Package ‘RcppEnsmallen’

November 22, 2021

Title     Header-Only C++ Mathematical Optimization Library for 'Armadillo'
Version   0.2.18.1.1
Description 'Ensmallen' is a templated C++ mathematical optimization library
(by the 'MLPACK' team) that provides a simple set of abstractions for writing an
objective function to optimize. Provided within are various standard and
cutting-edge optimizers that include full-batch gradient descent techniques,
small-batch techniques, gradient-free optimizers, and constrained optimization.
The 'RcppEnsmallen' package includes the header files from the 'Ensmallen' library
and pairs the appropriate header files from 'armadillo' through the
'RcppArmadillo' package. Therefore, users do not need to install 'Ensmallen' nor
'Armadillo' to use 'RcppEnsmallen'. Note that 'Ensmallen' is licensed under
3-Clause BSD, 'Armadillo' starting from 7.800.0 is licensed under Apache License 2,
'RcppArmadillo' (the 'Rcpp' bindings/bridge to 'Armadillo') is licensed under
the GNU GPL version 2 or later. Thus, 'RcppEnsmallen' is also licensed under
similar terms. Note that 'Ensmallen' requires a compiler that supports
'C++11' and 'Armadillo' 9.800 or later.

Depends  R (>= 3.3.0)
License   GPL (>= 2)
URL       https://github.com/coatless/rcppensmallen,
BugReports https://github.com/coatless/rcppensmallen/issues
Encoding  UTF-8
LinkingTo Rcpp, RcppArmadillo (>= 0.9.800.0.0)
Imports   Rcpp
RoxygenNote 7.1.1
SystemRequirements C++11
Suggests  knitr, rmarkdown
VignetteBuilder knitr
NeedsCompilation yes
**RcppEnsmallen-package**

### Description

"Ensmallen" is a templated C++ mathematical optimization library (by the 'MLPACK' team) that provides a simple set of abstractions for writing an objective function to optimize. Provided within are various standard and cutting-edge optimizers that include full-batch gradient descent techniques, small-batch techniques, gradient-free optimizers, and constrained optimization. The 'RcppEnsmallen' package includes the header files from the 'Ensmallen' library and pairs the appropriate header files from 'armadillo' through the 'RcppArmadillo' package. Therefore, users do not need to install 'Ensmallen' nor 'Armadillo' to use 'RcppEnsmallen'. Note that 'Ensmallen' is licensed under 3-Clause BSD, 'Armadillo' starting from 7.800.0 is licensed under Apache License 2, 'RcppArmadillo' (the 'Rcpp' bindings/bridge to 'Armadillo') is licensed under the GNU GPL version 2 or later. Thus, 'RcppEnsmallen' is also licensed under similar terms. Note that 'Ensmallen' requires a compiler that supports 'C++11' and 'Armadillo' 8.400 or later.

### Author(s)

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### See Also

Useful links:

- [https://github.com/coatless/rcppensmallen](https://github.com/coatless/rcppensmallen)
- [https://github.com/mlpack/ensmallen](https://github.com/mlpack/ensmallen)
- [http://ensmallen.org/](http://ensmallen.org/)
Description
Solves the Linear Regression’s Residual Sum of Squares using the L-BFGS optimizer.

Usage
lin_reg_lbfgs(X, y)

Arguments
X  A matrix that is the Design Matrix for the regression problem.
y  A vec containing the response values.

Details
Consider the **Residual Sum of Squares**, also known as **RSS**, defined as:

\[RSS(\beta) = (y - X\beta)^T (y - X\beta)\]

The objective function is defined as:

\[f(\beta) = (y - X\beta)^2\]

The gradient is defined as:

\[\frac{\partial RSS}{\partial \beta} = -2X^T (y - X\beta)\]

Value
The estimated \(\beta\) parameter values for the linear regression.

Examples
# Number of Points
n = 1000

# Select beta parameters
beta = c(-2, 1.5, 3, 8.2, 6.6)

# Number of Predictors (including intercept)
p = length(beta)

# Generate predictors from a normal distribution
X_i = matrix(rnorm(n), ncol = p - 1)

# Add an intercept
\[ X = \text{cbind}(1, X_i) \]

# Generate y values
\[ y = X\times_b eta + \text{rnorm}(n / (p - 1)) \]

# Run optimization with lbfgs
\[ \text{theta\_hat} = \text{lin\_reg\_lbfgs}(X, y) \]

# Verify parameters were recovered
\[ \text{cbind(actual = beta, estimated = theta\_hat)} \]
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