Package 'Colossus'

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Type Package

Title ``Risk Model Regression and Analysis with Complex Non-Linear Models"

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URL https://ericgiunta.github.io/Colossus/, https://github.com/ericgiunta/Colossus

BugReports https://github.com/ericgiunta/Colossus/issues

Description Performs survival analysis using general non-linear models. Risk models can be the sum or product of terms. Each term is the product of exponential/linear functions of covariates. Additionally sub-terms can be defined as a sum of exponential, linear threshold, and step functions. Cox Proportional hazards <https://en.wikipedia.org/wiki/Proportional_hazards_model>, Poisson <https://en.wikipedia.org/wiki/Poisson_regression>, and Fine-Grey competing risks <https://www.publichealth.columbia.edu/research/population-health-methods/competing-risk-analysis> regression are supported. This work was sponsored by NASA Grant 80NSSC19M0161 through a subcontract from the National Council on Radiation Protection and Measurements (NCRP). The computing for this project was performed on the Beocat Research Cluster at Kansas State University, which is funded in part by NSF grants CNS-1006860, EPS-1006860, EPS-0919443, ACI-1440548, CHE-1726332, and NIH P20GM113109.

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Contents

`Check_Dupe_Columns` *checks for duplicated column names*

Description

`Check_Dupe_Columns` checks for duplicated columns, columns with the same values, and columns with single value. Currently not updated for multi-terms

Usage

```
Check_Dupe_Columns(df, cols, term_n, verbose = 0, factor_check = FALSE)
```

Arguments

`df`	a data.table containing the columns of interest
`cols`	columns to check
`term_n`	term numbers for each element of the model

verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.
factor_check	a boolean used to skip comparing columns of the form ?_? with the same initial string, which is used for factored columns

Value

returns the usable columns

See Also

Other Data Cleaning Functions: Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
a <- c(0, 1, 2, 3, 4, 5, 6)
b <- c(1, 2, 3, 4, 5, 6, 7)
c <- c(0, 1, 2, 1, 0, 1, 0)
df <- data.table::data.table("a" = a, "b" = b, "c" = c)
cols <- c("a", "b", "c")
term_n <- c(0, 0, 1)
unique_cols <- Check_Dupe_Columns(df, cols, term_n)
```

Check_Trunc *Applies time duration truncation limits to create columns for Cox model*

Description

Check_Trunc creates columns to use for truncation

Usage

```
Check_Trunc(df, ce, verbose = 0)
```

Arguments

df	a data.table containing the columns of interest
ce	columns to check for truncation, (t0, t1, event)
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns the updated data and time period columns

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
ce <- c("%trunc%", "Ending_Age")
val <- Check_Trunc(df, ce)
df <- val$df
ce <- val$ce
```

Check_Verbose *General purpose verbosity check*

Description

Check_Verbose checks and assigns verbosity values

Usage

```
Check_Verbose(verbose)
```

Arguments

verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns correct verbose value

See Also

Other Data Cleaning Functions: `Check_Dupe_Columns()`, `Check_Trunc()`, `Correct_Formula_Order()`, `Date_Shift()`, `Def_Control()`, `Def_Control_Guess()`, `Def_model_control()`, `Def_modelform_fix()`, `Joint_Multiple_Events()`, `Replace_Missing()`, `Time_Since()`, `factorize()`, `factorize_par()`, `gen_time_dep()`, `interact_them()`

Correct_Formula_Order *Corrects the order of terms/formula/etc*

Description

`Correct_Formula_Order` checks the order of formulas given and corrects any ordering issues, orders alphabetically, by term number, etc.

Usage

```
Correct_Formula_Order(
  term_n,
  tform,
  keep_constant,
  a_n,
  names,
  der_iden = 0,
  cons_mat = matrix(c(0)),
  cons_vec = c(0),
  verbose = FALSE,
  model_control = list()
)
```

Arguments

term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
names	columns for elements of the model, used to identify data columns
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
cons_mat	Matrix containing coefficients for system of linear constraints, formatted as matrix
cons_vec	Vector containing constants for system of linear constraints, formatted as vector
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns the corrected lists

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
term_n <- c(0, 1, 1, 0, 0)
tform <- c("loglin", "quad_slope", "lin", "lin_int", "lin_slope")
keep_constant <- c(0, 0, 0, 1, 0)
a_n <- c(1, 2, 3, 4, 5)
names <- c("a", "a", "a", "a", "a")
val <- Correct_Formula_Order(term_n, tform, keep_constant,
  a_n, names,
  cons_mat = matrix(c(0)),
  cons_vec = c(0)
```

```
)
term_n <- val$term_n
tform <- val$tform
keep_constant <- val$keep_constant
a_n <- val$a_n
der_iden <- val$der_iden
names <- val$names
```

`Cox_Relative_Risk` *Calculates hazard ratios for a reference vector*

Description

`RunCoxRegression` uses user provided data, vectors specifying the model, and options to calculate relative risk for every row in the provided data

Usage

```
Cox_Relative_Risk(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  control = list(),
  model_control = list()
)
```

Arguments

`df`	a data.table containing the columns of interest
`time1`	column used for time period starts
`time2`	column used for time period end
`event0`	column used for event status
`names`	columns for elements of the model, used to identify data columns
`term_n`	term numbers for each element of the model
`tform`	list of string function identifiers, used for linear/step
`keep_constant`	binary values to denote which parameters to change

a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Plotting Wrapper Functions: RunCoxPlots()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
fir <- 0
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
a_n <- c(1.1, 0.1, 0.2, 0.5) # used to test at a specific point
keep_constant <- c(0, 0, 0, 0)
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
```

```
)
e <- Cox_Relative_Risk(
  df, time1, time2, event, names, term_n, tform,
  keep_constant, a_n, modelform, fir, control
)
```

`Date_Shift` *Automates creating a date difference column*

Description

`Date_Shift` generates a new dataframe with a column containing time difference in a given unit

Usage

```
Date_Shift(df, dcol0, dcol1, col_name, units = "days")
```

Arguments

`df`	a data.table containing the columns of interest
`dcol0`	list of starting month, day, and year
`dcol1`	list of ending month, day, and year
`col_name`	vector of new column names
`units`	time unit to use

