Package 'gradLasso'

January 8, 2026

Title Gradient Descent LASSO with Stability Selection and Bootstrapped Confidence Intervals

Version 0.1.1

Description Implements LASSO regression using gradient descent with support for Gaussian, Binomial, Negative Binomial, and Zero-Inflated Negative Binomial (ZINB) families. Features cross-validation for determining lambda, stability selection, and bootstrapping for confidence intervals. Methods described in Tibshirani (1996) <doi:10.1111/j.2517-6161.1996.tb02080.x> and Meinshausen and Buhlmann (2010) <doi:10.1111/j.1467-9868.2010.00740.x>.

URL https://github.com/ddefranza/gradLasso

BugReports https://github.com/ddefranza/gradLasso/issues

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Encoding UTF-8

RoxygenNote 7.3.3

Imports stats, utils, graphics, grDevices, foreach, doParallel, parallel

Suggests testthat (>= 3.0.0), knitr, rmarkdown

Config/testthat/edition 3

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2026-01-08 19:10:10 UTC

Contents

`coef.gradLasso` *Extract Model Coefficients*

Description

Extract Model Coefficients

Usage

```
## S3 method for class 'gradLasso'
coef(object, ...)
```

Arguments

`object`	A gradLasso fitted object.
`...`	Additional arguments.

Value

A numeric vector of coefficients.

`cv.gradLasso` *Cross-Validation for gradLasso*

Description

Cross-Validation for gradLasso

Usage

```
cv.gradLasso(
  object,
  data = NULL,
  family,
  lambdas = NULL,
  nfolds = 5,
  batch_size = NULL,
  subsample = NULL,
  parallel = FALSE,
  verbose = FALSE
)
```

Arguments

`object`	Matrix X (predictors).
`data`	Vector y (response).
`family`	Family object (e.g., grad_gaussian, grad_zinb).
`lambdas`	Vector of lambda values to test. If NULL, a sequence is generated.
`nfolds`	Integer. Number of CV folds (default 5).
`batch_size`	Integer. Mini-batch size for SGD.
`subsample`	Integer. Number of rows to use for CV (if NULL, uses all data).
`parallel`	Logical. If TRUE, runs folds in parallel.
`verbose`	Logical. Print progress to console?

Value

A list containing CV results (mean error, SD, optimal lambdas).

fitted.gradLasso *Extract Fitted Values*

Description

Extract Fitted Values

Usage

```
## S3 method for class 'gradLasso'
fitted(object, ...)
```

Arguments

object	A gradLasso fitted object.
...	Additional arguments.

Value

A numeric vector of fitted values.

gradLasso *Gradient Descent LASSO with Stability Selection*

Description

Gradient Descent LASSO with Stability Selection

Usage

```
gradLasso(
  formula,
  data = NULL,
  family = grad_gaussian(),
  lambda = NULL,
  lambda_cv = TRUE,
  standardize = TRUE,
  cv_subsample = NULL,
  parallel = FALSE,
  n_cores = NULL,
  boot = TRUE,
  n_boot = 50,
  boot_ci = c(0.025, 0.975),
  batch_size = NULL,
  warm_start = TRUE,
  verbose = FALSE
)
```

Arguments

formula	Formula object. Supports pipes for ZINB (e.g., y ~ x1 + x2 | z1).
data	Data frame.
family	Family object.
lambda	Optional fixed lambda.
lambda_cv	Configuration for CV.
standardize	Logical. Standardize predictors?
cv_subsample	Integer. Speedup for CV.
parallel	Logical. Enable parallel processing?
n_cores	Integer. Number of cores.
boot	Logical. Run stability selection?
n_boot	Number of bootstraps.
boot_ci	Vector of two probabilities for CIs.
batch_size	Integer. Mini-batch SGD.
warm_start	Logical. Warm start bootstraps.
verbose	Logical. Print progress to console?

Value

An object of class gradLasso. This is a list containing:

coefficients	A named vector of the final estimated regression coefficients.
fitted.values	A vector of the fitted values (response scale).
residuals	A vector of the residuals (observed - fitted).
lambda	The penalty term (lambda) used for the final model.
boot_matrix	A matrix of bootstrap coefficient estimates (rows=iterations, cols=features), or NULL if boot=FALSE.
cv_results	A list containing cross-validation metrics (if lambda_cv=TRUE), including lambda.min.
family	The family object used for the fit.
deviance	The final model deviance.
nobs	The number of observations used.

