Package ‘RcppArmadillo’

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Type Package
Title 'Rcpp' Integration for the 'Armadillo' Templated Linear Algebra Library
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Description 'Armadillo' is a templated C++ linear algebra library (by Conrad Sanderson) that aims towards a good balance between speed and ease of use. Integer, floating point and complex numbers are supported, as well as a subset of trigonometric and statistics functions. Various matrix decompositions are provided through optional integration with LAPACK and ATLAS libraries. The 'RcppArmadillo' package includes the header files from the templated 'Armadillo' library. Thus users do not need to install 'Armadillo' itself in order to use 'RcppArmadillo'. From release 7.800.0 on, 'Armadillo' is licensed under Apache License 2; previous releases were under licensed as MPL 2.0 from version 3.800.0 onwards and LGPL-3 prior to that; 'RcppArmadillo' (the 'Rcpp' bindings/bridge to Armadillo) is licensed under the GNU GPL version 2 or later, as is the rest of 'Rcpp'.
License GPL (>= 2)
LazyLoad yes
Depends R (>= 3.3.0)
LinkingTo Rcpp
Imports Rcpp (>= 0.11.0), stats, utils, methods
Suggests tinytest, Matrix (>= 1.3.0), pkgKitten, reticulate, slam
URL https://github.com/RcppCore/RcppArmadillo,
     https://dirk.eddelbuettel.com/code/rcpp.armadillo.html
BugReports https://github.com/RcppCore/RcppArmadillo/issues
NeedsCompilation yes
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Description

The package brings the power of Armadillo to R.

Armadillo

Armadillo is a C++ linear algebra library, aiming towards a good balance between speed and ease of use.

It provides efficient classes for vectors, matrices and cubes, as well as many functions which operate on the classes (eg. contiguous and non-contiguous submatrix views).

Various matrix decompositions are provided, and an automatic expression evaluator (via template meta-programming) combines several operations to increase efficiency.

The syntax (API) is deliberately similar to Matlab. It is useful for algorithm development directly in C++, or quick conversion of research code into production environments.

Armadillo has been primarily developed at NICTA (Australia) by Conrad Sanderson, with contributions from around the world.

RcppArmadillo

RcppArmadillo acts as a bridge between Rcpp and Armadillo, allowing the programmer to write code using Armadillo classes that integrate seamlessly with R via Rcpp.

Using RcppArmadillo

The simplest way to get started is to create a skeleton of a package using RcppArmadillo. This can be done conveniently by the RcppArmadillo.package.skeleton function.

The important steps are

- Include the RcppArmadillo.h header file, which also includes armadillo.h.
- Import Rcpp, and LinkingTo Rcpp and RcppArmadillo by adding these lines to the DESCRIPTION file:
armadillo_set_seed

Set the Armadillo Random Number Generator to the given value

Description

Set the Armadillo Random Number Generator to the given value

Usage

armadillo_set_seed(val)

Arguments

val The seed used to initialize Armadillo’s random number generator.
Details

Depending on whether RcppArmadillo was compiled for the C++98 standard (currently the default) or for C++11 (optional), two different RNGs may be used. This function resets either. For C++98, the R programming language’s RNG is used. For C++11, the RNG included in the `<random>` library is used only when `#define ARMA_USE_CXX11_RNG` is placed before `#include <RcppArmadillo.h>`. Otherwise, the R programming language’s RNG will be used.

Value

The function is invoked for its side effect and has no return value.

Note

This has been found to not work as expected in RStudio as its code also uses the system RNG library. You may have to either not run within RStudio or change your code to use a different RNG such as the one from R.

See Also

The R documentation on its RNGs all of which are accessible via Rcpp.

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armadillo_set_seed_random

*Set the Armadillo Random Number Generator to a random value*

Description

Set the Armadillo Random Number Generator to a random value

Usage

armadillo_set_seed_random()

Details

Depending on whether RcppArmadillo was compiled for the C++98 standard (currently the default) or for C++11 (optional), two different RNGs may be used. This function resets either. For C++98, the R programming language’s RNG is used. For C++11, the RNG included in the `<random>` library is used only when `#define ARMA_USE_CXX11_RNG` is placed before `#include <RcppArmadillo.h>`. Otherwise, the R programming language’s RNG will be used.

Value

The function is invoked for its side effect and has no return value.
Note

This has been found to not work as expected in RStudio as its code also uses the system RNG library. You may have to either not run within RStudio or change your code to use a different RNG such as the one from R.

See Also

The R documentation on its RNGs all of which are accessible via Rcpp.

armadillo_version

Report the version of Armadillo

Description

Report the version of Armadillo

Usage

armadillo_version(single)

Arguments

single A logical vector indicating whether a single return values is requested, or a named vector with three elements major, minor and patch.

Details

The version is defined by Armadillo in the header arma_version.hpp.

Value

Depending on the value of single, either a single number describing the Armadillo version or a named vector with three elements major, minor and patch.

See Also

Armadillo header file arma_version.hpp.
Description

fastLm estimates the linear model using the solve function of Armadillo linear algebra library.

Usage

fastLmPure(X, y)

fastLm(X, ...)
## Default S3 method:
fastLm(X, y, ...)
## S3 method for class 'formula'
fastLm(formula, data = list(), ...)

Arguments

y a vector containing the explained variable.
X a model matrix.
formula a symbolic description of the model to be fit.
data an optional data frame containing the variables in the model.
... not used

Details

Linear models should be estimated using the lm function. In some cases, lm.fit may be appropriate.

