Package ‘JMdesign’

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Description Performs power calculations for joint modeling of longitudinal and survival data with k-th order trajectories when the variance-covariance matrix, Sigma_theta, is unknown.
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R topics documented:

<table>
<thead>
<tr>
<th>JMdesign-package</th>
<th>JMDesign-package</th>
</tr>
</thead>
<tbody>
<tr>
<td>powerLongSurv</td>
<td>powerLongSurv</td>
</tr>
<tr>
<td>powerLongSurv-class</td>
<td>powerLongSurv-class</td>
</tr>
<tr>
<td>show-methods</td>
<td>show-methods</td>
</tr>
</tbody>
</table>

Index 10

Description

R function for power determination in joint modeling of longitudinal and survival data with k-th order trajectories and unknown variance-covariance matrix Sigma_theta.
The package contains the R-function `powerLongSurv` to perform power calculations for joint modeling of longitudinal and survival data when trajectories are of k-th order and the variance-covariance matrix Sigma_theta is unknown.

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**References**


**See Also**

`powerLongSurv`, `powerLongSurv-class`, `show-methods`

**Examples**

```r
## Example 1.
## **********
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2, 0.0, 0.0, 0.0, 0.0, 0.7, 0.0, 0.0, 0.0), nrow=3, ncol=3)

N <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta <- 0.2; # Effect of the trajectory;
alpha <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6, 2); # maximum 2 year follow-up;

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \(x_i\) in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.15, 0.1, 0.05);

## Input the order of trajectories
ordtraj <- 1 # linear trajectories
```
```r
## Call function
## Linear Trajectories
pLS1 <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, 
                      sigmae_2, ordtraj, beta, alpha=0.05)
pLS1
show(pLS1)
unclass(pLS1)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, 
              ordtraj=0, beta, alpha=0.05)

## Quadratic Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, 
              ordtraj=2, beta, alpha=0.05)

## Example 2.
## *********
## Input elements of Sigma_theta in forumula 4.6;
SigmaTheta <- matrix(c(1.2, 0.0, 0.0, 0.0, 0.0, 0.7, 0.0, 0.0, 0.0, 0.0, 0.0, 0.8), nrow=3, ncol=3)
N <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta <- 0.2; # Effect of the trajectory;
alpha <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6);

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \( \xi \) in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.2, 0.1);

## Input the order of trajectories
ordtraj <- 2 # quadratic trajectories

## Call function
## Quadratic Trajectories
pLSq <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, 
                      sigmae_2, ordtraj, beta, alpha=0.05)
pLSq
show(pLSq)
unclass(pLSq)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
```

Power calculation in joint modeling of longitudinal and survival data
- k-th Order Trajectories and Unknown Sigma

Description
Compute the power in joint modeling of longitudinal and survival data when the variance-covariance matrix Sigma_Theta is unknown and the trajectories are order k.

The function computes power for a one-sided test, either

\[ H_0 : \beta = 0 \quad \text{and} \quad H_{1A} : \beta > 0 \]

or

\[ H_0 : \beta = 0 \quad \text{and} \quad H_{1B} : \beta < 0 \]

with Type I error \( \alpha \). The choice of the alternative is determined by the sign of \( \beta \). Negative values for \( \beta \) indicate that the alternative hypothesis is \( H_{1B} \), while \( \beta \geq 0 \) indicates that it is \( H_{1A} \).

It creates a `powerLongSurv` object.

Usage

```
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj, beta = 0, alpha = 0.05, tol = 1.5e-8)
```

Arguments

- `N`
  numeric specifying the total sample size; minimum 20.
- `nevents`
  numeric specifying the number of events; at least 20 and at most N.
- `tmedian`
  numeric specifying the median survival time; positive
- `meantf`
  numeric specifying the mean follow-up time; positive and no greater than max(t).
- `p`
  numeric vector of estimated subject proportions with 2,3,... measurements, respectively, zero proportions allowed.
- `t`
  numeric vector of measurement times, distinct positive components; same length as `p`.
- `SigmaTheta`
  numeric matrix specifying the covariance matrix Sigma_Theta
- `sigmae_2`
  numeric specifying the measurement error; positive.
- `ordtraj`
  integer specifying the order of trajectories, must be less the order of Sigma_Theta
- `beta`
  numeric specifying the effect of the trajectory; default value 0.
- `alpha`
  numeric, strictly between 0.0 and 1.0, specifying the Type-I Error (2-sided), default value 0.05.
- `tol`
  numeric, For floating point objects x and y, if \(|x-y| \leq \text{tol}\), \(x==y\). Passed to R function `all.equal`.
Details

The function `powerLongSurv` is used to calculate the power in joint modeling of longitudinal and survival data.

