

# Package ‘sparsegl’

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**Type** Package

**Title** Sparse Group Lasso

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**Description** Efficient implementation of sparse group lasso with optional bound constraints on the coefficients. It supports the use of a sparse design matrix as well as returning coefficient estimates in a sparse matrix. Furthermore, it correctly calculates the degrees of freedom to allow for information criteria rather than cross-validation with very large data. Finally, the interface to compiled code avoids unnecessary copies and allows for the use of long integers.

**License** GPL (>= 2)

**URL** <https://github.com/dajmcdon/sparsegl/>

**BugReports** <https://github.com/dajmcdon/sparsegl/issues/>

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coef.cv.sparsegl	<i>Extract coefficients from a cv.sparsegl object.</i>
------------------	--

---

### Description

This function extracts coefficients from a cross-validated `sparsegl()` model, using the stored "sparsegl.fit" object, and the optimal value chosen for lambda.

### Usage

```
## S3 method for class 'cv.sparsegl'
coef(object, s = c("lambda.1se", "lambda.min"), ...)
```

**Arguments**

object	Fitted <code>cv.sparsegl()</code> object.
s	Value(s) of the penalty parameter lambda at which coefficients are desired. Default is the single value <code>s = "lambda.1se"</code> stored in the CV object (corresponding to the largest value of lambda such that CV error estimate is within 1 standard error of the minimum). Alternatively <code>s = "lambda.min"</code> can be used (corresponding to the minimum of cross validation error estimate). If s is numeric, it is taken as the value(s) of lambda to be used.
...	Not used.

**Value**

The coefficients at the requested value(s) for lambda.

**See Also**

`cv.sparsegl()` and `predict.cv.sparsegl()`.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
cv_fit <- cv.sparsegl(X, y, groups)
coef(cv_fit, s = c(0.02, 0.03))
```

---

code: `coef.sparsegl`
*Extract model coefficients from a sparsegl object.*


---

**Description**

Computes the coefficients at the requested value(s) for lambda from a `sparsegl()` object.

**Usage**

```
## S3 method for class 'sparsegl'
coef(object, s = NULL, ...)
```

**Arguments**

object	Fitted <code>sparsegl()</code> object.
s	Value(s) of the penalty parameter lambda at which coefficients are required. Default is the entire sequence.
...	Not used.

**Details**

`s` is the new vector of lambda values at which predictions are requested. If `s` is not in the lambda sequence used for fitting the model, the `coef` function will use linear interpolation to make predictions. The new values are interpolated using a fraction of coefficients from both left and right lambda indices.

**Value**

The coefficients at the requested values for lambda.

**See Also**

[sparsegl\(\)](#) and [predict.sparsegl\(\)](#).

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
coef(fit1, s = c(0.02, 0.03))
```

---

cv.sparsegl

*Cross-validation for a sparsegl object.*

---

**Description**

Performs k-fold cross-validation for [sparsegl\(\)](#). This function is largely similar [glmnet::cv.glmnet\(\)](#).

**Usage**

```
cv.sparsegl(
  x,
  y,
  group = NULL,
  family = c("gaussian", "binomial"),
  lambda = NULL,
  pred.loss = c("default", "mse", "deviance", "mae", "misclass"),
  nfolds = 10,
  foldid = NULL,
  ...
)
```

**Arguments**

x	Double. A matrix of predictors, of dimension $n \times p$ ; each row is a vector of measurements and each column is a feature. Objects of class <code>Matrix::sparseMatrix</code> are supported.
y	Double/Integer/Factor. The response variable. Quantitative for family="gaussian" and for other exponential families. If family="binomial" should be either a factor with two levels or a vector of integers taking 2 unique values. For a factor, the last level in alphabetical order is the target class.
group	Integer. A vector of consecutive integers describing the grouping of the coefficients (see example below).
family	Character or function. Specifies the generalized linear model to use. Valid options are: <ul style="list-style-type: none"> <li>• "gaussian" - least squares loss (regression, the default),</li> <li>• "binomial" - logistic loss (classification)</li> </ul> <p>For any other type, a valid <code>stats::family()</code> object may be passed. Note that these will generally be much slower to estimate than the built-in options passed as strings. So for example, family = "gaussian" and family = gaussian() will produce the same results, but the first will be much faster.</p>
lambda	A user supplied lambda sequence. The default, NULL results in an automatic computation based on <code>nlambda</code> , the smallest value of lambda that would give the null model (all coefficient estimates equal to zero), and <code>lambda.factor</code> . Supplying a value of lambda overrides this behaviour. It is likely better to supply a decreasing sequence of lambda values than a single (small) value. If supplied, the user-defined lambda sequence is automatically sorted in decreasing order.
pred.loss	Loss to use for cross-validation error. Valid options are: <ul style="list-style-type: none"> <li>• "default" the same as deviance (mse for regression and deviance otherwise)</li> <li>• "mse" mean square error</li> <li>• "deviance" the default (mse for Gaussian regression, and negative log-likelihood otherwise)</li> <li>• "mae" mean absolute error, can apply to any family</li> <li>• "misclass" for classification only, misclassification error.</li> </ul>
nfolds	Number of folds - default is 10. Although nfolds can be as large as the sample size (leave-one-out CV), it is not recommended for large datasets. Smallest value allowable is <code>nfolds = 3</code> .
foldid	An optional vector of values between 1 and nfolds identifying which fold each observation is in. If supplied, nfolds can be missing.
...	Additional arguments to <code>sparsegl()</code> .

