counts)

case <- c(225,85,100)
control <- c(125,95,125)
counts <- cbind(case,control)
ES.chisq.assoc(ct=counts)

p1 <- c(225,85,100)
p2 <- c(125,95,125)
p3 <- c(175,90,113)
counts <- cbind(p1,p2,p3)
ES.chisq.assoc(ct=counts)

ES.chisq.assoc(chisq=13.561,n=530,df=1,mindf=1)

ES.chisq.assoc(p=0.000231,n=530,df=1,mindf=1)
```

ES.chisq.gof *Compute effect size of chi-squared test of goodness of fit*

Description

Compute effect size of chi-squared test of goodness of fit

Usage

```
ES.chisq.gof(p1 = NULL, p0 = rep(1/length(p1), length(p1)))
```

Arguments

p1	a vector of frequencies or probabilities (alternative hypothesis). Frequencies will be rescaled to probabilities automatically. An error is given if any entry of p1 is negative.
p0	a vector of frequencies or probabilities of the same length of p1 (null hypothesis). Frequencies will be rescaled to probabilities automatically. An error is given if any entry of p0 is negative. Default value of p0 is a vector of 1/n with length of n. n is the length of p1.

See Also

ES.chisq.assoc

Examples

```
ES.chisq.gof(p1=c(10,20,30,40))
ES.chisq.gof(p1=c(0.1,0.2,0.3,0.4))

ES.chisq.gof(p1=c(10,20,30,40),p0=c(0.2,0.3,0.3,0.2))
ES.chisq.gof(p1=c(10,20,30,40),p0=c(20,30,30,20))
ES.chisq.gof(p1=c(0.1,0.2,0.3,0.4),p0=c(0.2,0.3,0.3,0.2))
ES.chisq.gof(p1=c(0.1,0.2,0.3,0.4),p0=c(20,30,30,20))
```

ES.proportions *Compute effect size for a difference in proportions*

Description

Compute effect size for a difference in proportions

Usage

```
ES.proportions(p1 = NULL, p2 = NULL, alternative = c("two.sided",
  "one.sided"))
```

Arguments

p1	Proportion of sample one
p2	Proportion of sample two or a constant proportion
alternative	The test is two sided or one sided

Examples

```
ES.proportions(0.65,0.45)

ES.proportions(0.25,0.05)
```

ES.t.one *Calculating effect size (Cohen's d) of one-sample t test*

Description

Calculating effect size (Cohen's d) of one-sample t test

Usage

```
ES.t.one(m = NULL, sd = NULL, n = NULL, t = NULL, se = NULL,
  df = NULL, mu = NULL, alternative = c("two.sided", "one.sided"))
```

Arguments

m	mean of sample
sd	standard deviation of sample
n	number of observations
t	t statistic
se	standard error of sample 1
df	degree of freedom
mu	population mean
alternative	The test is two sided or one sided

See Also

ES.t.two

ES.t.paired

Examples

```
## mean, sd and mu -> d
ES.t.one(m=-0.0938268,sd=0.9836668,mu=0)

## mean, se, n and mu -> d
ES.t.one(m=-0.0938268,se=0.1391115,n=50,mu=0)

## t and df -> d (df=n-1)
ES.t.one(t = -0.6745,df = 49)

## t and n -> d ((df=n-1))
ES.t.one(t = -0.6745,n = 50)
```

ES.t.paired *Calculating effect size (Cohen's d) of paired two-sample t test*

Description

Calculating effect size (Cohen's d) of paired two-sample t test

Usage

```
ES.t.paired(md = NULL, sd = NULL, n = NULL, t = NULL, se = NULL,
  df = NULL, alternative = c("two.sided", "one.sided"))
```

Arguments

md	mean difference (e.g., mean(x-y))
sd	standard deviation of mean differences (e.g., sd(x-y))
n	number of paires
t	t statistic
se	standard error of mean differences
df	degree of freedom
alternative	The test is two sided or one sided

See Also

ES.t.one

ES.t.two

Examples

```
## md, sd -> d
ES.t.paired(md=-0.08062384,sd=1.401886)

## md,se -> d
ES.t.paired(md=-0.08062384,se=0.1982566,n=50)

## t, df -> d
ES.t.paired(t=-0.4067,df=49)

## t, n -> d
ES.t.paired(t=-0.4067,n=50)
```

ES.t.two *Calculating effect size (Cohen's d) of independent two-sample t test*

Description

Calculating effect size (Cohen's d) of independent two-sample t test

Usage