Value

returns the updated dataframe

See Also

Other Data Cleaning Functions: `Check_Dupe_Columns()`, `Check_Trunc()`, `Check_Verbose()`, `Correct_Formula_Order()`, `Def_Control()`, `Def_Control_Guess()`, `Def_model_control()`, `Def_modelform_fix()`, `Joint_Multiple_Events()`, `Replace_Missing()`, `Time_Since()`, `factorize()`, `factorize_par()`, `gen_time_dep()`, `interact_them()`

Examples

```
library(data.table)
m0 <- c(1, 1, 2, 2)
m1 <- c(2, 2, 3, 3)
d0 <- c(1, 2, 3, 4)
d1 <- c(6, 7, 8, 9)
y0 <- c(1990, 1991, 1997, 1998)
y1 <- c(2001, 2003, 2005, 2006)
df <- data.table::data.table("m0" = m0, "m1" = m1, "d0" = d0, "d1" = d1, "y0" = y0, "y1" = y1)
df <- Date_Shift(df, c("m0", "d0", "y0"), c("m1", "d1", "y1"), "date_since")
```

Def_Control *Automatically assigns missing control values*

Description

Def_Control checks and assigns default values

Usage

```
Def_Control(control)
```

Arguments

control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a filled list

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "ties" = "breslow", "double_step" = 1
)
control <- Def_Control(control)
```

Def_Control_Guess *Automatically assigns missing guessing control values*

Description

Def_Control_Guess checks and assigns default values

Usage

```
Def_Control_Guess(guesses_control, a_n)
```

Arguments

guesses_control	list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.

Value

returns a filled list

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10,
  "loglin_min" = -1, "loglin_max" = 1, "loglin_method" = "uniform"
)
a_n <- c(0.1, 2, 1.3)
guesses_control <- Def_Control_Guess(guesses_control, a_n)
```

Def_modelform_fix *Automatically assigns geometric-mixture values and checks that a valid modelform is used*

Description

Def_model_control checks and assigns default values for modelform options

Usage

```
Def_modelform_fix(control, model_control, modelform, term_n)
```

Arguments

control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
term_n	term numbers for each element of the model

Value

returns a filled list

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "ties" = "breslow", "double_step" = 1
)
control <- Def_Control(control)
model_control <- list("single" = TRUE)
model_control <- Def_model_control(model_control)
term_n <- c(0, 1, 1)
modelform <- "a"
val <- Def_modelform_fix(control, model_control, modelform, term_n)
model_control <- val$model_control
modelform <- val$modelform
```

Def_model_control *Automatically assigns missing model control values*

Description

Def_model_control checks and assigns default values

Usage

```
Def_model_control(control)
```

Arguments

control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a filled list

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
control <- list("single" = TRUE)
control <- Def_model_control(control)
```

---

factorize *Splits a parameter into factors*

Description

factorize uses user provided list of columns to define new parameter for each unique value and update the data.table. Not for interaction terms

Usage

```
factorize(df, col_list, verbose = 0)
```

Arguments

df	a data.table containing the columns of interest
col_list	an array of column names that should have factor terms defined
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns a list with two named fields. df for the updated dataframe, and cols for the new column names

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
a <- c(0, 1, 2, 3, 4, 5, 6)
b <- c(1, 2, 3, 4, 5, 6, 7)
c <- c(0, 1, 2, 1, 0, 1, 0)
df <- data.table::data.table("a" = a, "b" = b, "c" = c)
col_list <- c("c")
val <- factorize(df, col_list)
df <- val$df
new_col <- val$cols
```

`factorize_par` *Splits a parameter into factors in parallel*

Description

`factorize_par` uses user provided list of columns to define new parameter for each unique value and update the data.table. Not for interaction terms

Usage

```
factorize_par(df, col_list, verbose = 0, nthreads = as.numeric(detectCores()))
```

Arguments

`df`	a data.table containing the columns of interest
`col_list`	an array of column names that should have factor terms defined
`verbose`	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.
`nthreads`	number of threads to use, do not use more threads than available on your machine

Value

returns a list with two named fields. df for the updated dataframe, and cols for the new column names

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
a <- c(0, 1, 2, 3, 4, 5, 6)
b <- c(1, 2, 3, 4, 5, 6, 7)
c <- c(0, 1, 2, 1, 0, 1, 0)
df <- data.table::data.table("a" = a, "b" = b, "c" = c)
col_list <- c("c")
val <- factorize_par(df, col_list, FALSE, 2)
df <- val$df
new_col <- val$cols
```

Gather_Guesses_CPP *Performs checks to gather a list of guesses and iterations*

Description

Gather_Guesses_CPP called from within R, uses a list of options and the model definition to generate a list of parameters and iterations that do not produce errors

Usage

```
Gather_Guesses_CPP(
  df,
  dfc,
  names,
  term_n,
  tform,
  keep_constant,
  a_n,
  x_all,
  a_n_default,
  modelform,
  fir,
  control,
  guesses_control,
```

```
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
dfc	vector matching subterm number to matrix column
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
x_all	covariate matrix
a_n_default	center of parameter distribution guessing scope
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
guesses_control	list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

Examples

```
library(data.table)
a <- c(0, 1, 2, 3, 4, 5, 6)
b <- c(1, 2, 3, 4, 5, 6, 7)
c <- c(0, 1, 0, 0, 0, 1, 0)
d <- c(3, 4, 5, 6, 7, 8, 9)
df <- data.table::data.table("a" = a, "b" = b, "c" = c, "d" = d)
time1 <- "a"
time2 <- "b"
event <- "c"
names <- c("d")
term_n <- c(0)
tform <- c("loglin")
keep_constant <- c(0)
```

```
a_n <- c(-0.1)
a_n_default <- a_n
modelform <- "M"
fir <- 0
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = -1,
  "halfmax" = 5, "epsilon" = 1e-9,
  "deriv_epsilon" = 1e-9, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
guesses_control <- list()
model_control <- list()
all_names <- unique(names(df))
dfc <- match(names, all_names)
term_tot <- max(term_n) + 1
x_all <- as.matrix(df[, all_names, with = FALSE])
control <- Def_Control(control)
guesses_control <- Def_Control_Guess(guesses_control, a_n)
model_control <- Def_model_control(model_control)
Gather_Guesses_CPP(
  df, dfc, names, term_n, tform, keep_constant,
  a_n, x_all, a_n_default,
  modelform, fir, control, guesses_control
)
```

`gcc_version` *Checks default c++ compiler*

Description

`gcc_version` Checks default c++ compiler, part of configuration script

Usage

