R documentation

of 'eff.Rd'

February 26, 2013

---

eff *Calculation of D-efficiency with arbitrary precision*

Description

Calculates the D-effficiency of design ξ_1 respect to design ξ_2 with arbitrary precision.

Usage

```
eff(ymean, yvar, param, points1, points2, weights1, weights2, prec = 53)
```

Arguments

ymean	a character string, formula of $E(y)$ with specific satndard: characters b1, b2, b3, ... symbolize model parameters and x1, x2, x3, ... symbolize explanatory variables. See 'Examples'.
yvar	a character string, formula of $Var(y)$ with specific standard as ymean. See 'Details' and 'Examples'.
param	a vector of values of parameters which must correspond to b1, b2, b3, ... in ymean. The number of parameters can not be more than 4.
points1	a vector of ξ_1 points. See 'Details'.
points2	a vector of ξ_2 points. See 'Details'.
weights1	a vector of ξ_1 points weights. The sum of weights should be 1; otherwise they will be normalized.
weights2	a vector of ξ_2 points weights. The sum of weights should be 1; otherwise they will be normalized.
prec	(optional) a number, the maximal precision to be used for D-efficiency calculation, in bite. Must be at least 2 (default 53).

Details

If response variables have the same constant variance, for example σ^2, then yvar must be 1.

Consider design ξ with n m-dimensional points. Then, the vector of ξ points is

$$(x_1, x_2, \ldots, x_i, \ldots, x_n),$$

where $x_i = (x_{i1}, x_{i2}, \ldots, x_{im})$. Hence the length of vector points is mn.

Value

D-efficiency as an 'mpfr' number.

Note

This function is applicable for models that can be written as $E(Y_i) = f(x_i, \beta)$ where y_i is the ith response variable, x_i is the observation vector of the ith explanatory variables, β is the vector of parameters and f is a continuous and differentiable function with respect to β. In addition, response variables must be independent with distributions that belong to the Natural exponential family. Logistic,Poisson, Negative Binomial, Exponential, Richards, Weibull, Log-linear, Inverse Quadratic and Michaelis-Menten are examples of these models.

Author(s)

Ehsan Masoudi, Majid Sarmad and Hooshang Talebi

References

Masoudi, E., Sarmad, M. and Talebi, H. 2012, An Almost General Code in R to Find Optimal Design, In Proceedings of the 1st ISM International Statistical Conference 2012, 292-297.

Examples

```
## Logistic dose-response model
ymean <- "(1/(exp(-b2*(x1-b1))+1))"
yvar <- "(1/(exp(-b2*(x1-b1))+1))*(1-(1/(exp(-b2*(x1-b1))+1)))"
eff (ymean, yvar,  param = c(.9, .8), points1 = c(-3, 1, 2),
     points2 = c(-1.029256,  2.829256), weights1 = rep(.33, 3), weights2 = c(.5, .5),
     prec = 54)
## or
ldlogistic(a = .9 , b = .8, form = 2, lb = -5, ub = 5, user.points = c(-3, 1, 2),
user.weights = c(.33, .33, .33))$user.eff

## Logistic model:
ymean <- "1/(exp(-b1 - b2 * x1) + 1)"
yvar <- "(1/(exp(-b1 - b2 * x1) + 1))*(1 - (1/(exp(-b1 - b2 * x1) + 1)))"
eff (ymean, yvar,  param = c(.9, .8), points1 = c(-3, 1, 2),
points2 = c(-3.0542556,  0.8042562), weights1 = rep(.33, 3), weights2 = c(.5, .5),
prec = 54)
## or
ldlogistic(a = .9 , b = .8, form = 1, lb = -5, ub = 5, user.points = c(-3, 1, 2),
user.weights = c(.33, .33, .33))$user.eff

## Poisson model:
ymean <- yvar <-  "exp(b1 + b2 * x1)"
eff (ymean, yvar,  param = c(.9, .8), points1 = c(-3, 1, 2), points2 = c(2.5, 5.0),
weights1 = rep(.33, 3), weights2 = c(.5, .5), prec = 54)

#########################################################################
## In the following, ymean and yvar for some famous models are given:

## Poisson dose response model:
ymean <- yvar <- "b1 * exp(-b2 * x1)"

## Inverse Quadratic model:
ymean <- "(b1 * x1)/(b2 + x1 + b3 * (x1)^2)"
```

```
yvar <- "1"
#
ymean <- "x1/(b1 + b2 * x1 + b3 * (x1)^2)"
yvar <- "1"

## Weibull model:
ymean <- "b1 - b2 * exp(-b3 * x1^b4)"
yvar <- "1"

## Richards model:
ymean <- "b1/(1 + b2 * exp(-b3 * x1))^b4"
yvar <- "1"

## Michaelis-Menten model:
ymean <- "(b1 * x1)/(1 + b2 * x1)"
yvar <- "1"
#
ymean <- "(b1 * x1)/(b2 + x1)"
yvar <- "1"
#
ymean <- "x1/(b1 + b2 * x1)"
yvar <- "1"

## log-linear model:
ymean <- "b1 + b2 * log(x1 + b3)"
yvar <- "1"

## Exponential model:
ymean <- "b1 + b2 * exp(x1/b3)"
yvar <- "1"

## Emax model:
ymean  <- "b1 + (b2 * x1)/(x1 + b3)"
yvar <- "1"

## Negative binomial model Y ~ NB(E(Y), theta) where E(Y) = b1 * exp(-b2 * x1):
theta <- 5
ymean <- "b1 * exp(-b2 * x1)"
yvar <- paste ("b1 * exp(-b2 * x1)*(1 + (1/", theta, ") * b1 * exp(-b2 * x1))", sep = "")

## Linear regression model:
ymean <- "b1 + b2 * x1 + b3 * x2 + b4 * x1 * x2"
yvar = "1"
```

Index