Package 'EMOTIONS'

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Type Package

Title 'EMOTIONS: Ensemble Models for Lactation Curves'

Version 1.0

Description Lactation curve modeling plays a central role in dairy production, supporting management decisions and the selection of animals with superior productivity and resilience. The package 'EMOTIONS' fits 47 models for lactation curves and creates ensemble models using model averaging based on Akaike information criterion, Bayesian information criterion, root mean square percentage error, and mean squared error, variance of the predictions, cosine similarity for each model's predictions, and Bayesian Model Average. The daily production values predicted through the ensemble models can be used to estimate resilience indicators in the package. Additionally, the package allows the graphical visualization of the model ranks and the predicted lactation curves.

Depends R (>= 4.2)

Imports dplyr, orthopolynom, quantreg, minpack.lm, tidyr, ggplot2, ggridges, parameters, rlang, tidyselect, splines

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.3.2

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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Contents

`LacCurveFit` *A wrapper function for the ModelsLac function that fits lactation curve models based on daily production and days in milk records simultaneously for a list of animals*

Description

The function uses a data frame containing the daily milking records as input.

Usage

```
LacCurveFit(
  data,
  ID,
  trait,
  dim,
  alpha = 0.5,
  models = "All",
  param_list = NULL,
  silent = TRUE
)
```

Arguments

`data`	A data frame containing the daily milking records.
`ID`	The name of the column containing the unique IDs of the individuals.
`trait`	The name of the column containing daily milking records.
`dim`	The name of the column containing days in milk records.
`alpha`	A penalization factor, ranging from 0 to 1, for the estimation of the model's weight.
`models`	A vector describing the models to be included in the analysis. In total, 47 models are included in EMOTIONS. The default option is "All", which results in the inclusion of the 47 models. Alternatively, a vector containing any subset of the following models can be provided: "MMR", "MME", "brody23", "brody24", "SCH", "SCHL", "PBE", "wood", "DHA", "CB", "QP", "CLD", "PapBo1", "PapBo2", "PapBo3", "PapBo4", "PapBo6", "GS1", "GS2", "LQ", "wil", "wilk", "wilycsml", "BC", "DJK", "MG2", "MG4", "MG", "KHN", "AS",

	"FRP", "PTmult", "PTmod", "MonoG", "MonoGpw", "DiG", "DiGpw", "legpol3", "legpol4", "legpolWil", "cubsplin3", "cubsplin4", "cubsplin5", "cubsplindef", "wilminkPop", "qntReg".
param_list	A list composed of the models, named as in the models parameter, and the respective parameters included in the models.
silent	A logical value defining whether warnings should be printed during the model fitting. The default value is TRUE (not printing warnings).

Value

A list containing the fitted models, the model's weights and ranks for each weighting strategy, and the predicted daily production obtained through the model ensemble for each weighting strategy.

ModelRankRange *Create a line plot that shows the range of the ranks obtained for each model across the individuals*

Description

Create a line plot that shows the range of the ranks obtained for each model across the individuals

Usage

```
ModelRankRange(LacCurveFit, metric = "AIC_rank")
```

Arguments

LacCurveFit	The object obtained from the LacCurveFit function
metric	The name of the metric to be used to plot the model's ranks

Value

A line plot that shows the range of the ranks obtained for each model across the individuals

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PlotWeightLac *Plot the actual and predicted daily milk production obtained by the ensemble model*

Description

Plot the actual and predicted daily milk production obtained by the ensemble model

Usage

```
PlotWeightLac(
  data,
  ID,
  trait,
  metric,
  dim,
  col = c("red", "blue"),
  point_size = 2,
  line_size = 1,
  axis_text_size = 15,
  axis_title_size = 15
)
```

Arguments

data	The object generated by the LacCurveFit function
ID	The ID of the individual whose daily milking records will be plotted
trait	The name of the column containing the daily milking records
metric	The name of the strategy used to obtain the predicted values through the ensemble model
dim	The name of the column containing the days in milk (DIM) records
col	A vector defining the colors for the actual and predicted values
point_size	Numeric value indicating the size of the observed data points in the plot
line_size	Numeric value indicating the thickness of the regression line
axis_text_size	Numeric value defining the font size of the axis tick labels
axis_title_size	Numeric value defining the font size of the axis titles

Value

A plot showing the actual and predicted daily milk production across the days in milk

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ResInd *Estimate resilience indicators (log-variance, lag-1 autocorrelation, and skewness) from daily milk production records*

Description

Estimate resilience indicators (log-variance, lag-1 autocorrelation, and skewness) from daily milk production records

Usage

```
ResInd(
  production_df,
  dim_filter_range = c(1, 7, 203, 210),
  outlier_sd_threshold = 4,
  weight = "weight_AIC",
  trait,
  DIM,
  ID_col
)
```

Arguments

production_df	A list containing data frames with the daily production records (actual or predicted) obtained from the LacCurveFit function
dim_filter_range	A numeric vector with the lower and upper limits used to filter out lactation records at the beginning and end of lactation. If no filtering is needed, set the first two values to the minimum days in milk and the last two to the maximum
outlier_sd_threshold	A numeric threshold defining the maximum number of standard deviations allowed for resilience indicator values before considering them outliers
weight	The name of the column containing the selected ensemble prediction. Default is "weight_AIC"
trait	The name of the column containing daily milking records
DIM	The name of the column containing days in milk records
ID_col	The name of the column containing the unique individual IDs

Value

A list containing: (1) the daily milk production values after filtering, (2) a list of removed individuals, and (3) a data frame with the resilience indicators

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RidgeModels *Visualize the distribution of model ranks across individuals using ridge density plots*

Description

The 'RidgeModels' function creates ridge density plots to visualize the distribution of model ranks across individuals.

Usage

```
RidgeModels(LacCurveFit, metric = "AIC_rank")
```

Arguments

`LacCurveFit`	The object returned by the ‘LacCurveFit‘ function
`metric`	The name of the metric used to plot the model ranks

Value

A ridge density plot showing the distribution of ranks for the models included in the ensemble

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