

# Package ‘statr’

July 4, 2018

**Type** Package

**Title** Matt Galloway Personal R Package

**Version** 0.1.0

**Description** This is a personal R package. It contains a number of various R functions for organization and convenience purposes.

**URL** <https://github.com/MGallow/statr>

**BugReports** <https://github.com/MGallow/statr/issues>

**License** GPL (>= 2)

**ByteCompile** TRUE

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.0.1

**Imports** dplyr,  
ggplot2,  
magrittr,  
formatR,  
grid,  
devtools,  
ADMMsigma,  
glmnet

**Suggests** testthat,  
knitr,  
rmarkdown,  
pkgdown

**SystemRequirements** GNU make

**VignetteBuilder** knitr

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bsearch	<i>Bisection search</i>
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## Description

Minimizes a univariate strictly pseudoconvex function over the interval  $[a, b]$ . This is augmented code from Adam Rothman's STAT 8054 course (2017).

## Usage

```
bsearch(dg, a, b, L = 1e-07, quiet = FALSE)
```

## Arguments

dg	the derivative of the function to minimize, where $dg(u, \dots)$ is the function evaluated at $u$ .
a	left endpoint of the initial interval of uncertainty.
b	right endpoint of the initial interval of uncertainty.
L	the maximum length of the final interval of uncertainty.
quiet	should the function stay quiet?
...	additional argument specifications for dg

## Value

returns the midpoint of the final interval of uncertainty.

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`compound`*Generate compound symmetric matrices*

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**Description**

Generate a p-dimensional compound symmetric matrix.

**Usage**

```
compound(p = 8, n = NULL)
```

**Arguments**

p	desired dimension
n	option to generate n observations from covariance matrix S

**Examples**

```
compound(p = 10, n = 100)
```

---

`CVsplit`*CV split*

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**Description**

splits data objects into training and testing sets

**Usage**

```
CVsplit(X, Y, split = 0.5)
```

**Arguments**

X	n x p data matrix. Each row corresponds to a single observation and each column contains n observations of a single feature/variable.
Y	n x r response matrix. Each row corresponds to a single response and each column contains n response of a single feature/response.
split	fraction of objects devoted to training set

**Value**

X.train, Y.train, X.test, Y.test

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data_gen	<i>Normal Linear Data Generator</i>
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### Description

True beta values are generated from  $p \times r$  independent draws from  $N(0, 1/p)$  distribution.  $X$  are  $n$  independent draws from  $p$  multivariate normal  $N(0, \text{SigmaX})$ .  $Y$  is then generated using  $X$  and true beta values with an iid error term that follows  $r$  multivariate normal distribution  $N(0, \text{Sigma})$ .

### Usage

```
data_gen(n, p, r = 1, sparsity = 0.5, Sigma = c("tridiag", "dense",
  "denseQR", "compound"), s = NULL, SigmaX = c("tridiag", "dense",
  "denseQR", "compound"), sx = NULL, ...)
```

### Arguments

n	desired sample size
p	desired dimension
r	number of responses
sparsity	desired sparsity for beta
Sigma	covariance matrix structure used to generate $Y   X$
s	option to specify diagonal elements in Sigma
SigmaX	covariance matrix structure used to generate data $X$
sx	option to specify diagonal elements in SigmaX
...	additional arguments to pass to data generating functions

### Value

$Y$ ,  $X$ , betas, Sigma, SigmaX

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dense	<i>Generate dense matrices</i>
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### Description

Generate  $p$ -dimensional matrices so that its inverse is dense.

### Usage

```
dense(p = 8, base = 0.9, n = NULL)
```

### Arguments

p	desired dimension
base	base multiplier
n	option to generate $n$ observations from covariance matrix $S$

**Examples**

```
dense(p = 10, base = 0.9)
```

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denseQR	<i>Generate dense matrices (via spectral decomposition)</i>
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**Description**

Generate p-dimensional matrices so that its inverse is dense. The matrix will be generated so its first 'num' eigen values are 1000 and the remaining are 1. The orthogonal basis is generated via QR decomposition of

**Usage**

```
denseQR(p = 8, num = 5, n = NULL)
```

**Arguments**

p	desired dimension
num	number of 'large' eigen values. Note num must be less than p
n	option to generate n observations from covariance matrix S

**Examples**

```
denseQR(p = 10, num = 10)
```

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derivative	<i>Derivative</i>
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**Description**

Takes the approximate derivative for a given function

**Usage**

```
derivative(g, x, delta = 1e-07)
```

**Arguments**

g	the derivative of the function to minimize, where dg(u, ...) is the function evaluated at u.
x	value to evaluate the derivative at
delta	defaults to 10e-8

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diagnostic	<i>Diagnostic</i>
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**Description**

This function simply streamlines the process of creating diagnostic plots with ggplot

**Usage**

```
diagnostic(data., x., y.)
```

**Arguments**

data.	data frame
x.	x-axis
y.	y-axis

**Value**

a residual plot and QQ plot

**Examples**

```
diagnostic(iris, Sepal.Length, Sepal.Width)
```

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dsearch	<i>Dichotomous search</i>
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**Description**

Minimizes a univariate strictly quasiconvex function over the interval  $[a, b]$ . This is augmented code from Adam Rothman's STAT 8054 course (2017).

