

# Package ‘RPEGLMEN’

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**Type** Package

**Title** Gamma and Exponential Generalized Linear Models with Elastic Net Penalty

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**Description** Implements the fast iterative shrinkage-thresholding algorithm (FISTA) algorithm to fit a Gamma distribution with an elastic net penalty as described in Chen, Arakvin and Martin (2018) <arxiv:1804.07780>. An implementation for the case of the exponential distribution is also available, with details available in Chen and Martin (2018) <[https://papers.ssrn.com/abstract\\_id=3085672](https://papers.ssrn.com/abstract_id=3085672)>.

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**Imports** Rcpp (>= 1.0.2), RPEIF, PerformanceAnalytics

**LinkingTo** Rcpp, RcppEigen

**RoxygenNote** 7.0.2

**Suggests** R.rsp, testthat

**NeedsCompilation** yes

**Biarch** true

**SystemRequirements** C++11

**VignetteBuilder** R.rsp

**Repository** CRAN

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fit.glmGammaNet	<i>Elastic Net Penalized Gamma or Exponentially Distributed Response Variables</i>
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### Description

fit.glmGammaNet Fit glmnet model for Gamma distributed response data.

### Usage

```
fit.glmGammaNet(
  A,
  b,
  exponential.dist = FALSE,
  alpha.EN = 0.5,
  num_lambda = 100L,
  glm_type = 1L,
  max_iter = 100L,
  abs_tol = 1e-04,
  rel_tol = 0.01,
  normalize_grad = FALSE,
  k_fold = 5L,
  has_intercept = TRUE,
  k_fold_iter = 5L,
  min.lambda.ratio = 1e-04,
  ...
)
```

### Arguments

A	The matrix of independent variables.
b	The vector of response variables.
exponential.dist	Parameter to determine whether we use the Exponential distribution (TRUE) or the Gamma distribution (FALSE).
alpha.EN	The coefficient of elastic net regularizer (1 means lasso).
num_lambda	Size of the lambda grid.
glm_type	Type of glm model, 1 is exponential, 2 is gamma (not implemented yet).
max_iter	Max number of iteration for the prox grad descent optimizer.

abs_tol	Absolute error threshold for the pgd optimizer.
rel_tol	Relative error threshold for the pgd optimizer (not used for vanilla PGD).
normalize_grad	Switch for whether to normalize the gradient or not.
k_fold	The number of folds for cross validation.
has_intercept	Parameter to determine if there is an intercept (TRUE) or not (FALSE).
k_fold_iter	The number of iterations for the cross-validation.
min.lambda.ratio	Minimum lambda ratio for cross-validation.
...	Additional parameters.

**Value**

vector of optimal coefficient for the glm model.

**Author(s)**

Anthony-Alexander Christidis, <anthony.christidis@stat.ubc.ca>

**Examples**

```
# Function to return the periodogram of data series
myperiodogram <- function (data, max.freq = 0.5,
                           twosided = FALSE, keep = 1){
  data.fft <- fft(data)
  N <- length(data)
  tmp <- Mod(data.fft[2:floor(N/2)])^2/N
  freq <- ((1:(floor(N/2) - 1))/N)
  tmp <- tmp[1:floor(length(tmp) * keep)]
  freq <- freq[1:floor(length(freq) * keep)]
  if (twosided) {
    tmp <- c(rev(tmp), tmp)
    freq <- c(-rev(freq), freq)
  }
  return(list(spec = tmp, freq = freq))
}

# Function to compute the standard error based the periodogram of
# the influence functions time series
SE.Gamma <- function(data, d = 7, alpha = 0.5, keep = 1){
  N <- length(data)
  # Compute the periodograms
  my.periodogram <- myperiodogram(data)
  my.freq <- my.periodogram$freq
  my.periodogram <- my.periodogram$spec
  # Remove values of frequency 0 as it does not contain information
  # about the variance
  my.freq <- my.freq[-1]
  my.periodogram <- my.periodogram[-1]
  # Implement cut-off
  nfreq <- length(my.freq)
```

```

my.freq <- my.freq[1:floor(nfreq*keep)]
my.periodogram <- my.periodogram[1:floor(nfreq*keep)]
# GLM with BFGS optimization
# Create 1, x, x^2, ..., x^d
x.mat <- rep(1,length(my.freq))
for(col.iter in 1:d){
  x.mat <- cbind(x.mat,my.freq^col.iter)
}
# Fit the Exponential or Gamma model
res <- fit.glmGammaNet(x.mat, my.periodogram, alpha.EN = alpha)
# Return the estimated variance
return(sqrt(exp(res[1])/N))
}

# Loading hedge fund data from PA
data(edhec, package = "PerformanceAnalytics")
colnames(edhec)

# Computing the expected shortfall for the time series of returns
# library(RPEIF)
# test.mat <- apply(edhec, 2, IF.ES)
# test.mat <- apply(test.mat, 2, as.numeric)

# Returning the standard errors from the Gamma distribution fit
# apply(test.mat, 2, SE.Gamma)