Value

An object of S4 class `powerLongSurv`, which has the following 12 components:

- `title`: character string
- `subtitle`: character string
- `t`: numeric vector
- `p`: numeric vector
- `N`: integer
- `nevents`: integer
- `censr`: numeric
- `tmedian`: numeric
- `meantf`: numeric
- `SigmaTheta`: numeric matrix
- `ordtraj`: integer
- `BSigma`: numeric matrix
- `beta`: numeric
- `alpha`: numeric
- `power`: numeric

Author(s)

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References


See Also

`powerLongSurv-class, show-methods`
Examples

```r
## Example 1.
## ************
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.8), nrow=3, ncol=3)

N <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
beta <- 0.2; # Effect of the trajectory;
alpha <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6, 2); # maximum 2 year follow-up;

## Input estimated proportion subjects with 2,3,4,5,6 measurements;
## This is \( \xi \) in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.15, 0.1, 0.05);

## Input the order of trajectories
ordtraj <- 1 # linear trajectories

## Call function
## Linear Trajectories
plSL <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta,
                      sigmae_2, ordtraj, beta, alpha=0.05)
plSL
show(plSL)
unclass(plSL)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=2, beta, alpha=0.05)

## Quadratic Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2,
              ordtraj=2, beta, alpha=0.05)

## Example 2.
## ************
## Input elements of Sigma_theta in formula 4.6;
SigmaTheta <- matrix(c(1.2, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.8), nrow=3, ncol=3)

N <- 200; # Total sample size;
nevents <- 140; # Number of events;
tmedian <- 0.7; # median survival;
meantf <- 1.4; # mean follow-up time;
```
beta <- 0.2; # Effect of the trajectory;
alpha <- 0.05; # Type-I Error (2-sided);
sigmae_2 <- 0.09; # measurement error;

## schedule of measurement;
t <- c(0.4, 0.8, 1.2, 1.6);

## Input estimated proportion subjects with 2, 3, 4, 5, 6 measurements;
## This is \( \xi \) in formula 4.6;
## The data is obtained from the simulated data for the calculation in table 2;
p <- c(0.3, 0.4, 0.2, 0.1);

## Input the order of trajectories
ordtraj <- 2 # quadratic trajectories

## Call function
## Quadratic Trajectories
plsq <- powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj, beta, alpha = 0.05)
plsq
show(plsq)
unclass(plsq)

## Constant Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj=0, beta, alpha=0.05)

## Linear Trajectories
powerLongSurv(N, nevents, tmedian, meantf, p, t, SigmaTheta, sigmae_2, ordtraj=1, beta, alpha=0.05)

---

powerLongSurv-class  Class "powerLongSurv"

Description

Class of objects like the output of function "powerLongSurv()".

Objects from the Class

Objects can be created by calls of the form new("powerLongSurv", ...).

Slots

title: Object of class "character"
subtitle: Object of class "character"
t: Object of class "vector"
p: Object of class "vector"
N: Object of class "integer"
nevents: Object of class "integer"
censr: Object of class "numeric"
tmedian: Object of class "numeric"
meantf: Object of class "numeric"
SigmaTheta: Object of class "matrix"
ordtraj: Object of class "integer"
BSigma: Object of class "matrix"
beta: Object of class "numeric"
alpha: Object of class "numeric"
power: Object of class "numeric"

Methods

show signature(object = "powerLongSurv")

Author(s)

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See Also

powerLongSurv, show-methods

Examples

showClass("powerLongSurv")
Index

*Topic classes
  powerLongSurv-class, 8

*Topic functions
  powerLongSurv, 5

*Topic methods
  show-methods, 9

*Topic package
  JMdesign-package, 1

JMdesign (JMdesign-package), 1
JMdesign-package, 1
JMdesign-powerLongSurv (powerLongSurv), 5
JMdesign-powerLongSurv-class
  (powerLongSurv-class), 8
powerLongSurv, 3, 5, 9
powerLongSurv-class, 8
show, powerLongSurv-method
  (show-methods), 9
show-methods, 9