Package ‘multipleOutcomes’

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Title  Asymptotic Covariance Matrix of Regression Models for Multiple Outcomes

Version  0.2

Description  Regression models can be fitted for multiple outcomes simultaneously. This package computes estimates of parameters across fitted models and returns the matrix of asymptotic covariance. Various applications of this package, including CUPED (Controlled Experiments Utilizing Pre-Experiment Data), multiple comparison adjustment, are illustrated.

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Imports  dplyr, ggplot2, mvtnorm, tidyr

Suggests  knitr, rmarkdown

VignetteBuilder  knitr

NeedsCompilation  no

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**multipleOutcomes**

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**coef.multipleOutcomes**  
*Extract Model Coefficients*

**Description**  
Extract Model Coefficients

**Usage**  
```r  
## S3 method for class 'multipleOutcomes'  
coef(object, model_index = NULL, ...)  
```

**Arguments**  
- `object`: an object returned by `multipleOutcomes()`.  
- `model_index`: NULL if displaying coefficients of all fitted models; otherwise, an integer indicating the fitted model.  
- `...`: for debugging only

**Value**  
a vector of coefficient estimates

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**multipleOutcomes**  
*Fitting Regression Models for Multiple Outcomes and Returning the Matrix of Covariance*

**Description**  
Fitting Regression Models for Multiple Outcomes and Returning the Matrix of Covariance

**Usage**  
```r  
multipleOutcomes(..., family, data, data_index = NULL, score_epsilon = 1e-06)  
```

**Arguments**  
- `...`: formulas of models to be fitted.  
- `family`: a character vector of families to be used in the models. Currently only `gaussian` and `binomial` are supported. `cox` for time-to-event data with potential censoring and `long` for longitudinal data may be supported in the future. `family` can be of length 1 if all models are fitted in the same family; otherwise `family` should be specified for each of the models in `. . .`.  
- `data`, `data_index`, `score_epsilon`: unspecified arguments
**multipleOutcomes**

- **data**: a data frame if all models are fitted on the same dataset; otherwise a list of data frames for fitting models in... Note that a dataset can be used to fit multiple models, thus, length(data) is unnecessary to be equal to the number of models in... The row names in a data frame are treated as sample IDs. Consequently, for any two records in different data frames that correspond to the same sample, their row names should be consistent.

- **data_index**: NULL if data is a data frame; otherwise, a vector in integer specifying mapping a model in... to a data frame in data (a list).

- **score_epsilon**: whatever.

### Value

It returns an object of class "multipleOutcomes", which is a list containing the following components:

- **coefficients**: an unnamed vector of coefficients of all fitted models. Use id_map for variable mapping.

- **mcov**: a unnamed matrix of covariance of coefficients. Use id_map for variable mapping.

- **id_map**: a list mapping the elements in coefficients and mcov to variable names.

- **n_shared_sample_sizes**: a matrix of shared sample sizes between datasets being used to fit the models.

- **call**: the matched call.

### Examples

```r
## More examples can be found in the vignettes.
library(mvtnorm)
genData <- function(seed = NULL){
  set.seed(seed)
  n <- 400
  sigma <- matrix(c(1, .6, .6, 1), 2)
  x <- rmvnorm(n, sigma = sigma)
  gam <- c(.1, -.2)
  z <- rbinom(n, 1, plogis(1-1/(1+exp(-.5+x%*%gam+.1*runorm(n)))))
  bet <- c(-.2, .2)
  #y <- rbinom(n, 1, plogis(1-1/(1+exp(-.5+x%*%bet + .2*z-.3*runorm(n)))))
  y <- -.5+x%*%bet + .2*z-.3*runorm(n)
  data.frame(y = y, z = z, x1 = x[, 1], x2 = x[, 2])
}

dat <- genData(123456)
dat1 <- head(dat,200)
dat2 <- tail(dat,200)
```

## fitting four models simultaneously.
fit <-
multipleOutcomes(
  y ~ z + x1 - 1,
  z ~ x1 + x2,
  z ~ x1 - 1,
  y ~ x2,
  ## z can be fitted with a linear or logistic regression
  family = c('gaussian', 'binomial', 'gaussian', 'gaussian'),
  data = list(dat1, dat2),
  ## each dataset is used to fit two models
  data_index = c(1, 1, 2, 2)
)

## unnamed coefficients of all model parameters
coef(fit)

## named coefficients of a specific model
coef(fit, 2)

## unnamed covariance matrix of all model parameters
vcov(fit)

## named covariance matrix of a specific model
vcov(fit, 1)

## summary of all parameter estimates
summary(fit)

## summary of parameters in a specific model
summary(fit, 4)

print.summary.multipleOutcomes

Title

Description

Title

Usage

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

Arguments

x an object returned by multipleOutcomes().
... for debugging only.
**summary.multipleOutcomes**

### Value

an invisible object.

### Examples

```r
## no example
```

---

**summary.multipleOutcomes**  
Object Summaries

### Description

Object Summaries

### Usage

```r
## S3 method for class 'multipleOutcomes'
summary(object, model_index = NULL, ...)
```

### Arguments

- **object**: an object returned by `multipleOutcomes()`.
- **model_index**: NULL if displaying summary of all fitted models; otherwise, an integer indicating the fitted model.
- **...**: for debugging only

### Value

a list

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**vcov.multipleOutcomes**  
Calculate Variance-Covariance Matrix for a Fitted Model Object

### Description

Calculate Variance-Covariance Matrix for a Fitted Model Object

### Usage

```r
## S3 method for class 'multipleOutcomes'
vcov(object, model_index = NULL, ...)
```
Arguments

- **object**: an object returned by `multipleOutcomes()`.
- **model_index**: `NULL` if displaying covariance matrix of all fitted models; otherwise, an integer indicating the fitted model.
- **...**: for debugging only

Value

A matrix of covariance of all estimates
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