```

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glmnet\_exp

*Elastic Net Penalized Exponentially Distributed Response Variables*


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## Description

fit.glmGammaNet Fit glmnet model for exponential distributed response data.

## Usage

```

glmnet_exp(
  A,
  b,
  alpha.EN = 0.5,
  num_lambda = 100L,
  glm_type = 1L,
  max_iter = 100L,
  abs_tol = 1e-04,
  rel_tol = 0.01,
  normalize_grad = FALSE,
  k_fold = 5L,
  has_intercept = TRUE,
  k_fold_iter = 5L,

```

```
    ...
  )
```

### Arguments

A	The matrix of independent variables.
b	The vector of response variables.
alpha.EN	The coefficient of elastic net regularizer (1 means lasso).
num_lambda	Size of the lambda grid.
glm_type	Type of glm model, 1 is exponential, 2 is gamma (not implemented yet).
max_iter	Max number of iteration for the prox grad descent optimizer.
abs_tol	Absolute error threshold for the pgd optimizer.
rel_tol	Relative error threshold for the pgd optimizer (not used for vanilla PGD).
normalize_grad	Switch for whether to normalize the gradient or not.
k_fold	The number of folds for cross validation.
has_intercept	Parameter to determine if there is an intercept (TRUE) or not (FALSE).
k_fold_iter	The number of iterations for the cross-validation.
...	Additional Parameters.

### Value

Vector of optimal coefficient for the glm model.

### Author(s)

Anthony-Alexander Christidis, <anthony.christidis@stat.ubc.ca>

### Examples

```
# Function to return the periodogram of data series
myperiodogram <- function (data, max.freq = 0.5,
                           twosided = FALSE, keep = 1){
  data.fft <- fft(data)
  N <- length(data)
  tmp <- Mod(data.fft[2:floor(N/2)])^2/N
  freq <- ((1:(floor(N/2) - 1))/N)
  tmp <- tmp[1:floor(length(tmp) * keep)]
  freq <- freq[1:floor(length(freq) * keep)]
  if (twosided) {
    tmp <- c(rev(tmp), tmp)
    freq <- c(-rev(freq), freq)
  }
  return(list(spec = tmp, freq = freq))
}

# Function to compute the standard error based the periodogram of
# the influence functions time series
```

```

SE.Exponential <- function(data, d = 7, alpha = 0.5, keep = 1){
  N <- length(data)
  # Compute the periodograms
  my.periodogram <- myperiodogram(data)
  my.freq <- my.periodogram$freq
  my.periodogram <- my.periodogram$spec
  # Remove values of frequency 0 as it does not contain information
  # about the variance
  my.freq <- my.freq[-1]
  my.periodogram <- my.periodogram[-1]
  # Implement cut-off
  nfreq <- length(my.freq)
  my.freq <- my.freq[1:floor(nfreq*keep)]
  my.periodogram <- my.periodogram[1:floor(nfreq*keep)]
  # GLM with BFGS optimization
  # Create 1, x, x^2, ..., x^d
  x.mat <- rep(1,length(my.freq))
  for(col.iter in 1:d){
    x.mat <- cbind(x.mat,my.freq^col.iter)
  }
  # Fit the Exponential model
  res <- glmnet_exp(x.mat, my.periodogram, alpha.EN = alpha)
  # Return the estimated variance
  return(sqrt(exp(res[1])/N))
}

# Loading hedge fund data from PA
data(edhec, package = "PerformanceAnalytics")
colnames(edhec)

# Computing the expected shortfall for the time series of returns
# library(RPEIF)
# test.mat <- apply(edhec, 2, IF.ES)
# test.mat <- apply(test.mat, 2, as.numeric)

# Returning the standard errors from the Exponential distribution fit
# apply(test.mat, 2, SE.Exponential)

```

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