```
ES.t.two(m1 = NULL, m2 = NULL, sd1 = NULL, sd2 = NULL, n1 = NULL,
  n2 = NULL, t = NULL, se1 = NULL, se2 = NULL, df = NULL,
  alternative = c("two.sided", "one.sided"))
```

Arguments

m1	mean of sample 1
m2	mean of sample 2
sd1	standard deviation of sample 1
sd2	standard deviation of sample 2
n1	number of observations in sample 1
n2	number of observations in sample 2
t	t statistic
se1	standard error of sample 1
se2	standard error of sample 2
df	degree of freedom
alternative	The test is two sided or one sided

See Also

ES.t.one

ES.t.paired

Examples

```
## mean, sd, n -> d
ES.t.two(m1=13.5,m2=5.5,sd1=4.1833,sd2=3.02765,n1=14,n2=10)

## mean se, n -> d
ES.t.two(m1=13.5,m2=5.5,se1=1.118034,se2=0.9574271,n1=14,n2=10)

## t and n -> d
ES.t.two(n1=14,n2=10,t=5.4349)

## t, df and n -> d
ES.t.two(t = 5.4349, df = 21.982,n1=14,n2=10)
```

```
## t and df -> d (assume n1=n2)
ES.t.two(t = 5.4349, df = 21.982)
```

`power.anova.oneway` *Power calculations for balanced one-way analysis of variance tests*

Description

Power calculations for balanced one-way analysis of variance tests

Usage

```
power.anova.oneway(groups = NULL, n = NULL, f = NULL, power = NULL,
  sig.level = 0.05)
```

Arguments

`groups`	Number of groups
`n`	Number of observations (per group)
`f`	Effect size, Cohen's f
`power`	power of study
`sig.level`	significance level

See Also

`ES.anova.oneway`

Examples

```
power.anova.oneway(groups=4,n=20,f=0.28)
```

`power.chisq` *Power calculations for chi-squared test*

Description

Power calculations for chi-squared test

Usage

```
power.chisq(es = NULL, df = NULL, n = NULL, power = NULL,
  sig.level = NULL)
```

Arguments

es	effect size. A numeric value or output of ES.chisq.gof, ES.chisq.assoc
df	degree of freedom
n	total number of observations
power	power of study
sig.level	significance level

See Also

ES.chisq.gof

ES.chisq.assoc

power.plot.chisq

Examples

```
## calculate power
power.chisq(es=0.16,df=1,n=530,sig.level=0.05)

## calculate sig.level
power.chisq(es=0.16,df=1,n=530,power=0.9576)

## calculate sample size
power.chisq(es=0.16,df=1,power=0.9576,sig.level=0.05)

## calculate effect size
power.chisq(df=1,n=530,power=0.9576,sig.level=0.05)
```

---

power.plot.chisq *Power analysis plot of chi-squared test*

Description

Power analysis plot of chi-squared test

Usage

```
power.plot.chisq(es = NULL, power = NULL, df = NULL, sig.level = NULL,
  allele = FALSE, xlab = NULL, ylab = NULL, main = NULL, grid = FALSE,
  type = c("np", "ne"))
```

Arguments

es	effect size.
power	power of study
df	degree of freedom
sig.level	significance level
allele	in genetic association study, whether test allele or genotype
xlab	a title for the x axis
ylab	a title for the y axis
main	an overall title for the plot
grid	add grid lines or not
type	"np": plot sample size vs. power; "ne": plot effevct size vs. sample size

See Also

power.chisq

Examples

```
## 'ne' type
### multiple effect size and multiple power
es=seq(from=0.1,to=0.5,by=0.1);
power=seq(from=0.7,to=0.9,by=0.1);
power.plot.chisq(es=es,power=power,df=1,sig.level=0.05,type="ne")
power.plot.chisq(es=es,power=power,df=1,sig.level=0.05,type="np")

### multiple effect size and single power
power.plot.chisq(es=seq(0.05,0.3,0.05),power=0.8,df=1,sig.level=0.05,type="ne")
power.plot.chisq(es=seq(0.05,0.3,0.05),power=0.8,df=1,sig.level=0.05,type="np")