**Details**

The function runs `sparsegl()` `nfolds + 1` times; the first to get the lambda sequence, and then the remainder to compute the fit with each of the folds omitted. The average error and standard error over the folds are computed.

**Value**

An object of class `cv.sparsegl()` is returned, which is a list with the components describing the cross-validation error.

<code>lambda</code>	The values of <code>lambda</code> used in the fits.
<code>cvm</code>	The mean cross-validated error - a vector of length <code>length(lambda)</code> .
<code>cvsd</code>	Estimate of standard error of <code>cvm</code> .
<code>cvupper</code>	Upper curve = <code>cvm + cvsd</code> .
<code>cvlower</code>	Lower curve = <code>cvm - cvsd</code> .
<code>name</code>	A text string indicating type of measure (for plotting purposes).
<code>nnzero</code>	The number of non-zero coefficients for each <code>lambda</code>
<code>active_grps</code>	The number of active groups for each <code>lambda</code>
<code>sparsegl.fit</code>	A fitted <code>sparsegl()</code> object for the full data.
<code>lambda.min</code>	The optimal value of <code>lambda</code> that gives minimum cross validation error <code>cvm</code> .
<code>lambda.1se</code>	The largest value of <code>lambda</code> such that error is within 1 standard error of the minimum.
<code>call</code>	The function call.

**See Also**

`sparsegl()`, as well as `plot()`, `predict()`, and `coef()` methods for "cv.sparsegl" objects.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
cv_fit <- cv.sparsegl(X, y, groups)
```

---

estimate\_risk

*Calculate information criteria.*

---

**Description**

This function uses the degrees of freedom to calculate various information criteria. This function uses the "unknown variance" version of the likelihood. Only implemented for Gaussian regression. The constant is ignored (as in `stats::extractAIC()`).

**Usage**

```
estimate_risk(object, x, type = c("AIC", "BIC", "GCV"), approx_df = FALSE)
```

**Arguments**

object	fitted object from a call to <code>sparsegl()</code> .
x	Matrix. The matrix of predictors used to estimate the <code>sparsegl</code> object. May be missing if <code>approx_df = TRUE</code> .
type	one or more of AIC, BIC, or GCV.
approx_df	the df component of a <code>sparsegl</code> object is an approximation (albeit a fairly accurate one) to the actual degrees-of-freedom. However, the exact value requires inverting a portion of $X'X$ . So this computation may take some time (the default computes the exact df).

**Value**

a data.frame with as many rows as `object$lambda`. It contains columns `lambda`, `df`, and the requested risk types.

**References**

Vaiteer S, Deledalle C, Peyré G, Fadili J, Dossal C. (2012). *The Degrees of Freedom of the Group Lasso for a General Design*. <https://arxiv.org/pdf/1212.6478.pdf>.

**See Also**

`sparsegl()` method.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
estimate_risk(fit1, type = "AIC", approx_df = TRUE)
```

---

make_irls_warmup	<i>Create starting values for iterative reweighted least squares</i>
------------------	--

---

### Description

This function may be used to create potentially valid starting values for calling `sparsegl()` with a `stats::family()` object. It is not typically necessary to call this function (as it is used internally to create some), but in some cases, especially with custom generalized linear models, it may improve performance.

