Package 'banter'

July 10, 2018

Type Package

Title BioAcoustic EveNT ClassifiER

Description Create a hierarchical acoustic event species classifier out of multiple call type detectors as described in Rankin et al (2017) <doi:10.1111/mms.12381>.

Version 0.9.3

Depends magrittr

Imports dplyr, ggplot2, gridExtra, methods, parallel, plyr, randomForest, ranger, rfPermute, rlang, stats, tibble, tidyr

License GNU General Public License

RoxygenNote 6.0.1

NeedsCompilation no

Author Eric Archer [aut, cre], Taiki Sakai [aut]

Maintainer Eric Archer <eric.archer@noaa.gov>

Repository CRAN

Date/Publication 2018-07-10 15:20:06 UTC

R topics documented:

`banter-package` *BioAcoustic EveNT ClassifiER*

Description

banter

`addBanterDetector` *Add a BANTER Detector Model*

Description

Add a detector model to a BANTER classifier.

Usage

```
addBanterDetector(x, data, name, ntree, sampsize = 1, importance = FALSE,
  num.cores = NULL)

removeBanterDetector(x, name)
```

Arguments

`x`	a `banter_model` object.
`data`	detector data.frame or named list of detector data.frames. If a data.frame, then `name` must be provided.
`name`	detector name.
`ntree`	number of trees.
`sampsize`	number or fraction of samples to use in each tree.
`importance`	retain importance scores in model? Defaults to `FALSE` and will be ignored if `num.cores > 1`.
`num.cores`	number of cores to use for Random Forest model.

Value

a `banter_model` object with the detector model added or removed.

Author(s)

Eric Archer `<eric.archer@noaa.gov>`

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add the 'bp' (burst pulse) detector model
bant.mdl <- addBanterDetector(
  x = bant.mdl,
  data = train.data$detectors$bp,
  name = "bp",
  ntree = 50, sampsize = 1, num.cores = 1
)
bant.mdl

# remove the 'bp' detector model
bant.mdl <- removeBanterDetector(bant.mdl, "bp")
bant.mdl
```

---

getBanterModel *Extract Random Forest Model*

Description

Extract BANTER event or detector Random Forest model.

Usage

```
getBanterModel(x, model = "event")
```

Arguments

x	a banter_model object.
model	name of model to extract. Default is "event" to summarize the event-level model. Can also be name of a detector.

Value

a randomForest model object.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

# extract the event randomForest model
library(randomForest)
event.rf <- getBanterModel(bant.mdl)
event.rf

# extract the burst pulse (bp) detector model
bp.rf <- getBanterModel(bant.mdl, "bp")
bp.rf
```

---

getBanterModelData *Extract Random Forest Model Data*

Description

Extract BANTER event data used for the Random Forest model.

Usage

```
getBanterModelData(x)
```

Arguments

x	a banter_model object.

Value

a randomForest model object.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

event.df <- getBanterModelData(bant.mdl)
head(event.df)
```

`getDetectorNames` *Detector Names*

Description

Return names of detectors loaded in BANTER model.

Usage

```
getDetectorNames(x)
```

Arguments

x	a `banter_model` object.

Value

a vector of names.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
```

```
getDetectorNames(bant.mdl)
```

`getSampSize` *Sample Size*

Description

Return sample size used for a BANTER model.

Usage

```
getSampSize(x, model = "event")
```

Arguments

`x`	a `banter_model` object.
`model`	name of model to extract. Default is `"event"` to summarize the event-level model. Can also be name of a detector.

Value

a vector of sample sizes.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 2, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

# sample size for the event model
getSampSize(bant.mdl)

# sample size for the burst pulse (bp) detector model
getSampSize(bant.mdl, "bp")
```

`initBanterModel` *Initialize BANTER model*

Description

Initialize a BANTER model with event data.

Usage

```
initBanterModel(x)
```

Arguments

`x`	a data.frame of events. Every row is a unique event. Must have columns named `event.id` and `species`. All other columns will be used as predictor variables for the BANTER event classifier model.

Value

a `banter_model` object without any detector models.

Note

Values in the column `species` are passed through the `make.names` function on creation to ensure they don't include invalid characters.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
bant.mdl
```

modelPctCorrect *Model Percent Correct*

Description

Extract percent correctly classified by species for detector and event models.

Usage

```
modelPctCorrect(x)
```

Arguments

x	a banter_model object.

