

Package ‘maxnet’

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Type Package

Title Fitting 'Maxent' Species Distribution Models with 'glmnet'

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Imports glmnet

Description

Procedures to fit species distributions models from occurrence records and environmental variables, using 'glmnet' for model fitting. Model structure is the same as for the 'Maxent' Java package, version 3.4.0, with the same feature types and regularization options. See the 'Maxent' website <http://biodiversityinformatics.amnh.org/open_source/maxent> for more details.

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URL <https://github.com/mrmaxent/maxnet>

RoxygenNote 5.0.1

LazyData true

NeedsCompilation no

Repository CRAN

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maxnet-package	<i>Maxent over glmnet</i>
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Description

Maxent species distribution modeling using glmnet for model fitting

Details

Package: maxnet
 Type: Package
 Date: 2013-06-06
 License: To be determined

Create Maxent models for species distributions from presence and background data, using the glmnet package to do the model fitting. By default, feature sets and regularization are the same as the Maxent java application.

Author(s)

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References

Phillips & Dudik Fithian & Hastie Glmnet

bradypus	<i>Occurrence records and background data for the brown-throated three-toed sloth, Bradypus variegatus</i>
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Description

A dataset containing environmental data at 116 Bradypus variegatus occurrence points and 1000 background points in South and Central America. Occurrence data are from Anderson and Handley (2001); see Phillips et al. (2006) for descriptions of the predictor variables.

Usage

bradypus

Format

An object of class data.frame with 1116 rows and 15 columns.

References

Anderson, R. P. and Handley, Jr., C. O. (2001). A new species of three-toed sloth (Mammalia: Xenarthra) from Panama, with a review of the genus *Bradypus*. *Proceedings of the Biological Society of Washington* 114, 1-33.

Phillips, S. J. et al. (2006). Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190, 231-259

hinge

Maxent feature classes

Description

Create and evaluate Maxent's feature classes

Usage

```
hinge(x, nknots = 50)
thresholds(x, nknots=50)
categorical(x)
```

Arguments

x	a predictor: a factor for categorical, otherwise numeric.
nknots	number of knots.

Value

These functions are typically called by `model.matrix` rather than directly by a user. `hinge`, `threshold` and `categorical` return a matrix with a column for each feature of the specified type. `hinge` creates $2 * nknots - 2$ hinge features, half with $min = min(x)$ and half with $max = max(x)$, and knots evenly spaced between $min(x)$ and $max(x)$. A hinge feature $h(min, knot)$ or $h(knot, max)$ is 0 if the predictor is below the first argument, 1 if the predictor is above the second argument, and linearly interpolated inbetween. A threshold feature is 1 if the predictor is above the knot, 0 otherwise. A categorical feature is 1 if the predictor matches the category and 0 otherwise.

Author(s)

Steven Phillips

Examples

```
library(maxnet)
data(bradypus)
hinge(bradypus$tmp6190_ann, nknots=10)
categorical(bradypus$coreg)
```

maxnet

*Maxent over glmnet***Description**

Maxent species distribution modeling using glmnet for model fitting

Usage

```
maxnet(p, data, f = maxnet.formula(p, data), regmult = 1,
      regfun = maxnet.default.regularization, addsamplestobackground=T, ...)
maxnet.default.regularization(p, m)
maxnet.formula(p, data, classes="default")

## S3 method for class 'maxnet'
predict(object, newdata, clamp=T, type=c("link", "exponential", "cloglog", "logistic"), ...)
```

Arguments

p	a vector of 1 (for presence) or 0 (for background).
data	a matrix or data frame of predictor variables.
f	a formula to determine the features to be used.
regmult	a constant to adjust regularization.
regfun	a function to compute regularization constant for each feature.
addsamplestobackground	if T, add to the background any presence sample that is not already there.
object	an object of class "maxnet", i.e., a fitted model.
newdata	values of predictor variables to predict to.
m	a matrix of feature values.
clamp	if true, predictors and features are restricted to the range seen during model training.
type	type of response required.
classes	continuous feature classes desired, either "default" or any subset of "lqph" (for example, "lh").
...	not used.

Details

Using lp for the linear predictor and entropy for the entropy of the exponential model over the background data, the values plotted on the y-axis are:

lp if type is "link".

$\exp(lp)$ if type is "exponential".

$1 - \exp(-\exp(\text{entropy} + lp))$ if type is "cloglog".

$1 / (1 + \exp(-\text{entropy} - lp))$ if type is "logistic".

Value

Maxnet returns an object of class maxnet, which is a list consisting of a glmnet model with the following elements added:

betas	nonzero coefficients of the fitted model
alpha	constant offset making the exponential model sum to one over the background data
entropy	entropy of the exponential model
penalty.factor	the regularization constants used for each feature
featuremins	minimum of each feature, to be used for clamping
featuremaxs	maximum of each feature, to be used for clamping
varmin	minimum of each predictor, to be used for clamping
varmax	maximum of each predictor, to be used for clamping
samplemeans	mean of each predictor over samples (majority for factors)
levels	levels of each predictor that is a factor

Author(s)

Steven Phillips

Examples

```
library(maxnet)
data(bradypus)
p <- bradypus$presence
data <- bradypus[,-1]
mod <- maxnet(p, data)
plot(mod, type="cloglog")
mod <- maxnet(p, data, maxnet.formula(p, data, classes="lq"))
plot(mod, "tmp6190_ann")
```

plot.maxnet *Response plots for maxnet models*

Description

Create response plots for each predictor in a maxnet model

Usage

```
## S3 method for class 'maxnet'
plot(x, vars = names(x$samplemeans), common.scale = T,
     type = c("link", "exponential", "cloglog", "logistic"), ylab = NULL, ...)

response.plot(mod, v, type, mm=mod$samplemeans, min=mod$varmin[v], max=mod$varmax[v],
             levels=unlist(mod$levels[v]), plot=T, xlab=v, ylab=tools::toTitleCase(type), ...)
```

Arguments

x	an object of class maxnet, i.e., a fitted model.
vars	vector of predictors for which response plots are desired.
common.scale	if true, all plots use the same scale on the y-axis.
type	type of response to plot on y-axis.
xlab	label for x-axis.
ylab	label for y-axis.
mod	a fitted model, must be of type maxnet if default values used for other arguments.
v	name of variable to be plotted.
mm	sample means (or majorities for factors) for predictors; predictors other than v are given these values.
min	minimum value of v; determines range of x-axis
max	maximum value of v; determines range of x-axis
levels	if v is a factor, determines levels to be plotted
plot	if false, don't draw the plot
...	passed to plot or barplot

Value

If plot is false, return a vector of y values, one for each factor or 100 ranging from $\min - 0.1 * (\max - \min)$ to $\max + 0.1 * (\max - \min)$.

Author(s)

Steven Phillips

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