### single effect size and single power
power.plot.chisq(es=0.2,power=0.8,df=1,sig.level=0.05,type="ne")
power.plot.chisq(es=0.2,power=0.8,df=1,sig.level=0.05,type="np")

### single effect size and multiple power
power.plot.chisq(es=0.2,power=seq(0.5,0.9,0.1),df=1,sig.level=0.05,type="ne")
power.plot.chisq(es=0.2,power=seq(0.5,0.9,0.1),df=1,sig.level=0.05,type="np")
```

---

power.proportions *Power calculations for proportion tests (two-sided)*

Description

Power calculations for proportion tests (two-sided)

Usage

```
power.proportions(n = NULL, h = NULL, power = NULL, sig.level = 0.05,
  type = c("two", "one", "unequal"), ratio = 1)
```

Arguments

n	Total number of observations
h	Effect size, Cohen's h
power	Power of test
sig.level	Significance level
type	Type of proportion tests, must be one of "one","two" (default), or "unequal". "one" means one sample proportion test. "two"/"unequal" means two sample (equal size/unequal size) proportion test.
ratio	The ratio of sample size 1 to sample size 2. Only will be used when 'type' is "unequal".

Examples

```
## one sample
power.proportions(n=600,h=0.3,type="one")

## two sample with same sample size
power.proportions(h=0.2,n=600)

## two sample with different sample size
power.proportions(h=0.2,n=1200,type="unequal",ratio=2)
```

---

power.t *Power calculations for t-test*

Description

Power calculations for t-test

Usage

```
power.t(es = NULL, n = NULL, power = NULL, sig.level = NULL,
  ratio = 1, type = c("two", "paired", "one", "unequal"),
  alternative = c("two.sided", "left", "right"))
```

Arguments

es	effect size.
n	total number of observations/pairs
power	power of study
sig.level	significance level
ratio	the ratio of sample size 1 to sample size 2. Only will be used when 'type' is "unequal".
type	type of t test, must be one of "one","two" (default), "paired", or "unequal". "one" means one sample t test, which test whether the population mean is equal to a specified value. "two"/"unequal" means two sample (equal size/unequal size) t test, which is used to ascertain how likely an observed mean difference between two groups would be to occur by chance alone. "paired" means paired t-test (also called the correlated t-test and the t-test for dependent means), which is used to ascertain how likely the difference between two means that contain the same (or matched) observations is to occur by chance alone.
alternative	One- or two-sided test, must be one of "two.sided" (default), "left", "right"

See Also

ES.t.one

ES.t.two

ES.t.paired

Examples

```
## one sample two sided test, calculate power
power.t(es=0.2,n=60,sig.level=0.10,type="one",alternative="two.sided")

## one sample one sided (left tail) test, calculate power
power.t(es=0.2,n=60,sig.level=0.10,type="one",alternative="left")

## one sample one sided (right tail) test, calculate power
power.t(es=0.2,n=60,sig.level=0.10,type="one",alternative="right")

## one sample two sided test, calculate sampe size
power.t(es=0.2,power=0.8,sig.level=0.05,type="one",alternative="two.sided")

## one sample two sided test, calculate effect size
power.t(n=200,power=0.8,sig.level=0.05,type="one",alternative="two.sided")

## one sample two sided test, calculate sig.level
power.t(es=0.2,n=200,power=0.8,type="one",alternative="two.sided")

## paired sample two sided test, calculate power
power.t(es=0.559,n=40,sig.level=0.05,type="paired",alternative="two.sided")

## paired sample two sided test, calculate sample size
power.t(es=0.15,power=0.8,sig.level=0.05,type="paired",alternative="two.sided")
```

```
## paired sample two sided test, calculate effect size
power.t(n=200,power=0.8,sig.level=0.05,type="paired",alternative="two.sided")

## two sample two sided test, calculate power
power.t(es=0.15,n=300,sig.level=0.05,type="two",alternative="two.sided")

## two sample two sided test, calculate sample size
power.t(es=0.15,power=0.8,sig.level=0.05,type="two",alternative="two.sided")

## two sample two sided test, calculate effect size
power.t(n=300,power=0.8,sig.level=0.05,type="two",alternative="two.sided")

## two sample (unequal size), calculate sample size
power.t(es=0.15,power=0.8,sig.level=0.05,type="unequal",ratio=2,alternative="two.sided")

power.t(es=0.1,n=3000,sig.level=0.05,type="unequal",ratio=2,alternative="two.sided")
```

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