### Usage

```
make_irls_warmup(nobs, nvars, b0 = 0, beta = double(nvars), r = double(nobs))
```

### Arguments

nobs	Number of observations in the response (or rows in x).
nvars	Number of columns in x
b0	Scalar. Initial value for the intercept.
beta	Vector. Initial values for the coefficients. Must be length nvars (or a scalar).
r	Vector. Initial values for the deviance residuals. Must be length nobs (or a scalar).

### Details

Occasionally, the irls fitting routine may fail with an admonition to create valid starting values.

### Value

List of class `irlssppl_warmup`

---

plot.cv.sparsegl	<i>Plot cross-validation curves produced from a cv.sparsegl object.</i>
------------------	---

---

### Description

Plots the cross-validation curve, and upper and lower standard deviation curves, as a function of the lambda values used.

### Usage

```
## S3 method for class 'cv.sparsegl'
plot(x, log_axis = c("xy", "x", "y", "none"), sign.lambda = 1, ...)
```

**Arguments**

x	Fitted "cv.sparsegl" object, produced with <code>cv.sparsegl()</code> .
log_axis	Apply log scaling to the requested axes.
sign.lambda	Either plot against $\log(\lambda)$ (default) or the reverse if $\text{sign}(\lambda) < 0$ .
...	Not used.

**Details**

A `ggplot2::ggplot()` plot is produced. Additional user modifications may be added as desired.

**See Also**

`cv.sparsegl()`.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
cv_fit <- cv.sparsegl(X, y, groups)
plot(cv_fit)
```

---

plot.sparsegl

*Plot solution paths from a sparsegl object.*

---

**Description**

Produces a coefficient profile plot of a fitted `sparsegl()` object. The result is a `ggplot2::ggplot()`. Additional user modifications can be added as desired.

**Usage**

```
## S3 method for class 'sparsegl'
plot(
  x,
  y_axis = c("coef", "group"),
  x_axis = c("lambda", "penalty"),
  add_legend = n_legend_values < 20,
  ...
)
```

**Arguments**

x	Fitted "sparsegl" object, produced by <code>sparsegl()</code> .
y_axis	Variable on the y_axis. Either the coefficients (default) or the group norm.
x_axis	Variable on the x-axis. Either the (log)-lambda sequence (default) or the value of the penalty. In the second case, the penalty is scaled by its maximum along the path.
add_legend	Show the legend. Often, with many groups/predictors, this can become overwhelming. The default produces a legend if the number of groups/predictors is less than 20.
...	Not used.

**See Also**

`sparsegl()`.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
plot(fit1, y_axis = "coef", x_axis = "penalty")
```

---

`predict.cv.sparsegl`    *Make predictions from a cv.sparsegl object.*

---

**Description**

This function makes predictions from a cross-validated `cv.sparsegl()` object, using the stored `sparsegl.fit` object, and the value chosen for `lambda`.

**Usage**

```
## S3 method for class 'cv.sparsegl'
predict(
  object,
  newx,
  s = c("lambda.1se", "lambda.min"),
  type = c("link", "response", "coefficients", "nonzero", "class"),
  ...
)
```

**Arguments**

object	Fitted <code>cv.sparsegl()</code> object.
newx	Matrix of new values for x at which predictions are to be made. Must be a matrix. This argument is mandatory.
s	Value(s) of the penalty parameter lambda at which coefficients are desired. Default is the single value <code>s = "lambda.1se"</code> stored in the CV object (corresponding to the largest value of lambda such that CV error estimate is within 1 standard error of the minimum). Alternatively <code>s = "lambda.min"</code> can be used (corresponding to the minimum of cross validation error estimate). If s is numeric, it is taken as the value(s) of lambda to be used.
type	Type of prediction required. Type "link" gives the linear predictors for "binomial"; for "gaussian" models it gives the fitted values. Type "response" gives predictions on the scale of the response (for example, fitted probabilities for "binomial"); for "gaussian" type "response" is equivalent to type "link". Type "coefficients" computes the coefficients at the requested values for s. Type "class" applies only to "binomial" models, and produces the class label corresponding to the maximum probability. Type "nonzero" returns a list of the indices of the nonzero coefficients for each value of s.
...	Not used.

**Value**

A matrix or vector of predicted values.

**See Also**

`cv.sparsegl()` and `coef.cv.sparsegl()`.