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gradLasso_imports *Package Imports and Global Documentation*

Description

This file manages all external package dependencies and global imports required by gradLasso. It ensures that standard library functions (like those from stats or graphics) are available without explicit namespace qualification.

grad_binomial *Binomial Family (Logistic Regression)*

Description

Binomial Family (Logistic Regression)

Usage

```
grad_binomial()
```

Value

A list containing gradient, deviance, and prediction functions for logistic regression.

grad_gaussian *Gaussian Family (Least Squares)*

Description

Gaussian Family (Least Squares)

Usage

```
grad_gaussian()
```

Value

A list containing gradient, deviance, and prediction functions for Gaussian regression.

grad_negbin *Negative Binomial Family*

Description

Negative Binomial Family

Usage

```
grad_negbin()
```

Value

A list containing gradient, deviance, and prediction functions for Negative Binomial regression.

grad_zinb *Zero-Inflated Negative Binomial Family*

Description

Zero-Inflated Negative Binomial Family

Usage

```
grad_zinb()
```

Value

A list containing gradient, deviance, and prediction functions for ZINB regression.

logLik.gradLasso *Extract Log-Likelihood*

Description

Extract Log-Likelihood

Usage

```
## S3 method for class 'gradLasso'
logLik(object, ...)
```

Arguments

object	A gradLasso fitted object.
...	Additional arguments.

Value

An object of class logLik.

plot.cv.gradLasso *Plot CV results (Standalone)*

Description

Plot CV results (Standalone)

Usage

```
## S3 method for class 'cv.gradLasso'
plot(x, ...)
```

Arguments

x	A cv.gradLasso fitted object.
...	Additional arguments passed to plot.

Value

Invisibly returns NULL.

plot.gradLasso *Master Plot Method*

Description

Diagnostic plots for gradLasso objects (Stability, CV, Residuals).

Usage

```
## S3 method for class 'gradLasso'
plot(x, which = c(1L:5L), ...)
```

Arguments

x	A gradLasso fitted object.
which	Integer vector specifying which plots to draw (1:5).
...	Additional arguments passed to plotting functions.

Value

Invisibly returns NULL.

predict.gradLasso *Predict method for gradLasso*

Description

Predict method for gradLasso

Usage

```
## S3 method for class 'gradLasso'
predict(object, newdata, type = c("response", "link", "count", "zero"), ...)
```

Arguments

object	A gradLasso fitted object.
newdata	Optional new data frame for prediction. If missing, returns fitted values.
type	Type of prediction: "response" (default), "link", "count" (mu), or "zero" (pi).
...	Additional arguments passed to methods.

Value

A vector or matrix of predictions.

print.cv.gradLasso *Print CV results*

Description

Print CV results

Usage

```
## S3 method for class 'cv.gradLasso'
print(x, ...)
```

Arguments

x	A cv.gradLasso fitted object.
...	Additional arguments passed to print.

Value

Invisibly returns the input object.

print.gradLasso *Print method for gradLasso object*

Description

Print method for gradLasso object

Usage

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

Arguments

x	A gradLasso fitted object.
...	Additional arguments passed to print.

Value

Invisibly returns the input object.

print.summary.gradLasso *Print method for summary*

Description

Print method for summary

Usage

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

Arguments

x	A summary.gradLasso object.
...	Additional arguments passed to print.

Value

Invisibly returns the input object.

residuals.gradLasso *Extract Residuals*

Description

Extract Residuals

Usage

```
## S3 method for class 'gradLasso'
residuals(object, ...)
```

Arguments

object	A gradLasso fitted object.
...	Additional arguments.

Value

A numeric vector of residuals.

simulate_data *Simulate Data for gradLasso*

Description

Generates synthetic data for Gaussian, Binomial, Negative Binomial, or ZINB models with correlated predictors.

Usage

```
simulate_data(
  n = 1000,
  p = 20,
  family = "gaussian",
  rho = 0.2,
  k = 5,
  k_mu = 5,
  k_pi = 5,
  theta = 1,
  intercept_mu = 0,
  intercept_pi = -1,
  snr = 3
)
```

Arguments

n	Number of observations.
p	Number of predictors.
family	Model family: "gaussian", "binomial", "negbin", or "zinb".
rho	Correlation coefficient between predictors (Toeplitz structure).
k	Number of non-zero coefficients (sparsity) for single-part models.
k_mu	Number of non-zero coefficients for Count part (ZINB only).
k_pi	Number of non-zero coefficients for Zero part (ZINB only).
theta	Dispersion parameter for NegBin and ZINB.
intercept_mu	Intercept for main model (or count part).
intercept_pi	Intercept for zero-inflation part.
snr	Signal-to-noise ratio (Gaussian only).

Value

A list containing the following components:

X	A matrix of predictor variables with induced correlation.
y	A vector of the simulated response variable.
family	The family string used for simulation.
truth	A list containing the true parameters used to generate the data (e.g., beta, theta, sigma).

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summary.gradLasso *Summary method for gradLasso*

Description

Summary method for gradLasso

Usage

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

Arguments

object	A gradLasso fitted object.
...	Additional arguments passed to methods.

Value

A list containing the coefficient table, fit statistics (AIC/BIC), and stability selection results.

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