

Package ‘cluscov’

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Description Clustered covariate regression enables estimation and inference in both linear and non-linear models with linear predictor functions even when the design matrix is column rank deficient. Routines in this package implement algorithms in Soale and Tsyawo (2019) <[doi:10.13140/RG.2.2.32355.81441](https://doi.org/10.13140/RG.2.2.32355.81441)>.

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CCRLs

Sequential CCR

Description

CCRLs runs regressions with potentially more covariates than observations. See `c_chmod()` for the list of models supported.

Usage

```
CCRLs(Y, X, kap = 0.1, modclass = "lm", tol = 1e-06, reltol = TRUE,
      rndcov = NULL, report = NULL, ...)
```

Arguments

Y	vector of dependent variable Y
X	design matrix (without intercept)
kap	maximum number of parameters to estimate in each active sequential step, as a fraction of the less of total number of observations n or number of covariates p. i.e. $\min(n, p)$
modclass	a string denoting the desired the class of model. See c_chmod for details.
tol	level of tolerance for convergence; default tol=1e-6
reltol	a logical for relative tolerance instead of level. Defaults at TRUE
rndcov	seed for randomising assignment of covariates to partitions; default NULL
report	number of iterations after which to report progress; default NULL
...	additional arguments to be passed to the model

Value

betas parameter estimates (intercept first),
 iter number of iterations,
 dev increment in the objective function value at convergence
 fval objective function value at convergence

Examples

```
set.seed(14) #Generate data
N = 1000; (bets = rep(-2:2,4)); p = length(bets); X = matrix(rnorm(N*p),N,p)
Y = cbind(1,X)%*%matrix(c(0.5,bets),ncol = 1)
CCRLs(Y,X,kap=0.1,modclass="lm",tol=1e-6,reltol=TRUE,rndcov=NULL,report=8)
```

CCRLs.coord

Linear regression via coordinate descent with covariate clustering

Description

This function is a wrapper for `linrclus`. It requires less input.

Usage

```
CCRLs.coord(Y, X, k, nC = 1, ...)
```

Arguments

Y	vector of outcome variable
X	matrix of covariates. Should not include 1's for the intercept
k	number of clusters
nC	first nC-1 covariates in X not to cluster. Must be at least 1 for the intercept
...	additional parameters to be passed to lm

Value

`mobj` the low dimension [lm](#) regression object

`clus` cluster assignments of covariates (excluding the first nC covariates - including the intercept 1)

Examples

```
set.seed(14) #Generate data
N = 1000; (bets = rep(-2:2,4)); p = length(bets); X = matrix(rnorm(N*p),N,p)
Y = cbind(1,X)%*%matrix(c(0.5,bets),ncol = 1)
CCRLs.coord(Y,X,k=5,nC=1)
```

CCRseqk

*Sequential CCR with k clusters***Description**

CCRseqk runs regressions with potentially more covariates than observations with k clusters. See `c_chmod()` for the list of models supported.

Usage

```
CCRseqk(Y, X, k, nC = 1, kap = 0.1, modclass = "lm", tol = 1e-06,
        reltol = TRUE, rndcov = NULL, report = NULL, ...)
```

Arguments

Y	vector of dependent variable Y
X	design matrix (without intercept)
k	number of clusters
nC	first nC-1 columns in X not to cluster
kap	maximum number of parameters to estimate in each active sequential step, as a fraction of the less of total number of observations n or number of covariates p. i.e. $\min(n, p)$
modclass	a string denoting the desired the class of model. See c_chmod for details.
tol	level of tolerance for convergence; default tol=1e-6
reltol	a logical for relative tolerance instead of level. Defaults at TRUE
rndcov	seed for randomising assignment of covariates to partitions; default NULL
report	number of iterations after which to report progress; default NULL
...	additional arguments to be passed to the model

Value

a list of objects

- mobj low dimensional model object of class lm, glm, or rq (depending on modclass)
- clus cluster assignments of covariates
- iter number of iterations
- dev decrease in the function value at convergence

Examples

```
set.seed(14) #Generate data
N = 1000; (bets = rep(-2:2,4)/2); p = length(bets); X = matrix(rnorm(N*p),N,p)
Y = cbind(1,X)%*%matrix(c(0.5,bets),ncol = 1); nC=1
zg=CCRseqk(Y,X,k=5,nC=nC,kap=0.1,modclass="lm",tol=1e-6,reltol=TRUE,rndcov=NULL,report=8)
(del=zg$mobj$coefficients) # delta
(bets = c(del[1:nC],(del[-c(1:nC)])[zg$clus])) #construct beta
```

chmod	<i>Model criterion function</i>
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Description

A generic S3 function as wrapper for internal R routines for classes of models implemented in this package. See details [c_chmod](#) for the list of classes supported.

