Package ‘ICC.Sample.Size’

September 4, 2015

Type Package
Version 1.0
Date 2015-08-01
Title Calculation of Sample Size and Power for ICC
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Imports stats
Description Provides functions to calculate the requisite sample size for studies where ICC is the primary outcome. Can also be used for calculation of power. In both cases it allows the user to test the impact of changing input variables by calculating the outcome for several different values of input variables. Based off the work of Zou.
License GPL-3
NeedsCompilation no
Repository CRAN
Date/Publication 2015-09-04 01:03:54

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Description

Provides functions to calculate the requisite sample size for studies where ICC is the primary outcome. Can also be used for calculation of power. In both cases it allows the user to test the impact of changing input variables by calculating the outcome for several different values of input variables. Based off the work of Zou. Zou, G. Y. (2012). Sample size formulas for estimating intraclass correlation coefficients with precision and assurance. Statistics in medicine, 31(29), 3972-3981.

Details

This package provides a sample size and power calculator for ICC based off those derived by Zou (Zou, G. Y. (2012). Sample size formulas for estimating intraclass correlation coefficients with precision and assurance. Statistics in medicine, 31(29), 3972-3981.) It contains the following functions:

- `calculateiccsamplesize`: Calculates a sample size for given values of p, the null hypothesis p0, number of raters (k), desired power and alpha. Can also generate sample sizes for different values of p, p0 or combinations of p and p0 from 0-1.
- `iccNpower`: Calculates power for given value of p, the null hypothesis p0, number of raters (k), number of comparisons (N) and alpha. Can also be used to calculate the effect of increasing N at given intervals to a maximum N, or to calculate the increase in sample size to obtain increasing power with a given maximum N.
- `iccNachievableNpP`: Calculates the largest possible null hypothesis that can be tests with given power and alpha for p, the null hypothesis p0, number of raters (k) and number of comparisons (N)

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References

Function to calculate largest \( p_0 \) that the data are powered to test

**Description**

This function when given the parameters of a study to measure an ICC calculates what is the largest \( p_0 \) that can be tested for at the specified power, alpha and number of tails.

**Usage**

```r
calculateAchievablep0(p, k, alpha, tails, power, N)
```

**Arguments**

- `p` The intraclass correlation coefficient obtained in the study. No default.
- `k` The number of ratings of each subject. If missing default is 2.
- `alpha` The desired alpha for hypothesis testing. If missing default is 0.05.
- `tails` The number of trails for hypothesis test. If missing default is 2.
- `power` The desired power of the hypothesis test. If missing default is 0.80.
- `N` The number of subjects in the study. No default

**Value**

Returns a list with the following items:

- `resultFrame` A data frame consisting of columns \( p_0, N, p, k, alpha, tails \) and `power`.

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**References**


**Examples**

```r
# Calculate achievable \( p_0 \) for a given study with \( p=0.80, k=2, alpha=0.05, tails=2, power=0.80, N=30 \)
calculateAchievablep0(p=0.80, k=2, alpha=0.05, tails=2, power=0.80, N=30)
```
calculateIccPower  

*Function to calculate post-hoc power for ICC studies*

**Description**

Calculates a post-hoc power for an ICC study. Given the study parameters can also demonstrate the additional power gained by increasing number of subjects or the number of subjects needed to be added to increase power.

**Usage**

\[
\text{calculateIccPower}(p,p0,k,\alpha,\text{tails},N,\text{by},\text{desiredPower},\text{maxN},\text{step})
\]

**Arguments**

- **p**: The intraclass correlation coefficient obtained in the study. No default.
- **p0**: The null hypothesis value of p. If missing default is 0.
- **k**: The number of ratings of each subject. If missing default is 2.
- **alpha**: The desired alpha for hypothesis testing. If missing default is 0.05.
- **tails**: The number of trails for hypothesis test. If missing default is 2.
- **N**: The number of subjects in the study. No default
- **by**: Can be used to calculate sample sizes for varied p and/or p0.
  - If by="": Only the post-hoc power will be calculated.
  - If by="N": Increases N by step and calculates new power for each larger N until either maximum N or desired power is reached.
  - If by="power": Increase power by step and calculates requisite sample size for each larger power until either maximum N or desired power is reached.
  - If missing, default is "."
- **desiredPower**: The desired power of the study. If calculated desired power is reached then function will cease to increase N or power by steps and return result. If missing default is 0.80.
- **maxN**: The maximum N to increase sample size to when testing the effect on increasing sample size on power or the requisite increase in sample size for increasing power. If maxN is reached then function will cease to increase N or power by steps and return result. If missing default is 10 times the N of the study.
- **step**: When the function varies N or power it calculates power or sample size respectively for N or power, then for 0+step*(i-1) where i is the number of repeats, until MaxN or desired power is reached.