```
gcc_version()
```

Value

returns a string representation of gcc, clang, or c++ output

gen_time_dep *Applies time dependence to parameters*

Description

gen_time_dep generates a new dataframe with time dependent covariates by applying a grid in time

Usage

```
gen_time_dep(
  df,
  time1,
  time2,
  event0,
  iscox,
  dt,
  new_names,
  dep_cols,
  func_form,
  fname,
  tform,
  nthreads = as.numeric(detectCores())
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
iscox	boolean if rows not at event times should not be kept, rows are removed if true. a Cox proportional hazards model does not use rows with intervals not containing event times
dt	spacing in time for new rows
new_names	list of new names to use instead of default, default used if entry is ”
dep_cols	columns that are not needed in the new dataframe
func_form	vector of functions to apply to each time-dependent covariate. Of the form func(df, time) returning a vector of the new column value
fname	filename used for new dataframe
tform	list of string function identifiers, used for linear/step
nthreads	number of threads to use, do not use more threads than available on your machine

Value

returns the updated dataframe

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), interact_them()

Examples

```
library(data.table)
# Adapted from the tests
a <- c(20, 20, 5, 10, 15)
b <- c(1, 2, 1, 1, 2)
c <- c(0, 0, 1, 1, 1)
df <- data.table::data.table("a" = a, "b" = b, "c" = c)
time1 <- "%trunc%"
time2 <- "a"
event <- "c"
control <- list(
  "lr" = 0.75, "maxiter" = -1, "halfmax" = 5, "epsilon" = 1e-9,
  "deriv_epsilon" = 1e-9, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0,
  "verbose" = FALSE, "ties" = "breslow", "double_step" = 1
)
grt_f <- function(df, time_col) {
  return((df[, "b"] * df[, get(time_col)])[[1]])
}
func_form <- c("lin")
df_new <- gen_time_dep(
  df, time1, time2, event, TRUE, 0.01, c("grt"), c(),
  c(grt_f), paste("test", "_new.csv", sep = ""), func_form, 2
)
file.remove("test_new.csv")
```

GetCensWeight *Calculates and returns data for time by hazard and survival to estimate censoring rate*

Description

GetCensWeight uses user provided data, time/event columns, vectors specifying the model, and options generate an estimate of the censoring rate, plots, and returns the data

Usage

```
GetCensWeight(
  df,
  time1,
  time2,
  event0,
  names,
  term_n,
  tform,
  keep_constant,
  a_n,
  modelform,
  fir,
  control,
  plot_options,
  model_control = list(),
  strat_col = "e"
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
plot_options	list of parameters controlling the plot options, see RunCoxPlots() for different options
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
strat_col	column to stratify by if needed

Value

saves the plots in the current directory and returns a data.table of time and corresponding hazard, cumulative hazard, and survival

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
df$censor <- (df$Cancer_Status == 0)
event <- "censor"
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 20, "halfmax" = 5,
  "epsilon" = 1e-6, "deriv_epsilon" = 1e-6,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0, "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1
)
plot_options <- list(
  "name" = paste(tempfile(), "run_06", sep = ""), "verbose" = FALSE,
  "studyID" = "studyID", "age_unit" = "years"
)
dft <- GetCensWeight(
  df, time1, time2, event, names, term_n, tform,
  keep_constant, a_n, modelform, fir, control, plot_options
)
t_ref <- dft$t
surv_ref <- dft$surv
t_c <- df$t1
cens_weight <- approx(t_ref, surv_ref, t_c, rule = 2)$y
```

get_os *Checks system OS*

Description

get_os checks the system OS, part of configuration script

Usage

```
get_os()
```

Value

returns a string representation of OS

interact_them *Defines Interactions*

Description

interact_them uses user provided interactions define interaction terms and update the data.table. assumes interaction is "+" or "*" and applies basic anti-aliasing to avoid duplicates

Usage

```
interact_them(df, interactions, new_names, verbose = 0)
```

Arguments

df	a data.table containing the columns of interest
interactions	array of strings, each one is of form term1?*?term2" for term1 interaction of type * or + with term2, "?" dlimits
new_names	list of new names to use instead of default, default used if entry is ”
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns a list with two named fields. df for the updated dataframe, and cols for the new column names

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep()

Examples

```
library(data.table)
a <- c(0, 1, 2, 3, 4, 5, 6)
b <- c(1, 2, 3, 4, 5, 6, 7)
c <- c(0, 1, 2, 1, 0, 1, 0)
df <- data.table::data.table("a" = a, "b" = b, "c" = c)
interactions <- c("a?+?b", "a?*?c")
new_names <- c("ab", "ac")
vals <- interact_them(df, interactions, new_names)
df <- vals$df
new_col <- vals$cols
```

Joint_Multiple_Events *Automates creating data for a joint competing risks analysis*

Description

Joint_Multiple_Events generates input for a regression with multiple non-independent events and models

Usage

```
Joint_Multiple_Events(
  df,
  events,
  name_list,
  term_n_list = list(),
  tform_list = list(),
  keep_constant_list = list(),
  a_n_list = list()
)
```

Arguments

df	a data.table containing the columns of interest
events	vector of event column names
name_list	list of vectors for columns for event specific or shared model elements, required
term_n_list	list of vectors for term numbers for event specific or shared model elements, defaults to term 0

tform_list — list of vectors for subterm types for event specific or shared model elements, defaults to loglinear

keep_constant_list — list of vectors for constant elements for event specific or shared model elements, defaults to free (0)

a_n_list — list of vectors for parameter values for event specific or shared model elements, defaults to term 0

Value

returns the updated dataframe and model inputs

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Replace_Missing(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
a <- c(0, 0, 0, 1, 1, 1)
b <- c(1, 1, 1, 2, 2, 2)
c <- c(0, 1, 2, 2, 1, 0)
d <- c(1, 1, 0, 0, 1, 1)
e <- c(0, 1, 1, 1, 0, 0)
df <- data.table("t0" = a, "t1" = b, "e0" = c, "e1" = d, "fac" = e)
time1 <- "t0"
time2 <- "t1"
df$pyr <- df$t1 - df$t0
pyr <- "pyr"
events <- c("e0", "e1")
names_e0 <- c("fac")
names_e1 <- c("fac")
names_shared <- c("t0", "t0")
term_n_e0 <- c(0)
term_n_e1 <- c(0)
term_n_shared <- c(0, 0)
tform_e0 <- c("loglin")
tform_e1 <- c("loglin")
tform_shared <- c("quad_slope", "loglin_top")
keep_constant_e0 <- c(0)
keep_constant_e1 <- c(0)
keep_constant_shared <- c(0, 0)
a_n_e0 <- c(-0.1)
a_n_e1 <- c(0.1)
a_n_shared <- c(0.001, -0.02)
name_list <- list("shared" = names_shared, "e0" = names_e0, "e1" = names_e1)
term_n_list <- list("shared" = term_n_shared, "e0" = term_n_e0, "e1" = term_n_e1)
tform_list <- list("shared" = tform_shared, "e0" = tform_e0, "e1" = tform_e1)
```