Usage

```
chmod(object, ...)
```

Arguments

object	the object to be passed to the concrete class constructor chmod
...	additional paramters to be passed to the internal routine

chmod.gammainverse	<i>Regression - gammainverse class</i>
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Description

A gamma regression implementation for the "gammainverse" class. It uses [glm](#) with the Gamma link function set to "inverse"

Usage

```
## S3 method for class 'gammainverse'  
chmod(object, ...)
```

Arguments

object	a list of Y - outcome variable and X - design matrix of class "probit"
...	additional parameters to be passed to glm

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="gammainverse"))
```

chmod.gammllog	<i>Regression - gammllog class</i>
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Description

A gamma regression implementation for the "gammllog" class. It uses [glm](#) with the Gamma link function set to "log"

Usage

```
## S3 method for class 'gammllog'
chmod(object, ...)
```

Arguments

object	a list of Y - outcome variable and X - design matrix of class "probit"
...	additional parameters to be passed to glm

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="gammllog"))
```

chmod.lm	<i>Regression - lm class</i>
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Description

A linear regression implementation for the "lm" class. It uses [lm](#)

Usage

```
## S3 method for class 'lm'
chmod(object, ...)
```

Arguments

object	a list of Y - outcome variable and X - design matrix of class "lm"
...	additional parameters to be passed to lm

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="lm"))
```

`chmod.logit`*Regression - logit class*

Description

A logit regression implementation for the "logit" class. It uses [glm](#) with the binomial link function set to "logit"

Usage

```
## S3 method for class 'logit'  
chmod(object, ...)
```

Arguments

<code>object</code>	a list of Y - outcome variable and X - design matrix of class "logit"
<code>...</code>	additional parameters to be passed to glm

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height<=50,X=women$weight,modclass="logit"))
```

`chmod.negbin`*Regression - negbin class*

Description

A negative binomial regression implementation for the "negbin" class. It uses [glm.nb](#)

Usage

```
## S3 method for class 'negbin'  
chmod(object, ...)
```

Arguments

<code>object</code>	a list of Y - outcome variable and X - design matrix of class "negbin"
<code>...</code>	additional parameters to be passed to glm.nb

Value

fitted model object

chmod.poissonidentity *Regression - poissonidentity class*

Description

A poisson regression implementation for the "poissonidentity" class. It uses [glm](#) with the poisson link function set to "identity"

Usage

```
## S3 method for class 'poissonidentity'
chmod(object, ...)
```

Arguments

object a list of Y - outcome variable and X - design matrix of class "poissonidentity"
 ... additional parameters to be passed to [glm](#)

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="poissonidentity"))
```

chmod.poissonlog *Regression - poissonlog class*

Description

A poisson regression implementation for the "poissonlog" class. It uses [glm](#) with the poisson link function set to "log"

Usage

```
## S3 method for class 'poissonlog'
chmod(object, ...)
```

Arguments

object a list of Y - outcome variable and X - design matrix of class "poissonlog"
 ... additional parameters to be passed to [glm](#)

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="poissonlog"))
```

chmod.poissonsqrt	<i>Regression - poissonsqrt class</i>
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Description

A poisson regression implementation for the "poissonsqrt" class. It uses [glm](#) with the poisson link function set to "sqrt"

Usage

```
## S3 method for class 'poissonsqrt'
chmod(object, ...)
```

Arguments

object	a list of Y - outcome variable and X - design matrix of class "poissonsqrt"
...	additional parameters to be passed to glm

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="poissonsqrt"))
```

chmod.probit	<i>Regression - probit class</i>
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Description

A probit regression implementation for the "probit" class. It uses [glm](#) with the binomial link set to "probit"

Usage

```
## S3 method for class 'probit'
chmod(object, ...)
```

Arguments

object a list of Y - outcome variable and X - design matrix of class "probit"
 ... additional parameters to be passed to [glm](#)

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height<=50,X=women$weight,modclass="probit"))
```

chmod.qreg	<i>Regression - qreg class</i>
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Description

A quantile regression implementation for the "qreg" class. It uses [rq](#)

Usage

```
## S3 method for class 'qreg'
chmod(object, ...)
```

Arguments

object a list of Y - outcome variable and X - design matrix of class "qreg"
 ... additional parameters to be passed to [rq](#), for example tau

Value

fitted model object

Examples

```
chmod(c_chmod(Y=women$height,X=women$weight,modclass="qreg"),tau=0.45)
```

c_chmod	<i>Concrete class constructor</i>
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Description

A function for constructing functions for concrete classes of models for the `chmod()` family of functions.

Usage

```
c_chmod(Y, X, modclass = "lm")
```

Arguments

Y	vector of the outcome variable
X	matrix of covariates; excepting intercepts 1's
modclass	the class of model. Currently, "lm" for linear regression, "logit" (logit model), "qreg" (quantile regression), "probit" (probit model), "gammmainverse" (gamma with inverse link), "gammalog" (gamma with log link), "poissonlog" (poisson model with log link), "poissonidentity" (poisson with identity link), "poisson-sqrt" (poisson with sqrt link), "negbin" (negative binomial) are supported.