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
cv_fit <- cv.sparsegl(X, y, groups)
predict(cv_fit, newx = X[50:60, ], s = "lambda.min")
```

---

predict.sparsegl      *Make predictions from a sparsegl object.*

---

### Description

Similar to other predict methods, this function produces fitted values and class labels from a fitted `sparsegl` object.

### Usage

```
## S3 method for class 'sparsegl'
predict(
  object,
  newx,
  s = NULL,
  type = c("link", "response", "coefficients", "nonzero", "class"),
  ...
)
```

### Arguments

object	Fitted <code>sparsegl()</code> model object.
newx	Matrix of new values for $x$ at which predictions are to be made. Must be a matrix. This argument is mandatory.
s	Value(s) of the penalty parameter $\lambda$ at which predictions are required. Default is the entire sequence used to create the model.
type	Type of prediction required. Type "link" gives the linear predictors for "binomial"; for "gaussian" models it gives the fitted values. Type "response" gives predictions on the scale of the response (for example, fitted probabilities for "binomial"); for "gaussian" type "response" is equivalent to type "link". Type "coefficients" computes the coefficients at the requested values for $s$ . Type "class" applies only to "binomial" models, and produces the class label corresponding to the maximum probability. Type "nonzero" returns a list of the indices of the nonzero coefficients for each value of $s$ .
...	Not used.

### Details

$s$  is the new vector of  $\lambda$  values at which predictions are requested. If  $s$  is not in the  $\lambda$  sequence used for fitting the model, the `coef` function will use linear interpolation to make predictions. The new values are interpolated using a fraction of coefficients from both left and right  $\lambda$  indices.

### Value

The object returned depends on type.

**See Also**

[sparsegl\(\)](#), [coef.sparsegl\(\)](#).

**Examples**

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit1 <- sparsegl(X, y, group = groups)
predict(fit1, newx = X[10, ], s = fit1$lambda[3:5])
```

---

sparsegl

*Regularization paths for sparse group-lasso models*

---

**Description**

Fits regularization paths for sparse group-lasso penalized learning problems at a sequence of regularization parameters  $\lambda$ . Note that the objective function for least squares is

$$RSS/(2n) + \lambda \text{penalty}$$

Users can also tweak the penalty by choosing a different penalty factor.

**Usage**

```
sparsegl(
  x,
  y,
  group = NULL,
  family = c("gaussian", "binomial"),
  nlambda = 100,
  lambda.factor = ifelse(nobs < nvars, 0.01, 1e-04),
  lambda = NULL,
  pf_group = sqrt(bs),
  pf_sparse = rep(1, nvars),
  intercept = TRUE,
  asparse = 0.05,
  standardize = TRUE,
  lower_bnd = -Inf,
  upper_bnd = Inf,
  weights = NULL,
  offset = NULL,
  warm = NULL,
  trace_it = 0,
```

```

dfmax = as.integer(max(group)) + 1L,
pmax = min(dfmax * 1.2, as.integer(max(group))),
eps = 1e-08,
maxit = 3e+06
)

```

## Arguments

x	Double. A matrix of predictors, of dimension $n \times p$ ; each row is a vector of measurements and each column is a feature. Objects of class <code>Matrix::sparseMatrix</code> are supported.
y	Double/Integer/Factor. The response variable. Quantitative for <code>family="gaussian"</code> and for other exponential families. If <code>family="binomial"</code> should be either a factor with two levels or a vector of integers taking 2 unique values. For a factor, the last level in alphabetical order is the target class.
group	Integer. A vector of consecutive integers describing the grouping of the coefficients (see example below).
family	Character or function. Specifies the generalized linear model to use. Valid options are: <ul style="list-style-type: none"> <li>"gaussian" - least squares loss (regression, the default),</li> <li>"binomial" - logistic loss (classification)</li> </ul> <p>For any other type, a valid <code>stats::family()</code> object may be passed. Note that these will generally be much slower to estimate than the built-in options passed as strings. So for example, <code>family="gaussian"</code> and <code>family=gaussian()</code> will produce the same results, but the first will be much faster.</p>
nlambda	The number of lambda values - default is 100.
lambda.factor	A multiplicative factor for the minimal lambda in the lambda sequence, where $\min(\lambda) = \lambda.factor * \max(\lambda)$ . $\max(\lambda)$ is the smallest value of lambda for which all coefficients are zero. The default depends on the relationship between $n$ (the number of rows in the matrix of predictors) and $p$ (the number of predictors). If $n \geq p$ , the default is $0.0001$ . If $n < p$ , the default is $0.01$ . A very small value of <code>lambda.factor</code> will lead to a saturated fit. This argument has no effect if there is user-defined lambda sequence.
lambda	A user supplied lambda sequence. The default, NULL results in an automatic computation based on <code>nlambda</code> , the smallest value of lambda that would give the null model (all coefficient estimates equal to zero), and <code>lambda.factor</code> . Supplying a value of <code>lambda</code> overrides this behaviour. It is likely better to supply a decreasing sequence of lambda values than a single (small) value. If supplied, the user-defined lambda sequence is automatically sorted in decreasing order.
pf_group	Penalty factor on the groups, a vector of the same length as the total number of groups. Separate penalty weights can be applied to each group of $\beta$ s to allow differential shrinkage. Can be 0 for some groups, which implies no shrinkage, and results in that group always being included in the model (depending on <code>pf_sparse</code> ). Default value for each entry is the square-root of the corresponding size of each group.