```
keep_constant_list <- list(
  "shared" = keep_constant_shared,
  "e0" = keep_constant_e0, "e1" = keep_constant_e1
)
a_n_list <- list("shared" = a_n_shared, "e0" = a_n_e0, "e1" = a_n_e1)
val <- Joint_Multiple_Events(
  df, events, name_list, term_n_list,
  tform_list, keep_constant_list, a_n_list
)
```

`Likelihood_Ratio_Test` *Defines the likelihood ratio test*

Description

`Likelihood_Ratio_Test` uses two models and calculates the ratio

Usage

```
Likelihood_Ratio_Test(alternative_model, null_model)
```

Arguments

`alternative_model`	the new model of interest in list form, output from a poisson regression
`null_model`	a model to compare against, in list form

Value

returns the score statistic

Examples

```
library(data.table)
# In an actual example, one would run two seperate RunCoxRegression regressions,
#    assigning the results to e0 and e1
e0 <- list("name" = "First Model", "LogLik" = -120)
e1 <- list("name" = "New Model", "LogLik" = -100)
score <- Likelihood_Ratio_Test(e1, e0)
```

Linked_Dose_Formula *Calculates Full Parameter list for Special Dose Formula*

Description

Linked_Dose_Formula Calculates all parameters for linear-quadratic and linear-exponential linked formulas

Usage

```
Linked_Dose_Formula(tforms, paras, verbose = 0)
```

Arguments

tforms	list of formula types
paras	list of formula parameters
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns list of full parameters

Examples

```
library(data.table)
tforms <- list("cov_0" = "quad", "cov_1" = "exp")
paras <- list("cov_0" = c(1, 3.45), "cov_1" = c(1.2, 4.5, 0.1))
full_paras <- Linked_Dose_Formula(tforms, paras)
```

Linked_Lin_Exp_Para *Calculates The Additional Parameter For a linear-exponential formula with known maximum*

Description

Linked_Lin_Exp_Para Calculates what the additional parameter would be for a desired maximum

Usage

```
Linked_Lin_Exp_Para(y, a0, a1_goal, verbose = 0)
```

Arguments

y	point formula switch
a0	linear slope
a1_goal	exponential maximum desired
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns parameter used by Colossus

Examples

```
library(data.table)
y <- 7.6
a0 <- 1.2
a1_goal <- 15
full_paras <- Linked_Lin_Exp_Para(y, a0, a1_goal)
```

OMP_Check *Checks the OMP flag*

Description

OMP_Check Called directly from R, checks the omp flag and returns if omp is enabled

Usage

```
OMP_Check()
```

Value

boolean: True for OMP allowed

Rcomp_version *Checks how R was compiled*

Description

Rcomp_version Checks how R was compiled, part of configuration script

Usage

```
Rcomp_version()
```

Value

returns a string representation of gcc, clang, or R CMD config CC output

Rcpp_version *Checks default R c++ compiler*

Description

Rcpp_version checks ~/.R/Makevars script for default compilers set, part of configuration script

Usage

```
Rcpp_version()
```

Value

returns a string representation of gcc, clang, or head ~/.R/Makevars

Replace_Missing *Automatically assigns missing values in listed columns*

Description

Replace_Missing checks each column and fills in NA values

Usage

```
Replace_Missing(df, name_list, msv, verbose = FALSE)
```

Arguments

df	a data.table containing the columns of interest
name_list	vector of string column names to check
msv	value to replace na with, same used for every column used
verbose	integer valued 0-4 controlling what information is printed to the terminal. Each level includes the lower levels. 0: silent, 1: errors printed, 2: warnings printed, 3: notes printed, 4: debug information printed. Errors are situations that stop the regression, warnings are situations that assume default values that the user might not have intended, notes provide information on regression progress, and debug prints out C++ progress and intermediate results. The default level is 2 and True/False is converted to 3/0.

Value

returns a filled datatable

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Time_Since(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, NA, 47, 36, NA, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0)
)
df <- Replace_Missing(df, c("Starting_Age", "Ending_Age"), 70)
```

RunCoxNull *Performs basic Cox Proportional Hazards regression with the null model*

Description

RunCoxRegression uses user provided data and time/event columns to calculate the log-likelihood with constant hazard ratio

Usage

```
RunCoxNull(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  control = list()
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
control <- list(
  "ncores" = 2, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
e <- RunCoxNull(df, time1, time2, event, control)
```

RunCoxPlots *Performs Cox Proportional Hazard model plots*

Description

RunCoxPlots uses user provided data, time/event columns, vectors specifying the model, and options to choose and save plots

Usage

```
RunCoxPlots(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  control = list(),
  plot_options = list(),
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters

control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
plot_options	list of parameters controlling the plot options, see RunCoxPlots() for different options
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

saves the plots in the current directory and returns a string

See Also

Other Plotting Wrapper Functions: Cox_Relative_Risk()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(-0.1, 0.5, 1.1, -0.3)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = -1, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "ties" = "breslow", "double_step" = 1
)
# setting maxiter below 0 forces the function to calculate the score
# and return
plot_options <- list(
  "type" = c("surv", paste(tempfile(),
```

```
    "run",
    sep = ""
  )), "studyid" = "UserID",
  "verbose" = FALSE
)
RunCoxPlots(
  df, time1, time2, event, names, term_n, tform, keep_constant,
  a_n, modelform, fir, control, plot_options
)
```

RunCoxRegression *Performs basic Cox Proportional Hazards regression without special options*

Description

RunCoxRegression uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting position

Usage

```
RunCoxRegression(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list()
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model

tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
```

```
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "ties" = "breslow", "double_step" = 1
)
e <- RunCoxRegression(
  df, time1, time2, event, names, term_n, tform,
  keep_constant, a_n, modelform, fir, der_iden, control
)
```

RunCoxRegression_Basic *Performs basic Cox Proportional Hazards regression with a multiplicative log-linear model*