Value

object an object list with class attribute `modclass`.

dcluspar	<i>Clustering of vector elements</i>
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Description

A deterministic clustering device of vector elements into k clusters

Usage

```
dcluspar(k, vec)
```

Arguments

k	number of clusters
vec	the vector of real valued elements

Value

clus integer assignment of corresponding elements in `vec` in up to k clusters

Examples

```
set.seed(2); (v=c(rnorm(4,0,0.5),rnorm(3,3,0.5))[sample(1:7)])
dcluspar(k=2,vec = v)
```

goldensearch

Golden Section Search Algorithm

Description

Minimising a continuous univariate function using the golden section search algorithm.

Usage

```
goldensearch(fn, interval, tol = 1)
```

Arguments

fn	the function; should be scalar valued
interval	a vector containing the lower and upper bounds of search
tol	tolerance level for convergence

Value

a list of objects

- k: minimiser
- value: minimum value
- iter: number of iterations before convergence
- iterfn: number of function evaluations

Examples

```
fn = function(x) (x-1)^2; goldensearch(fn=fn,interval=c(-2,3),tol=1)
```

goldopt

*Integer Golden Search Minimisation***Description**

This function conducts an integer golden search minimisation of a univariate function.

Usage

```
goldopt(fn, interval, tol = 1)
```

Arguments

fn	function to be minimised. fn should return a list, with fval as the function value.
interval	a vector of length two containing the minimum and maximum interger values within which to search for the minimiser.
tol	the tolerance level. Defaults at 1

Value

k minimiser of fn()
 crit the minimum
 iter total number of iterations
 iterfn total number of function evaluations of fn()
 fobj an object of the function minimisation
 key a logical for warning if fobj may not correspond to k

Examples

```
set.seed(14) #Generate data
N = 1000; (bets = rep(-2:2,4)); p = length(bets); X = matrix(rnorm(N*p),N,p)
Y = cbind(1,X)%*%matrix(c(0.5,bets),ncol = 1)
fn=function(k){du=CCRLs.coord(Y,X,k=k,nc=1)
return(list(fval=BIC(du$mobj),obj=du))}
goldopt(fn=interval=c(2,7),tol=1)
```

linrclus

*Linear regression via coordinate descent with covariate clustering***Description**

Covariate assignment to k clusters using the coordinate descent algorithm. This function is a wrapper for the C function `linreg_coord_clus`

Usage

```
linrclus(Y, X, k, coefs, clus, clumns, nC = 1, x = FALSE)
```

Arguments

<code>Y</code>	vector of outcome variable
<code>X</code>	matrix of covariates. Should not include 1's for the intercept
<code>k</code>	number of clusters
<code>coefs</code>	vector of coefficients as starting values. Should not include the intercept.
<code>clus</code>	vector of covariate cluster assignments as starting values
<code>clumns</code>	vector k cluster parameter centers
<code>nC</code>	first $nC-1$ covariates in X not to cluster. Must be at least 1 for the intercept
<code>x</code>	a logical for returning the design matrix

Value

`clus` cluster assignments
`coefs` vector of coefficients as starting values
`clumns` vector of cluster means

Examples

```
set.seed(14) #Generate data
N = 1000; (bets = rep(-2:2,4)); p = length(bets); X = matrix(rnorm(N*p),N,p)
Y = cbind(1,X)%*%matrix(c(0.5,bets),ncol = 1)
begin_v<- rep(NA,p)
for (j in 1:p) {
  begin_v[j] = stats::coef(lm(Y~X[,j]))[2]
}
set.seed(12); kclus_obj<- kmeans(begin_v,centers = 5)
linrclus(Y,X,k=5,coefs=c(0,begin_v),clus=kclus_obj$cluster,clumns=kclus_obj$centers)
```

netdat	<i>Construct a network design matrix</i>
--------	--

Description

This function creates the design matrix for a latent network structure using a balanced panel

Usage

```
netdat(datf, Y, X, Wi, W = NULL, panvar, tvar, factors, scaling = TRUE,
       unicons = TRUE)
```

Arguments

datf	the entire data frame of balanced panel with NT rows of unit-time observations
Y	dependent variable in the data frame datf
X	the covariate(s) generating spillovers
Wi	other unit-varying (can be time-invariant) control variables
W	global variables. these are only time varying but are common to all units. eg. GDP for individual/state-level data. Note that W has to be a vector of length T so cannot be in the data frame datf
panvar	the panel variable eg. unique person/firm identifiers
tvar	time variable, eg. years
factors	a vector of characters of factors in the data
scaling	a logical indicating whether non-discrete covariates should be scaled by their standard deviations
unicons	a logical indicating whether to include unit-specific constant term

Value

Y vector of dependent variables
 X a block matrix of spillover matrix ($TN \times N^2$)
 Wm a matrix corresponding to covariate Wi
 Wf a matrix of dummies corresponding to factors

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