**Value**

Returns a list with the following items:

- **parameters**: Dataframe with columns p,p0,k,\alpha,\text{tails},N,power.
- **npower**: Dataframe with a list of N’s and powers calculated. Provided when by="N" or by="power".
calculateIccSampleSize

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**References**

**Examples**
```r
##Calculate post-hoc power for p=0.80, p0=0.60, k=2, alpha=0.05, tails=2 and N of 30.
calculateIccPower(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,N=30)
##Calculate post-hoc power for p=0.80, p0=0.60, k=2, alpha=0.05, tails=2 and N of 30.
##Test effect on power of increasing sample size in steps of 1 up until a maximum of 50
##with a desired power of 0.80.
calculateIccPower(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,N=30, by="N",desiredPower=0.80,maxN=50)
##Calculate post-hoc power for p=0.80, p0=0.60, k=2, alpha=0.05, tails=2 and N of 30.
##Calculate the sample size need to increase power by
##steps of 0.05 up until a maximum sample size of 50 with a desired power of 0.80.
calculateIccPower(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,N=30, by="power",desiredPower=0.80,maxN=50)
```

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**calculateIccSampleSize**

*Function to calculate sample size required for studies where ICC is primary outcome.*

**Description**
Calculates a sample size for given values of \(p\), the null hypothesis \(p_0\), number of ratings \(k\), desired power and alpha. Can also generate sample sizes for different values of \(p\), \(p_0\) or combinations of \(p\) and \(p_0\) from 0-1.

**Usage**
```
calculateIccSampleSize(p,p0,k,alpha,tails,power,by,step)
```

**Arguments**
- \(p\): The hypothesized value of \(p\). Hypothesized based on previous data, or experience. If missing default is 0.
- \(p_0\): The null hypothesis value of \(p\). If missing default is 0.
- \(k\): The number of ratings of each subject. If missing default is 2.
- \(alpha\): The desired alpha for hypothesis testing. If missing default is 0.05.
- \(tails\): The number of tails for hypothesis test. If missing default is 2.
- \(power\): The desired power of the hypothesis test. If missing default is 0.80.
by  Can be used to calculate sample sizes for varied p and/or p0.
If by="" Only the sample size for the specified p and p0 will be calculated.
If by="p" Calculates sample sizes for all p starting from 0, increasing by step until 1.
If by="pθ" Calculates sample sizes for all p0 starting from 0, increasing by step until 1.
If by="both" Calculates sample sizes for all combinations of p and p0 starting each from 0, increasing by step until 1. Row labels are p and column labels are p0.
If missing, default is "".
step  When the function varies p or p0 it calculates sample size for 0, then for 0+step*(i-1)
where i is the number of repeats, until p=1

Value
Returns a list with the following items:
resultdf  Data frame with columns N, p, p0, k, alpha, tails, and power.
sampleSize  For by="p" or by="pθ" is a data frame with columns of p or p0 respectively and N.
ndataframe  For by="both" is a data frame with rows defined by p and columns defined by p0 representing values of N for each combination.

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References

Examples
```r
## Calculate Sample Size for p=0.80, p0=0.60, two ratings, alpha=0.05 with two tails and power=0.80.
calculateIccSampleSize(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,power=0.80)
## Calculate Sample Size as above, but test varying p from 0 to 1 by steps of 0.05
calculateIccSampleSize(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,power=0.80,by="p",step=0.05)
## Calculate Sample Size as above, but test varying p0 from 0 to 1 by steps of 0.05
calculateIccSampleSize(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,power=0.80,by="p0",step=0.05)
## Calculate Sample Size as above, but test varying both p and p0 from 0 to 1 by steps of 0.05
calculateIccSampleSize(p=0.80,p0=0.60,k=2,alpha=0.05,tails=2,power=0.80,by="both",step=0.05)
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