Description

RunCoxRegression_Basic uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions

Usage

```
RunCoxRegression_Basic(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  keep_constant = c(0),
  a_n = c(0),
  der_iden = 0,
  control = list()
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.

der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3, "abs_max" = 1.0,
  "change_all" = TRUE, "dose_abs_max" = 100.0, "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1
)
e <- RunCoxRegression_Basic(
  df, time1, time2, event, names, keep_constant,
  a_n, der_iden, control
)
```

RunCoxRegression_CR *Performs basic Cox Proportional Hazards regression with competing risks*

Description

RunCoxRegression_CR uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence, starting positions, and censoring adjustment

Usage

```
RunCoxRegression_CR(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  cens_weight = "null"
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters

der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
cens_weight	column containing the row weights

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 2, 1, 2, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1
)
# weights the probability that a row would continue to extend without censoring,
```

```
#    for risk group calculation
df$cens_weight <- c(0.83, 0.37, 0.26, 0.34, 0.55, 0.23, 0.27)
# censoring weight is generated by the survival library finegray function, or by hand.
# The ratio of weight at event end point to weight at row endpoint is used.
e <- RunCoxRegression_CR(
  df, time1, time2, event, names, term_n, tform,
  keep_constant, a_n, modelform, fir, der_iden, control, "cens_weight"
)
```

RunCoxRegression_Guesses_CPP *Performs basic Cox Proportional Hazards regression, Generates multiple starting guesses on c++ side*

Description

RunCoxRegression_Guesses_CPP uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Has additional options to starting with several initial guesses

Usage

```
RunCoxRegression_Guesses_CPP(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  guesses_control = list(),
  strat_col = "null",
  model_control = list(),
  cens_weight = "null"
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts

time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
guesses_control	list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cens_weight	column containing the row weights

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
```

```
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10,
  "lin_min" = 0.001, "lin_max" = 1,
  "loglin_min" = -1, "loglin_max" = 1,
  "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "e"
e <- RunCoxRegression_Guesses_CPP(
  df, time1, time2, event, names, term_n,
  tform, keep_constant, a_n, modelform, fir,
  der_iden, control, guesses_control, strat_col
)
```

`RunCoxRegression_Omnibus` *Performs Cox Proportional Hazards regression using the omnibus function*

Description

`RunCoxRegression_Omnibus` uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Has additional options for starting with several initial guesses, using stratification, multiplicative loglinear 1-term, competing risks, and calculation without derivatives

Usage

```
RunCoxRegression_Omnibus(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  strat_col = "null",
  cens_weight = "null",
  model_control = list(),
  cons_mat = as.matrix(c(0)),
  cons_vec = c(0)
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed

cens_weight	column containing the row weights
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cons_mat	Matrix containing coefficients for system of linear constraints, formatted as matrix
cons_vec	Vector containing constants for system of linear constraints, formatted as vector

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- list(c(1.1, -0.1, 0.2, 0.5), c(1.6, -0.12, 0.3, 0.4))
# used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiters" = c(5, 5, 5),
  "halfmax" = 5, "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1, "guesses" = 2
```

```
)
e <- RunCoxRegression_Omnibus(df, time1, time2, event,
  names, term_n, tform, keep_constant,
  a_n, modelform, fir, der_iden, control,
  model_control = list(
    "single" = FALSE,
    "basic" = FALSE, "cr" = FALSE, "null" = FALSE
  )
)
```

RunCoxRegression_Omnibus_Multidose

Performs Cox Proportional Hazards regression using the omnibus function with multiple column realizations

---

Description

RunCoxRegression_Omnibus_Multidose uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Used for 2DMC column uncertainty methods. Returns optimized parameters, log-likelihood, and standard deviation for each realization. Has additional options for using stratification, multiplicative loglinear 1-term, competing risks, and calculation without derivatives

Usage

```
RunCoxRegression_Omnibus_Multidose(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
 realization_columns = matrix(c("temp00", "temp01", "temp10", "temp11"), nrow = 2),
  realization_index = c("temp0", "temp1"),
  control = list(),
  strat_col = "null",
  cens_weight = "null",
  model_control = list(),
  cons_mat = as.matrix(c(0)),
  cons_vec = c(0)
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
realization_columns	used for multi-realization regressions. Matrix of column names with rows for each column with realizations, columns for each realization
realization_index	used for multi-realization regressions. Vector of column names, one for each column with realizations. each name should be used in the "names" variable in the equation definition
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
cens_weight	column containing the row weights
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cons_mat	Matrix containing coefficients for system of linear constraints, formatted as matrix
cons_vec	Vector containing constants for system of linear constraints, formatted as vector

Value

returns a list of the final results for each realization

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_STRATA(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "t0" = c(18, 20, 18, 19, 21, 20, 18),
  "t1" = c(30, 45, 57, 47, 36, 60, 55),
  "lung" = c(0, 0, 1, 0, 1, 0, 0),
  "dose" = c(0, 1, 1, 0, 1, 0, 1)
)
set.seed(3742)
df$rand <- floor(runif(nrow(df), min = 0, max = 5))
df$rand0 <- floor(runif(nrow(df), min = 0, max = 5))
df$rand1 <- floor(runif(nrow(df), min = 0, max = 5))
df$rand2 <- floor(runif(nrow(df), min = 0, max = 5))
time1 <- "t0"
time2 <- "t1"
names <- c("dose", "rand")
term_n <- c(0, 0)
tform <- c("loglin", "loglin")
realization_columns <- matrix(c("rand0", "rand1", "rand2"), nrow = 1)
realization_index <- c("rand")
keep_constant <- c(1, 0)
a_n <- c(0, 0)
modelform <- "M"
fir <- 0
der_iden <- 0
cens_weight <- c(0)
event <- "lung"
a_n <- c(-0.1, -0.1)
keep_constant <- c(0, 0)
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 1,
  "halfmax" = 2, "epsilon" = 1e-6,
  "deriv_epsilon" = 1e-6, "abs_max" = 1.0,
  "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = 0, "ties" = "breslow", "double_step" = 1
)
e <- RunCoxRegression_Omnibus_Multidose(df, time1, time2, event,
  names,
  term_n = term_n, tform = tform,
  keep_constant = keep_constant, a_n = a_n,
  modelform = modelform, fir = fir, der_iden = der_iden,
  realization_columns = realization_columns,
  realization_index = realization_index,
  control = control, strat_col = "fac",
  model_control = list(), cens_weight = "null"
)
```