Value

a data.frame with the percent correctly classified for each model in x.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)
modelPctCorrect(bant.mdl)
```

numCalls *Number and Proportion of Calls*

Description

Number and proportion of calls in BANTER detector models

Usage

```
numCalls(x, by = c("species", "event"))

propCalls(x, by = c("species", "event"))
```

Arguments

x	a banter_model object.
by	return summary by "species" or "event".

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

# number of calls by species and event
numCalls(bant.mdl, "species")
numCalls(bant.mdl, "event")

# proportion of calls by species and event
propCalls(bant.mdl, "species")
propCalls(bant.mdl, "event")
```

---

numEvents *Number of Events*

Description

Number of events in BANTER model by species.

Usage

```
numEvents(x, model = "event")
```

Arguments

x	a banter_model object.
model	name of model to extract. Default is "event" to summarize the event-level model. Can also be name of a detector.

Value

a data.frame giving the number of events available for each species.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

# number of events in event model
numEvents(bant.mdl)

# number of events in burst pulse (bp) detector model
numEvents(bant.mdl, "bp")
```

---

plotDetectorTrace *Plot BANTER Detector Traces*

Description

Plot traces of OOB error rates for detector Random Forest models

Usage

```
plotDetectorTrace(x, detector = NULL)
```

Arguments

x	a banter_model object.
detector	names of models to plot. If set to NULL, traces for all models will be shown.

Author(s)

Eric Archer <eric.archer@noaa.gov>

See Also

plotRFtrace

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)

plotDetectorTrace(bant.mdl)
```

---

predict *Predict BANTER events*

Description

Predict species of events for novel data from a BANTER model.

Usage

```
## S3 method for class 'banter_model'
predict(object, new.data, ...)
```

Arguments

object	a banter_model object.
new.data	a list of event and detector data that has the same predictors as in the banter_model. It must contain elements called events and detectors. The events element must be a data.frame that has a column called event.id and the same predictor columns as the event data used to initialize the banter model (see initBanterModel). The detectors element must be a named list with the same detectors used to build the model (see addBanterDetector).
...	unused.

Value

A list with the following elements:

events the data frame used in the event model for predictions.

predict.df data.frame of predicted species and assignment probabilities for each event.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 2, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)

# predict test data
data(test.data)
test.pred <- predict(bant.mdl, test.data)
test.pred
```

---

runBanterModel *Run BANTER Model*

Description

Build full event classifier model

Usage

```
runBanterModel(x, ntree, sampsize = 1)
```

Arguments

x	a banter_model object.
ntree	number of trees.
sampsize	number or fraction of samples to use in each tree.

Value

a banter_model object with the complete BANTER model.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)
summary(bant.mdl)
```

---

summary *BANTER Classifier Model Summary*

Description

Display summaries for event and detector models

Usage

```
## S3 method for class 'banter_model'
summary(object, model = "event", n = 0.1,
  bins = 20, ...)
```

Arguments

object	a banter_model object.
model	name of model to summarize. Default is "event" to summarize the event-level model. Can also be name of a detector.
n	number of final iterations to summarize OOB error rate for. If between 0 and 1 is taken as a proportion of chain.
bins	number of bins in inbag histogram.
...	ignored.

Value

In the plot that is created, the upper panel shows the trace of the Random Forest model OOB rate across sequential trees in the forest. The lower plot shows a frequency histogram of the number of times each sample was inbag (used as training data in a tree in the forest). The vertical red lines indicate the expected inbag rate for samples of each species.

Author(s)

Eric Archer <eric.archer@noaa.gov>

Examples

```
data(train.data)
# initialize BANTER model with event data
bant.mdl <- initBanterModel(train.data$events)
# add all detector models
bant.mdl <- addBanterDetector(
  bant.mdl, train.data$detectors,
  ntree = 50, sampsize = 1, num.cores = 1
)
# run BANTER event model
bant.mdl <- runBanterModel(bant.mdl, ntree = 1000, sampsize = 1)
summary(bant.mdl)
```

---

test.data *Testing events and detectors*

Description

A list of events and call data from detectors for testing BANTER model

Usage

```
data(test.data)
```

Format

list

---

train.data *Training events and detectors*

Description

A list of events and call data from detectors for training BANTER model

Usage

```
data(train.data)
```

Format

list

Index