The fastLmPure function provides a reference use case of the Armadillo library via the wrapper functions in the RcppArmadillo package.

The fastLm function provides a more standard implementation of a linear model fit, offering both a default and a formula interface as well as print, summary and predict methods.

Lastly, one must be be careful in timing comparisons of lm and friends versus this approach based on Armadillo. The reason that Armadillo can do something like lm.fit faster than the functions in the stats package is because Armadillo uses the Lapack version of the QR decomposition while the stats package uses a modified Linpack version. Hence Armadillo uses level-3 BLAS code whereas the stats package uses level-1 BLAS. However, Armadillo will either fail or, worse, produce completely incorrect answers on rank-deficient model matrices whereas the functions from the stats package will handle them properly due to the modified Linpack code.

An example of the type of situation requiring extra care in checking for rank deficiency is a two-way layout with missing cells (see the examples section). These cases require a special pivoting scheme of “pivot only on (apparent) rank deficiency” which is not part of conventional linear algebra software.
Value

`fastLmPure` returns a list with three components:

- `coefficients` a vector of coefficients
- `stderr` a vector of the (estimated) standard errors of the coefficient estimates
- `df.residual` a scalar denoting the degrees of freedom in the model

`fastLm` returns a richer object which also includes the residuals, fitted values and call argument similar to the `lm` or `rlm` functions.

Author(s)

Armadillo is written by Conrad Sanderson. RcppArmadillo is written by Romain Francois, Dirk Eddelbuettel, Douglas Bates and Binxiang Ni.

References

Armadillo project: https://arma.sourceforge.net/

See Also

`lm`, `lm.fit`

Examples

```r
data(trees, package="datasets")

## bare-bones direct interface
flm <- fastLmPure( cbind(1, log(trees$Girth)), log(trees$Volume) )
print(flm)

## standard R interface for formula or data returning object of class fastLm
flmmod <- fastLm( log(Volume) ~ log(Girth), data=trees)
summary(flmmod)

## case where fastLm breaks down
dd <- data.frame(f1 = gl(4, 6, labels = LETTERS[1:4]),
                 f2 = gl(3, 2, labels = letters[1:3])[-(7:8), ]
xtabs(~ f2 + f1, dd)  # one missing cell
mm <- model.matrix(~ f1 * f2, dd)
kappa(mm)  # large, indicating rank deficiency
set.seed(1)
dd$y <- mm %*% seq_len(ncol(mm)) + rnorm(nrow(mm), sd = 0.1)
summary(lm(y ~ f1 * f2, dd))  # detects rank deficiency
summary(fastLm(y ~ f1 * f2, dd))  # some huge coefficients
```
RcppArmadillo.package.skeleton

Create a skeleton for a new package that intends to use RcppArmadillo

Description

RcppArmadillo.package.skeleton automates the creation of a new source package that intends to use features of RcppArmadillo.

It is based on the package.skeleton function which it executes first.

Usage

RcppArmadillo.package.skeleton(name = "anRpackage", list = character(),
environment = .GlobalEnv, path = ".", force = FALSE,
code_files = character(), example_code = TRUE)

Arguments

name See package.skeleton
list See package.skeleton
environment See package.skeleton
path See package.skeleton
force See package.skeleton
code_files See package.skeleton
example_code If TRUE, example c++ code using RcppArmadillo is added to the package

Details

In addition to package.skeleton:

The ‘DESCRIPTION’ file gains a Depends line requesting that the package depends on Rcpp and RcppArmadillo and a LinkingTo line so that the package finds Rcpp and RcppArmadillo header files.

The ‘NAMESPACE’, if any, gains a useDynLib directive.

The ‘src’ directory is created if it does not exists and a ‘Makevars’ file is added setting the environment variable ‘PKG_LIBS’ to accomodate the necessary flags to link with the Rcpp library.

If the example_code argument is set to TRUE, example files ‘rcpparma_hello_world.h’ and ‘rcpparma_hello_world.cpp’ are also created in the ‘src’. An R file ‘rcpparma_hello_world.R’ is expanded in the ‘R’ directory, the rcpparma_hello_world function defined in this files makes use of the C++ function ‘rcpparma_hello_world’ defined in the C++ file. These files are given as an example and should eventually be removed from the generated package.

Value

Nothing, used for its side effects
References

Read the Writing R Extensions manual for more details.
Once you have created a source package you need to install it: see the R Installation and Administration manual, INSTALL and install.packages.

See Also

package.skeleton

Examples

```r
## Not run:
RcppArmadillo.package.skeleton( "foobar" )

## End(Not run)
```
Index

* interface
  RcppArmadillo-package, 2

* package
  RcppArmadillo-package, 2

* programming
  RcppArmadillo-package, 2
  RcppArmadillo.package.skeleton, 8

* regression
  fastLm, 6
  armadillo_set_seed, 3
  armadillo_set_seed_random, 4
  armadillo_version, 5
  fastLm, 6
  fastLmPure (fastLm), 6
  INSTALL, 9
  install.packages, 9
  lm, 6, 7
  lm.fit, 6, 7
  package.skeleton, 8, 9
  RcppArmadillo (RcppArmadillo-package), 2
  RcppArmadillo-package, 2
  RcppArmadillo.package.skeleton, 2, 8
  RcppArmadilloExample
    (RcppArmadillo-package), 2
  rlm, 7