`RunCoxRegression_Single` *Performs basic Cox Proportional Hazards calculation with no derivative*

Description

`RunCoxRegression_Single` uses user provided data, time/event columns, vectors specifying the model, and options and returns the log-likelihood

Usage

```
RunCoxRegression_Single(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  control = list()
)
```

Arguments

`df`	a data.table containing the columns of interest
`time1`	column used for time period starts
`time2`	column used for time period end
`event0`	column used for event status
`names`	columns for elements of the model, used to identify data columns
`term_n`	term numbers for each element of the model
`tform`	list of string function identifiers, used for linear/step
`keep_constant`	binary values to denote which parameters to change
`a_n`	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
`modelform`	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
`fir`	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
`control`	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
keep_constant <- c(0, 0, 0, 0)
control <- list(
  "ncores" = 2, "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1
)
e <- RunCoxRegression_Single(
  df, time1, time2, event, names, term_n, tform,
  keep_constant, a_n, modelform, fir, control
)
```

RunCoxRegression_STRATA

Performs basic Cox Proportional Hazards regression with strata effect

---

Description

RunCoxRegression_STRATA uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions

Usage

```
RunCoxRegression_STRATA(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  strat_col = "null"
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_Single(), RunCoxRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 0, 0, 1, 0, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "ties" = "breslow", "double_step" = 1
)
strat_col <- "e"
e <- RunCoxRegression_STRATA(
  df, time1, time2, event, names, term_n,
  tform, keep_constant, a_n, modelform,
  fir, der_iden, control, strat_col
)
```

RunCoxRegression_Tier_Guesses

Performs basic cox regression, with multiple guesses, starts with solving for a single term

Description

RunCoxRegression_Tier_Guesses uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions, with additional guesses

Usage

```
RunCoxRegression_Tier_Guesses(
  df,
  time1 = "start",
  time2 = "end",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  guesses_control = list(),
  strat_col = "null",
  model_control = list(),
  cens_weight = "null"
)
```

Arguments

df	a data.table containing the columns of interest
time1	column used for time period starts
time2	column used for time period end
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.

modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
guesses_control	list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cens_weight	column containing the row weights

Value

returns a list of the final results

See Also

Other Cox Wrapper Functions: RunCoxNull(), RunCoxRegression(), RunCoxRegression_Basic(), RunCoxRegression_CR(), RunCoxRegression_Guesses_CPP(), RunCoxRegression_Omnibus(), RunCoxRegression_Omnibus_Multidose(), RunCoxRegression_STRATA(), RunCoxRegression_Single()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 0, 0, 1, 0, 1)
)
# For the interval case
time1 <- "Starting_Age"
time2 <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
```

```
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "ties" = "breslow", "double_step" = 1
)
guesses_control <- list(
  "iterations" = 10, "guesses" = 10, "lin_min" = 0.001,
  "lin_max" = 1, "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = TRUE, term_initial = c(0, 1)
)
strat_col <- "e"
e <- RunCoxRegression_Tier_Guesses(
  df, time1, time2, event, names,
  term_n, tform, keep_constant,
  a_n, modelform, fir, der_iden,
  control, guesses_control,
  strat_col
)
```

`RunPoissonEventAssignment`

Predicts how many events are due to baseline vs excess

Description

`RunPoissonEventAssignment` uses user provided data, person-year/event columns, vectors specifying the model, and options to calculate background and excess events

Usage

```
RunPoissonEventAssignment(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
```

```
  control = list(),
  strat_col = "null",
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
```

```
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
df$pyr <- df$Ending_Age - df$Starting_Age
pyr <- "pyr"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "double_step" = 1
)
e <- RunPoissonEventAssignment(
  df, pyr, event, names, term_n,
  tform, keep_constant,
  a_n, modelform, fir, der_iden, control
)
```

RunPoissonEventAssignment_bound *Predicts how many events are due to baseline vs excess at the confidence bounds of a single parameter*

Description

RunPoissonEventAssignment_bound uses user provided data, the results of a poisson regression, and options to calculate background and excess events

Usage

```
RunPoissonEventAssignment_bound(
  df,
  pyr0 = "pyr",
  event0 = "event",
  alternative_model = list(),
```

```
  keep_constant = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  check_num = 1,
  z = 2,
  control = list(),
  strat_col = "null",
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
alternative_model	the new model of interest in list form, output from a poisson regression
keep_constant	binary values to denote which parameters to change
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
check_num	the parameter number to check at the bounds of, indexed from 1 using the order returned by Colossus
z	Z score to use for confidence interval
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus
RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
pyr <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10, "lin_min" = 0.001,
  "lin_max" = 1, "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "e"
e0 <- RunPoissonRegression_Omnibus(
  df, pyr, event, names, term_n, tform,
  keep_constant,
  a_n, modelform, fir, der_iden,
  control, strat_col
)
e <- RunPoissonEventAssignment_bound(
  df, pyr, event, e0, keep_constant,
  modelform, fir, der_iden, 4, 2, control
)
```

RunPoissonRegression *Performs basic poisson regression*

Description

RunPoissonRegression uses user provided data, person-year/event columns, vectors specifying the model, and options to control the convergence and starting positions with no special options

Usage

```
RunPoissonRegression(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
df$pyr <- df$Ending_Age - df$Starting_Age
pyr <- "pyr"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "double_step" = 1
)
e <- RunPoissonRegression(
  df, pyr, event, names, term_n, tform,
  keep_constant,
  a_n, modelform, fir, der_iden, control
)
```

RunPoissonRegression_Guesses_CPP *Performs basic Poisson regression, generates multiple starting guesses on c++ side*

Description

RunPoissonRegression_Guesses_CPP uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Has additional options to starting with several initial guesses

Usage

```
RunPoissonRegression_Guesses_CPP(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  guesses_control = list(),
  strat_col = "null",
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")

guesses_control
: list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")

strat_col
: column to stratify by if needed

model_control
: controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
pyr <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
```

```
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10,
  "lin_min" = 0.001, "lin_max" = 1,
  "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "e"
e <- RunPoissonRegression_Guesses_CPP(
  df, pyr, event, names, term_n,
  tform, keep_constant, a_n, modelform, fir,
  der_iden, control, guesses_control, strat_col
)
```

RunPoissonRegression_Joint_Omnibus

Performs joint Poisson regression using the omnibus function

Description

RunPoissonRegression_Joint_Omnibus uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Has additional options to starting with several initial guesses, uses joint competing risks equation