pf_sparse	Penalty factor on $\ell_1$ -norm, a vector the same length as the total number of columns in $x$ . Each value corresponds to one predictor. Can be 0 for some predictors, which implies that predictor will receive only the group penalty.
intercept	Whether to include intercept in the model. Default is TRUE.
aspase	The relative weight to put on the $\ell_1$ -norm in sparse group lasso. Default is 0.05 (resulting in 0.95 on the $\ell_2$ -norm).
standardize	Logical flag for variable standardization (scaling) prior to fitting the model. Default is TRUE.
lower_bnd	Lower bound for coefficient values, a vector in length of 1 or of length the number of groups. Must be non-positive numbers only. Default value for each entry is $-\text{Inf}$ .
upper_bnd	Upper for coefficient values, a vector in length of 1 or of length the number of groups. Must be non-negative numbers only. Default value for each entry is $\text{Inf}$ .
weights	Double vector. Optional observation weights. These can only be used with a <code>stats::family()</code> object.
offset	Double vector. Optional offset (constant predictor without a corresponding coefficient). These can only be used with a <code>stats::family()</code> object.
warm	List created with <code>make_irls_warmup()</code> . These can only be used with a <code>stats::family()</code> object, and is not typically necessary even then.
trace_it	Scalar integer. Larger values print more output during the irls loop. Typical values are 0 (no printing), 1 (some printing and a progress bar), and 2 (more detailed printing). These can only be used with a <code>stats::family()</code> object.
dfmax	Limit the maximum number of groups in the model. Default is no limit.
pmax	Limit the maximum number of groups ever to be nonzero. For example once a group enters the model, no matter how many times it exits or re-enters model through the path, it will be counted only once.
eps	Convergence termination tolerance. Defaults value is $1e-8$ .
maxit	Maximum number of outer-loop iterations allowed at fixed lambda value. Default is $3e8$ . If models do not converge, consider increasing <code>maxit</code> .

## Value

An object with S3 class "sparsegl". Among the list components:

- `call` The call that produced this object.
- `b0` Intercept sequence of length `length(lambda)`.
- `beta` A  $p \times \text{length}(\text{lambda})$  sparse matrix of coefficients.
- `df` The number of features with nonzero coefficients for each value of lambda.
- `dim` Dimension of coefficient matrix.
- `lambda` The actual sequence of lambda values used.
- `npasses` Total number of iterations summed over all lambda values.
- `jerr` Error flag, for warnings and errors, 0 if no error.

- group A vector of consecutive integers describing the grouping of the coefficients.
- nobs The number of observations used to estimate the model.

If `sparsegl()` was called with a `stats::family()` method, this may also contain information about the deviance and the family used in fitting.

### See Also

`cv.sparsegl()` and the `plot()`, `predict()`, and `coef()` methods for "sparsegl" objects.

### Examples

```
n <- 100
p <- 20
X <- matrix(rnorm(n * p), nrow = n)
eps <- rnorm(n)
beta_star <- c(rep(5, 5), c(5, -5, 2, 0, 0), rep(-5, 5), rep(0, (p - 15)))
y <- X %*% beta_star + eps
groups <- rep(1:(p / 5), each = 5)
fit <- sparsegl(X, y, group = groups)

yp <- rpois(n, abs(X %*% beta_star))
fit_pois <- sparsegl(X, yp, group = groups, family = poisson())
```

---

trust\_experts

*Trust in scientific experts during the Covid-19 pandemic*

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### Description

A dataset containing a measurement of "trust" in experts along with other metrics collected through the Delphi Group at Carnegie Mellon University U.S. COVID-19 Trends and Impact Survey, in partnership with Facebook. This particular dataset is created from one of the public [contingency tables](#), specifically, the breakdown by state, age, gender, and race/ethnicity published on 05 February 2022.

