Package ‘glmADMM’

July 23, 2015

Type Package

Title Solving Equality constrained L1-Regularized General Linear Models via ADMM

Version 1.0

Date 2015-07-12

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Description Fitting L1-regularization path for linear regression, logistic regression and Poisson regression. A major characteristic is that users can have an equality constraint on the coefficients. The algorithm uses Alternating Direction Method of Multipliers.

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R topics documented:

`glmADMM-package` *Lasso regularization path for some generalized linear models*

Description

This package fits lasso paths for linear regression, logistic and Poisson regression. It can also incorporate an equality constraint on the coefficients. In addition, this package can solve logistic and Poisson regression via inexact ADMM which is more efficient.

Details

Package:	glmADMM
Type:	Package
Version:	1.0
Date:	2015-07-13
License:	GPL-2

Accepts `A,b` data for regression models, and produces the regularization path over a default of 100 tuning parameter `lambda` values. Note that `C` and `d` may need to be specified only when `equality=TRUE`. Only 2 function to use: `glmADMM`
`plotglmADMM`

Author(s)

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References

Boyd S., Parikh N., Chu E., Peleato B. and Eckstein J. *Distributed optimization and statistical learning via the alternating direction method of multipliers*, https://web.stanford.edu/~boyd/papers/pdf/admm_distr_stats.pdf
Foundations and Trends in Machine Learning, 3(1)(1-122), 2011
Chang T., Hong M. and Wang X. *Multi-agent distributed optimization via inexact consensus admm*, http://arxiv.org/pdf/1402.6065v2.pdf
IEEE TRANSACTIONS ON SIGNAL PROCESSING, 63(482-497), 2015
Ivanoff S., Picard F. and Rivoirard V. *Adaptive Lasso and group-Lasso for functional Poisson regression*, http://arxiv.org/pdf/1412.6966v2.pdf
arXiv:1412.6966 [stat.ME] 26 Dec 2014

`DataExample` *Simulated data for linear, logistic and Poisson Regression*

Description

Simple simulated data, used to demonstrate the feature of glmADMM

Usage

```
data(GaussianExample)
data(BinomialExample)
data(PoissonExample)
```

Format

Data objects used to demonstrate the feature of glmADMM

Examples

```
data(GaussianExample)
glmADMM(A,b,family="gaussian")
```

glmADMM *fit a GLM with lasso regularization and equality constraint if specified*

Description

Fit a sequence of generalized linear model by ADMM (Alternating Direction Method of Multipliers). The sequence is implied by lambda which is the regularization parameter. Fits linear, logistic and Poisson regression models. Users can add an equality constraint to the coefficients. In order to solve logistic and Poisson regression efficiently, users can also use inexact-ADMM to get the solution.

Usage

```
glmADMM(A, b, lambda_seq, family, rho = 1, intercept = TRUE, equality=FALSE, C, d, inexact=FALSE)
```

Arguments

A	input feature matrix, of dimension nobs x nvars; each row is an observation vector.
b	the response vector. Quantitative for family="gaussian", or non-negative counts for family="poisson". For family="binomial", it should be a factor with two levels indicated by either 1 or -1.
lambda_seq	A user supplied lambda sequence. By default, the program compute its own lambda sequence based on the data and run the regression based on a decreasing sequence of lambda values. The default number of lambda is 100 and we use a warm-start in runing this sequence of regressions.
family	Response type, including "gaussian", "binomial" and "poisson".
rho	the augmented Lagrangian parameter in ADMM, usually set to 1.
intercept	Should intercept(s) be fitted (default=TRUE) or igonored (FALSE)
equality	Should there be an equality constraint to the coefficients (TRUE) or no constraint (default=FALSE)
C	a designed matrix that add equality constraint to the coefficients, dimension of 1 row and number of columns matches the number of observations (number of rows in A). Note that if an intercept is fitted, adding a zero to the left of the first column, meaning do not constrain the intercept. If C is not supplied and equality=TRUE, the default design is to sum up all the coefficients.
d	specify the value on the right-hand side of the equality constraint. If not specified, d=0.
inexact	Should the program solve x via inexact-ADMM (TRUE) or not (default=FALSE).

Value

solution	solution of x, each column represents the solution at a lambda value.
time	Program running time.
iter	iteration number at each lambda.
lambda	The actual sequence of lambda values used.
intercept	record if an intercept is fitted (intercept=1) or not (intercept=0)

Author(s)

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References

Boyd S., Parikh N., Chu E., Peleato B. and Eckstein J. *Distributed optimization and statistical learning via the alternating direction method of multipliers*, https://web.stanford.edu/~boyd/papers/pdf/admm_distr_stats.pdf
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arXiv:1412.6966 [stat.ME] 26 Dec 2014

Examples

```
# Gaussian
data(GaussianExample)
fit1=glmADMM(A,b,family="gaussian")

# Binomial
data(BinomialExample)
fit2=glmADMM(A,b,family="binomial",inexact=TRUE)

# Poisson
data(PoissonExample)
fit3=glmADMM(A,b,family="poisson",inexact=TRUE)
```

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plotglmADMM — *plot the solution path from a "glmADMM" object*

Description

This function plot the solution of coefficients at each `lambda` value

Usage

```
plotglmADMM(fit)
```

Arguments

`fit`	the output of the `glmADMM` function

Details

Note that we do not plot `intercept` if `intercept=TRUE`, because `intercept` is not involved in the shrinkage

Examples

```
data(GaussianExample)
fit=glmADMM(A,b,family="gaussian")
plotglmADMM(fit)
```

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