Usage

```
RunPoissonRegression_Joint_Omnibus(
  df,
  pyr0,
  events,
  name_list,
  term_n_list = list(),
  tform_list = list(),
  keep_constant_list = list(),
  a_n_list = list(),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  strat_col = "null",
  model_control = list(),
  cons_mat = as.matrix(c(0)),
  cons_vec = c(0)
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row

events	vector of event column names
name_list	list of vectors for columns for event specific or shared model elements, required
term_n_list	list of vectors for term numbers for event specific or shared model elements, defaults to term 0
tform_list	list of vectors for subterm types for event specific or shared model elements, defaults to loglinear
keep_constant_list	list of vectors for constant elements for event specific or shared model elements, defaults to free (0)
a_n_list	list of vectors for parameter values for event specific or shared model elements, defaults to term 0
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cons_mat	Matrix containing coefficients for system of linear constraints, formatted as matrix
cons_vec	Vector containing constants for system of linear constraints, formatted as vector

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
a <- c(0, 0, 0, 1, 1, 1)
b <- c(1, 1, 1, 2, 2, 2)
c <- c(0, 1, 2, 2, 1, 0)
d <- c(1, 1, 0, 0, 1, 1)
```

```
e <- c(0, 1, 1, 1, 0, 0)
f <- c(0, 1, 0, 0, 1, 1)
df <- data.table("t0" = a, "t1" = b, "e0" = c, "e1" = d, "fac" = e)
time1 <- "t0"
time2 <- "t1"
df$pyr <- df$t1 - df$t0
pyr <- "pyr"
events <- c("e0", "e1")
names_e0 <- c("fac")
names_e1 <- c("fac")
names_shared <- c("t0", "t0")
term_n_e0 <- c(0)
term_n_e1 <- c(0)
term_n_shared <- c(0, 0)
tform_e0 <- c("loglin")
tform_e1 <- c("loglin")
tform_shared <- c("quad_slope", "loglin_top")
keep_constant_e0 <- c(0)
keep_constant_e1 <- c(0)
keep_constant_shared <- c(0, 0)
a_n_e0 <- c(-0.1)
a_n_e1 <- c(0.1)
a_n_shared <- c(0.001, -0.02)
name_list <- list("shared" = names_shared, "e0" = names_e0, "e1" = names_e1)
term_n_list <- list("shared" = term_n_shared, "e0" = term_n_e0, "e1" = term_n_e1)
tform_list <- list("shared" = tform_shared, "e0" = tform_e0, "e1" = tform_e1)
keep_constant_list <- list(
  "shared" = keep_constant_shared,
  "e0" = keep_constant_e0, "e1" = keep_constant_e1
)
a_n_list <- list("shared" = a_n_shared, "e0" = a_n_e0, "e1" = a_n_e1)
der_iden <- 0
modelform <- "M"
fir <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE,
  "ties" = "breslow", "double_step" = 1
)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10,
  "lin_min" = 0.001, "lin_max" = 1,
  "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "f"
e <- RunPoissonRegression_Joint_Omnibus(
  df, pyr, events, name_list,
  term_n_list,
  tform_list, keep_constant_list,
  a_n_list,
```

```
  modelform, fir, der_iden,
  control, strat_col
)
```

RunPoissonRegression_Omnibus
Performs basic Poisson regression using the omnibus function

Description

RunPoissonRegression_Omnibus uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions. Has additional options to starting with several initial guesses

Usage

```
RunPoissonRegression_Omnibus(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  strat_col = "null",
  model_control = list(),
  cons_mat = as.matrix(c(0)),
  cons_vec = c(0)
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change

a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details
cons_mat	Matrix containing coefficients for system of linear constraints, formatted as matrix
cons_vec	Vector containing constants for system of linear constraints, formatted as vector

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
pyr <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
```

```
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10, "lin_min" = 0.001,
  "lin_max" = 1, "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "e"
e <- RunPoissonRegression_Omnibus(
  df, pyr, event, names, term_n,
  tform, keep_constant,
  a_n, modelform, fir, der_iden,
  control, strat_col
)
```

`RunPoissonRegression_Residual`

Calculates poisson residuals

Description

`RunPoissonRegression_Residual` uses user provided data, time/event columns, vectors specifying the model, and options. Calculates residuals or sum of residuals

Usage

```
RunPoissonRegression_Residual(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
```

```
  der_iden = 0,
  control = list(),
  strat_col = "null",
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 1, 0, 0, 0, 1)
)
# For the interval case
pyr <- "Ending_Age"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "ties" = "breslow",
  "double_step" = 1
)
guesses_control <- list(
  "maxiter" = 10, "guesses" = 10,
  "lin_min" = 0.001, "lin_max" = 1,
  "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = FALSE
)
strat_col <- "e"
e <- RunPoissonRegression_Residual(
  df, pyr, event, names, term_n,
  tform, keep_constant,
  a_n, modelform, fir, der_iden,
  control, strat_col
)
```

RunPoissonRegression_Single

Performs poisson regression with no derivative calculations

Description

RunPoissonRegression_Single uses user provided data, person-year/event columns, vectors specifying the model, and returns the results

Usage

```
RunPoissonRegression_Single(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  a_n = c(0),
  modelform = "M",
  fir = 0,
  control = list(),
  keep_constant = rep(0, length(names))
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
keep_constant	binary values to denote which parameters to change

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1)
)
# For the interval case
df$pyr <- df$Ending_Age - df$Starting_Age
pyr <- "pyr"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "double_step" = 1
)
e <- RunPoissonRegression_Single(
  df, pyr, event, names,
  term_n, tform, a_n, modelform,
  fir, control
)
```

RunPoissonRegression_STRATA *Performs poisson regression with strata effect*

Description

RunPoissonRegression_STRATA uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions

Usage

```
RunPoissonRegression_STRATA(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  strat_col = "null"
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E
fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
strat_col	column to stratify by if needed

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_Single(), RunPoissonRegression_Tier_Guesses()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 0, 0, 1, 0, 1)
)
# For the interval case
df$pyr <- df$Ending_Age - df$Starting_Age
pyr <- "pyr"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
a_n <- c(0.1, 0.1, 0.1, 0.1)
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5, "halfmax" = 5,
  "epsilon" = 1e-3, "deriv_epsilon" = 1e-3,
  "abs_max" = 1.0, "change_all" = TRUE, "dose_abs_max" = 100.0,
  "verbose" = FALSE, "double_step" = 1
)
strat_col <- c("e")
e <- RunPoissonRegression_STRATA(
  df, pyr, event, names,
  term_n, tform, keep_constant,
  a_n, modelform, fir, der_iden, control, strat_col
)
```