### Usage

```
trust_experts
```

### Format

A data.frame with 9759 rows and 8 columns

`trust_experts` Real-valued. This is the average of `pct_trust_covid_info_*` where `*` is each of `doctors`, `expert`, `cdc`, and `govt_health`.

`period` Factor. Start date of data collection period. There are 13 monthly periods

`region` Factor. State abbreviation.

`age` Factor. Self-reported age bucket.

gender Factor. Self-reported gender.

raceethnicity Factor. Self-reported race or ethnicity.

cli Real-valued. This is the wcli indicator measuring the percent of circulating Covid-like illness in a particular region. See the [Delphi Epidata API](#) for a complete description.

hh\_cmnty\_cli Real-valued. This is the whh\_cmnty\_cli indicator measuring the percent of people reporting illness in their local community and household.

## Source

The U.S. COVID-19 Trends and Impact Survey.

The paper describing the survey:

Joshua A. Salomon, Alex Reinhart, Alyssa Bilinski, Eu Jing Chua, Wichada La Motte-Kerr, Minttu M. Rönn, Marissa Reitsma, Katherine Ann Morris, Sarah LaRocca, Tamar Farag, Frauke Kreuter, Roni Rosenfeld, and Ryan J. Tibshirani (2021). "The US COVID-19 Trends and Impact Survey: Continuous real-time measurement of COVID-19 symptoms, risks, protective behaviors, testing, and vaccination", Proceedings of the National Academy of Sciences 118 (51) e2111454118. [doi:10.1073/pnas.2111454118](https://doi.org/10.1073/pnas.2111454118).

[The Public Delphi US CTIS Documentation](#)

## Examples

```
## Not run:
library(splines)
library(dplyr)
library(magrittr)
df <- 10

trust_experts <- trust_experts %>%
  mutate(across(
    where(is.factor),
    ~ set_attr(.x, "contrasts", contr.sum(nlevels(.x), FALSE, TRUE))
  ))

x <- Matrix::sparse.model.matrix(
  ~ 0 + region + age + gender + raceethnicity + period +
  bs(cli, df = df) + bs(hh_cmnty_cli, df = df),
  data = trust_experts, drop.unused.levels = TRUE)

gr <- sapply(trust_experts, function(x) ifelse(is.factor(x), nlevels(x), NA))
gr <- rep(seq(ncol(trust_experts) - 1), times = c(gr[!is.na(gr)], df, df))
fit <- cv.sparsegl(x, trust_experts$trust_experts, gr)

## End(Not run)
```

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`zero_norm`*Calculate common norms*

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**Description**

Calculate different norms of vectors with or without grouping structures.

**Usage**`zero_norm(x)``one_norm(x)``two_norm(x)``grouped_zero_norm(x, gr)``grouped_one_norm(x, gr)``grouped_two_norm(x, gr)``grouped_sp_norm(x, gr, aspase)``gr_one_norm(x, gr)``gr_two_norm(x, gr)``sp_group_norm(x, gr, aspase = 0.05)`**Arguments**

<code>x</code>	A numeric vector.
<code>gr</code>	An integer (or factor) vector of the same length as <code>x</code> .
<code>aspase</code>	Scalar. The weight to put on the l1 norm when calculating the group norm.

**Value**

A numeric scalar or vector

**Functions**

- `zero_norm()`: l0-norm (number of nonzero entries).
- `one_norm()`: l1-norm (Absolute-value norm).
- `two_norm()`: l2-norm (Euclidean norm).
- `grouped_zero_norm()`: A vector of group-wise l0-norms.
- `grouped_one_norm()`: A vector of group-wise l1-norms.

- `grouped_two_norm()`: A vector of group-wise l2-norms.
- `grouped_sp_norm()`: A vector of length `unique(gr)` consisting of the asparse convex combination of the l1 and l2-norm for each group.
- `gr_one_norm()`: The l1-norm norm of a vector (a scalar).
- `gr_two_norm()`: The sum of the group-wise l2-norms of a vector (a scalar).
- `sp_group_norm()`: The sum of the asparse convex combination of group l1 and l2-norms vectors (a scalar).

### Examples

```
x <- c(rep(-1, 5), rep(0, 5), rep(1,5))
gr <- c(rep(1,5), rep(2,5), rep(3,5))
aspase <- 0.05
grouped_sp_norm(x, gr, aspase)
```

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