**Usage**

```
dsearch(g, a, b, L = 1e-07, eps = (L/2.1), quiet = FALSE)
```

**Arguments**

g	the function to minimize, where $g(u, \dots)$ is the function evaluated at $u$ .
a	left endpoint of the initial interval of uncertainty.
b	right endpoint of the initial interval of uncertainty.
L	the maximum length of the final interval of uncertainty.
eps	search parameter, must be less than $L/2$
quiet	should the function stay quiet?
...	additional argument specifications for g

**Value**

returns the midpoint of the final interval of uncertainty.

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fro	<i>Frobenius norm</i>
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**Description**

calculates the frobenius norm of an object

**Usage**

```
fro(X)
```

**Arguments**

X	object
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**Value**

norm

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LASSO	<i>Lasso regression</i>
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**Description**

calculate lasso regression coefficients using the optimal tuning parameter from the glmnet package.

**Usage**

```
LASSO(X, Y, lam = NULL, intercept = FALSE, standardize = FALSE)
```

**Arguments**

X	n x p data matrix. Each row corresponds to a single observation and each column contains n observations of a single feature/variable.
Y	n x r response matrix. Each row corresponds to a single response and each column contains n response of a single feature/response.
lam	tuning parameter

**Value**

betas, lam

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LDA	<i>Linear Discriminant Analysis</i>
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**Description**

this function fit the LDA model

**Usage**

```
LDA(X, y, method = c("MLE", "diagonal", "ridge"), lam = NULL)
```

**Arguments**

X	n x p matrix where the ith row is the values of the predictor for the ith case
y	n entry response vector where the ith entry is the response category in 1, ..., C for the ith case
method	estimation method
lam	optional tuning parameter specification

**Value**

returns a list with the parameter estimates

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multiplot	<i>Multiple Plot</i>
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**Description**

Taken from: [http://www.cookbook-r.com/Graphs/Multiple\\_graphs\\_on\\_one\\_page\\_\(ggplot2\)/](http://www.cookbook-r.com/Graphs/Multiple_graphs_on_one_page_(ggplot2)/)

**Usage**

```
multiplot(..., plotlist = NULL, cols = 1, layout = NULL)
```

**Arguments**

...	object can be passed in
plotlist	plotlist
cols	number of columns in layout
layout	a matrix specify the layout. If present, 'cols' is ignored

**Value**

plots



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predict\_QDA

*Predict QDA*


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**Description**

this function classifies test data using a fitted QDA model

**Usage**

```
predict_QDA(fit, Xtest)
```

**Arguments**

fit	this is a list with elements pi.hats, mu.hats, and Sigma.hats where pi.hats is a list of C response category sample proportions, mu.hats is a list of C p-dimensional sample mean proportions, Sigma.hats is a list of C p by p Sample covariance matrices
Xtest	this is a matrix with ntest rows and p column, each row is a test case

**Value**

returns a vector of ntest entries, where the ith entry is the estimated response category (some value in 1, ..., C) for the ith test case.

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QDA

*Quadratic Discriminant Analysis*


---

**Description**

this function fit the QDA model

**Usage**

```
QDA(X, y, method = c("MLE", "diagonal", "ridge"), lam = NULL)
```

**Arguments**

X	n x p matrix where the ith row is the values of the predictor for the ith case
y	n entry response vector where the ith entry is the response category in 1, ..., C for the ith case
method	estimation method
lam	optional tuning parameter specification

**Value**

returns a list with the parameter estimates

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RIDGE	<i>Ridge regression</i>
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**Description**

calculate ridge regression coefficients using the optimal tuning parameter from the glmnet package.

**Usage**

```
RIDGE(X, Y, lam = NULL, intercept = FALSE, standardize = FALSE)
```

**Arguments**

X	n x p data matrix. Each row corresponds to a single observation and each column contains n observations of a single feature/variable.
Y	n x r response matrix. Each row corresponds to a single response and each column contains n response of a single feature/response.
lam	tuning parameter

**Value**

betas, lam

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scatter	<i>Scatter</i>
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**Description**

This function simply streamlines the process of creating a scatterplot with ggplot

**Usage**

```
scatter(data., x., y.)
```

**Arguments**

data.	data frame
x.	x-axis
y.	y-axis

**Value**

a scatterplot

**Examples**

```
scatter(iris, Sepal.Length, Sepal.Width)
```

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`tidy`*Tidy*

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**Description**

tidys package R code and updates package documentation. Directly uses Yihui Xie's 'formatR' package.

**Usage**

```
tidy()
```

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`timeit`*Time-It*

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**Description**

Simple function that prints the computation time of a function

**Usage**

```
timeit(f)
```

**Arguments**

`f` the function to time

**Value**

returns the elapsed time

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`tridiag`*Generate tri-diagonal matrices*

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**Description**

Generate p-dimensional matrices so that its inverse is tri-diagonal.

**Usage**

```
tridiag(p = 8, base = 0.7, n = NULL)
```

**Arguments**

`p` desired dimension  
`base` base multiplier  
`n` option to generate n observations from covariance matrix S

**Examples**

```
tridiag(p = 10, base = 0.7)
```

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