RunPoissonRegression_Tier_Guesses

Performs basic poisson regression, with multiple guesses, starts with a single term

Description

RunPoissonRegression_Tier_Guesses uses user provided data, time/event columns, vectors specifying the model, and options to control the convergence and starting positions, with additional guesses

Usage

```
RunPoissonRegression_Tier_Guesses(
  df,
  pyr0 = "pyr",
  event0 = "event",
  names = c("CONST"),
  term_n = c(0),
  tform = "loglin",
  keep_constant = c(0),
  a_n = c(0),
  modelform = "M",
  fir = 0,
  der_iden = 0,
  control = list(),
  guesses_control = list(),
  strat_col = "null",
  model_control = list()
)
```

Arguments

df	a data.table containing the columns of interest
pyr0	column used for person-years per row
event0	column used for event status
names	columns for elements of the model, used to identify data columns
term_n	term numbers for each element of the model
tform	list of string function identifiers, used for linear/step
keep_constant	binary values to denote which parameters to change
a_n	list of initial parameter values, used to determine number of parameters. May be either a list of vectors or a single vector.
modelform	string specifying the model type: M, ME, A, PA, PAE, GMIX, GMIX-R, GMIX-E

fir	term number for the initial term, used for models of the form T0*f(Ti) in which the order matters
der_iden	number for the subterm to test derivative at, only used for testing runs with a single varying parameter, should be smaller than total number of parameters. indexed starting at 0
control	list of parameters controlling the convergence, see Def_Control() for options or vignette("Control_Options")
guesses_control	list of parameters to control how the guessing works, see Def_Control_Guess() for options or vignette("Control_Options")
strat_col	column to stratify by if needed
model_control	controls which alternative model options are used, see Def_model_control() for options and vignette("Control_Options") for further details

Value

returns a list of the final results

See Also

Other Poisson Wrapper Functions: RunPoissonEventAssignment(), RunPoissonEventAssignment_bound(), RunPoissonRegression(), RunPoissonRegression_Guesses_CPP(), RunPoissonRegression_Joint_Omnibus(), RunPoissonRegression_Omnibus(), RunPoissonRegression_Residual(), RunPoissonRegression_STRATA(), RunPoissonRegression_Single()

Examples

```
library(data.table)
## basic example code reproduced from the starting-description vignette
df <- data.table::data.table(
  "UserID" = c(112, 114, 213, 214, 115, 116, 117),
  "Starting_Age" = c(18, 20, 18, 19, 21, 20, 18),
  "Ending_Age" = c(30, 45, 57, 47, 36, 60, 55),
  "Cancer_Status" = c(0, 0, 1, 0, 1, 0, 0),
  "a" = c(0, 1, 1, 0, 1, 0, 1),
  "b" = c(1, 1.1, 2.1, 2, 0.1, 1, 0.2),
  "c" = c(10, 11, 10, 11, 12, 9, 11),
  "d" = c(0, 0, 0, 1, 1, 1, 1),
  "e" = c(0, 0, 0, 0, 1, 0, 1)
)
# For the interval case
df$pyr <- df$Ending_Age - df$Starting_Age
pyr <- "pyr"
event <- "Cancer_Status"
names <- c("a", "b", "c", "d")
a_n <- c(1.1, -0.1, 0.2, 0.5) # used to test at a specific point
term_n <- c(0, 1, 1, 2)
tform <- c("loglin", "lin", "lin", "plin")
modelform <- "M"
fir <- 0
```

```
keep_constant <- c(0, 0, 0, 0)
der_iden <- 0
control <- list(
  "ncores" = 2, "lr" = 0.75, "maxiter" = 5,
  "halfmax" = 5, "epsilon" = 1e-3,
  "deriv_epsilon" = 1e-3, "abs_max" = 1.0, "change_all" = TRUE,
  "dose_abs_max" = 100.0, "verbose" = FALSE, "double_step" = 1
)
guesses_control <- list(
  "iterations" = 10, "guesses" = 10,
  "lin_min" = 0.001, "lin_max" = 1,
  "loglin_min" = -1, "loglin_max" = 1, "lin_method" = "uniform",
  "loglin_method" = "uniform", strata = TRUE, term_initial = c(0, 1)
)
strat_col <- c("e")
e <- RunPoissonRegression_Tier_Guesses(
  df, pyr, event, names,
  term_n, tform, keep_constant, a_n, modelform,
  fir, der_iden, control, guesses_control, strat_col
)
```

`System_Version` *Checks OS, compilers, and OMP*

Description

`System_Version` checks OS, default R c++ compiler, and if OMP is enabled

Usage

```
System_Version()
```

Value

returns a list of results

`Time_Since` *Automates creating a date since a reference column*

Description

`Time_Since` generates a new dataframe with a column containing time since a reference in a given unit

Usage

```
Time_Since(df, dcol0, tref, col_name, units = "days")
```

Arguments

df	a data.table containing the columns of interest
dcol0	list of ending month, day, and year
tref	reference time in date format
col_name	vector of new column names
units	time unit to use

Value

returns the updated dataframe

See Also

Other Data Cleaning Functions: Check_Dupe_Columns(), Check_Trunc(), Check_Verbose(), Correct_Formula_Order(), Date_Shift(), Def_Control(), Def_Control_Guess(), Def_model_control(), Def_modelform_fix(), Joint_Multiple_Events(), Replace_Missing(), factorize(), factorize_par(), gen_time_dep(), interact_them()

Examples

```
library(data.table)
m0 <- c(1, 1, 2, 2)
m1 <- c(2, 2, 3, 3)
d0 <- c(1, 2, 3, 4)
d1 <- c(6, 7, 8, 9)
y0 <- c(1990, 1991, 1997, 1998)
y1 <- c(2001, 2003, 2005, 2006)
df <- data.table::data.table(
  "m0" = m0, "m1" = m1,
  "d0" = d0, "d1" = d1,
  "y0" = y0, "y1" = y1
)
tref <- strptime("3-22-1997", format = "%m-%d-%Y", tz = "UTC")
df <- Time_Since(df, c("m1", "d1", "y1"), tref, "date_since")
```

Index