Package ‘grpseq’

December 6, 2021

Type Package
Title Group Sequential Analysis of Clinical Trials
Version 1.0
Author Lu Mao
Maintainer Lu Mao <lmao@biostat.wisc.edu>
URL https://sites.google.com/view/lmaowisc/
Description Design of group sequential trials, including non-binding futility analysis
License GPL (>= 2)
Encoding UTF-8
RoxygenNote 7.1.1
VignetteBuilder knitr
Depends R (>= 2.10)
Imports mvtnorm
Suggests knitr, rmarkdown
NeedsCompilation no
Repository CRAN
Date/Publication 2021-12-06 17:20:02 UTC

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**Description**

Design of non-binding futility looks at multiple information times based on conditional power (CP), predictive power (PP), or condition power under current estimate (CPd) (Gallo, Mao, and Shih, 2014).

**Usage**

```r
fut(
  alpha,
  beta,
  t,
  gamma,
  side = 2,
  increment = 1e-04,
  si = 0,
  scale = "CP",
  seed = 12345
)
```

**Arguments**

- `alpha`: Type I error.
- `beta`: Type II error (1 - power).
- `t`: A numeric vector of information times in (0, 1) for futility looks.
- `gamma`: A numeric vector of probabilities (whose meaning depends on `scale`) at information times t.
- `side`: 1- or 2-sided test.
- `increment`: Error for the numerical solution of the sample size inflation factor.
- `si`: 0: without sample size inflation; 1: with sample size inflation.
- `scale`: Character string specifying the scaled used: "CP", conditional power; "PP", predictive power; "CPd": condition power under current estimate.
- `seed`: Seed number for the randomized evaluation of multivariate normal distribution.

**Value**

An object of class `fut` with the following components. `gamma1`: conditional power at information times t converted from the supplied `gamma` and `scale`; `theta`: local alternative associated with the actual power when the futility rules of enforced; `IF`: sample size inflation factor if `si`=1; `loss`: power loss if `si`=0.
plot.fut

References

See Also
print.fut, summary.fut, plot.fut, powerplot

Examples
## load the package
library(grpseq)
## two-sided level 0.05 test with 80% power;
## evenly spaced three futility looks with predictive power 20%;
## inflate sample size to recoup power.
obj1 <- fut(alpha=0.05,beta=0.2,t=(1:3)/4,gamma=0.2*rep(1,3),side=2,scale="PP",si=1)
obj1
## print the summary results
summary(obj1)

## do the same thing without sample size inflation
obj2 <- fut(alpha=0.05,beta=0.2,t=(1:3)/4,gamma=0.2*rep(1,3),side=2,scale="PP",si=0)
obj2
## print the summary results
summary(obj2)
oldpar <- par(mfrow = par("mfrow"))
par(mfrow=c(1,2))
## plot the futility boundaries by z-value
plot(obj2, scale="z", lwd=2, main="")
## plot the futility boundaries by B-value
plot(obj2, scale="b", lwd=2, main="")
par(oldpar)
## plot the power curve as a function of the (local)
## effect size in units of the hypothesized effect size
## ref=TRUE requests the power curve for the original one-time analysis
powerplot(obj2, lwd=2, ref=TRUE)

plot.fut

Plot the planned futility boundaries

Description
Plot the planned futility boundaries in B- or z-values as a function of information time.

Usage
## S3 method for class 'fut'
plot(
x,
scale = "z",
add = FALSE,
lty = 8,
xlab = "Info Time",
ylab = "z score",
type = "b",
pch = 1,
cex = 1,
main = "Futility Boundary for the Planned Test",
xlim = c(0, 1.1),
ylim = NULL,
...)

Arguments

x An object returned by fut.
scale "z": plot z-values; "b": plot B-values.
add If TRUE, the curve will be overlaid on an existing plot; otherwise, a separate
     plot will be constructed.
lty Line type for the segments connecting the z-/B-value points.
xlab A label for the x axis, defaults to a description of x.
ylab A label for the y axis, defaults to a description of y.
type Plot type. "l": only line segments; "p": only z-/B-value points; "b": both.
pch Point types for the z-/B-values.
cex Point size.
main A main title for the plot.
xlim The x limits of the plot.
ylim The y limits of the plot.
... Other arguments that can be passed to the underlying plot method.

Value

No return value, called for side effects.

See Also

fut, summary.fut, powerplot.

Examples

# see example for fut
powerplot

Plot the power function of the planned analysis

Description

Plot the power curve of the planned futility analysis as a function of the effect size (in units of the hypothesized effect size).

Usage

```r
powerplot(
  x,
  ref = FALSE,
  add = FALSE,
  lty = 1,
  ref.lty = 2,
  lwd = 1,
  xlab = expression(delta),
  ylab = "Power",
  main = "Power curve of the planned futility analysis",
  xlim = c(0, 1.5),
  ylim = c(0, 1),
  ...
)
```

Arguments

- `x`: An object returned by `fut`.
- `ref`: If TRUE, power curve of the reference test (one that ignores the futility boundaries) will be overlaid.
- `add`: If TRUE, the curve will be overlaid on an existing plot; otherwise, a separate plot will be constructed.
- `lty`: Line type for the power curve of the futility analysis.
- `ref.lty`: Line type for the power curve of the reference if `ref=TRUE`.
- `lwd`: Line width.
- `xlab`: A label for the x axis, defaults to a description of x.
- `ylab`: A label for the y axis, defaults to a description of y.
- `main`: A main title for the plot.
- `xlim`: The x limits of the plot.
- `ylim`: The y limits of the plot.
- `...`: Other arguments that can be passed to the underlying `plot` method.

Value

No return value, called for side effects.
See Also

fut, summary.fut, plot.fut.

Examples

# see example for fut

Description

Print the power loss or sample size inflation factor due to the planned futility analysis.

Usage

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

Arguments

x An object of class fut.

... Further arguments passed to or from other methods.

Value

Print the results of fut object.

See Also

fut, summary.fut

Examples

# see example for fut
print.summary.fut  

Print method for summary.fut objects

Description

Print the detailed summary of the futility design.

Usage

```r
## S3 method for class 'summary.fut'
print(x, ...)
```

Arguments

- `x` An object returned by `summary.fut`.
- `...` Further arguments passed to or from other methods

Value

No return value, called for side effects.

See Also

`fut`, `summary.fut`.

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summary.fut  

Detailed summary of the futility design

Description

Provide key information about the futility design, including B/z-values, beta (type II error) spent, and power loss at each futility look as well the the sample size distribution under the null hypothesis.

Usage

```r
## S3 method for class 'fut'
summary(object, ...)
```

Arguments

- `object` An object returned by `fut`.
- `...` further arguments passed to or from other methods.
Value

An object of class `summary.fut` with components:

- **t**: A $K$-dimensional vector of information times.
- **b**: A $K$-dimensional vector of B-values at $t$.
- **z**: A $K$-dimensional vector of z-values at $t$.
- **type2**: A $K$-dimensional vector of beta spent at $t$.
- **loss**: A $K$-dimensional vector of power loss at $t$.
- **ess**: Expected sample size at $H_0$.

See Also

`fut`, `print.fut`, `print.summary.fut`.

Examples

```r
# see example for fut
```
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