Package 'survivalPLANN'

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Type Package

Title Neural Networks to Predict Survival

Version 0.1

Depends R (>= 4.0.0), survival, nnet

Imports methods, stats

Description Several functions and S3 methods to predict survival by using neural networks. We implemented Partial Logistic Artificial Neural Networks (PLANN) as proposed by Biganzoli et al. (1998) <https://pubmed.ncbi.nlm.nih.gov/9618776>.

License GPL (>= 2)

LazyLoad yes

NeedsCompilation no

BugReports https://github.com/chupverse/survivalPLANN/issues

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Repository CRAN

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Contents

dataK *Observed Mortality Data of Patients with Cancer*

Description

An data frame with a simulated sample of patients with a cancer and their follow-up.

Usage

```
data(dataK)
```

Format

The format is "data.frame". The names of the columns are:

sex	A numeric vector equals 1 for male and 2 for male.
age	A numeric vector with the age of the patient at the time of cancer diagnosis (baseline).
year	A numeric vector with the date of diagnosis (in date format, i.e., the number of days since 1Jan60).
stade	A numeric vector with the disease stage: 1 for advanced cancer and 0 otherwise. according to the time. Only the dimension related to sex equals 1.
delay	A numeric vector indicating early diagnosis: 1 for delayed diagnosis and 0 otherwise.
biomarker	A numeric vector with a biomarker associated with cancer-specific mortality.
sexchara	A character vector with the patient gender: "male" or "female".
event	A numeric vector equals 1 for death and 0 for censoring.
time	A numeric vector with the follow-up time in days since the cancer diagnostic.

Details

The data frame was obtained by simulations. The French mortality tables were used for the expected mortality and a proportional hazard model with an Exponential distribution for the baseline hazard.

Examples

```
data(dataK)

# Plotting the observed survival by using the Kaplan-Meier estimator

plot(survfit(Surv(time/365.241, event) ~ 1, data = dataK),
     ylab="Patient survival", xlab="Post-diagnostic time in years")
```

predict.survivalPLANN *Predict Survival From a Neural Network Based on the PLANN Method*

Description

This function produces survival prediction from a neural network based on the PLANN method.

Usage

```
## S3 method for class 'survivalPLANN'
predict(object, newdata = NULL, newtimes = NULL, ...)
```

Arguments

object	The result of the survivalPLANN function.
newdata	An optional data frame comprising of new examples to be predicted. If NULL, the data frame used is the one used for training in the survivalPLANN function.
newtimes	A optional numeric vector comprising of times to get survival estimations. If NULL, the times are the intervals used in the survivalPLANN function.
...	Further arguments passed to or from other methods.

Value

times	The times used for the predicitions.
predictions	A data frame comprising of the survival predictions from the neural network.

References

Biganzoli E, Boracchi P, Mariani L, and et al. Feed forward neural networks for the analysis of censored survival data: a partial logistic regression approach. Stat Med, 17:1169-86, 1998.

Examples

```
data(dataK)

splann <- survivalPLANN(Surv(time, event) ~ sex + stade + delay, data=dataK, inter=365,
                        size=32, decay=0.01, maxit=200, MaxNWts=10000)

dnew <- data.frame(sex=c(1,2), delay=c(0,0), stade=c(0,0))

pred <- predict(splann, newdata = dnew)

# Predictions for a men or a women with no delay at the diagnostic of non-agressive cancer

plot(c(0,pred$times/365.241), c(1,pred$predictions[1,]), ylab="Patient survival",
  xlab="Post-diagnosis time in years", type="l")
lines(c(0,pred$times/365.241), c(1,pred$predictions[2,]), type="l", col=2)
```

print.survivalPLANN *Print Method for a Neural Network Based on the PLANN Method*

Description

This function prints a description of the neural network using the PLANN method.

Usage

```
## S3 method for class 'survivalPLANN'
print(x, ...)
```

Arguments

x	The result of a survivalPLANN fit.
...	Further arguments passed to or from other methods.

Value

No return value for this S3 method.

References

Biganzoli E, Boracchi P, Mariani L, and et al. Feed forward neural networks for the analysis of censored survival data: a partial logistic regression approach. Stat Med, 17:1169-86, 1998.

Examples

```
data(dataK)

splann <- survivalPLANN(Surv(time, event) ~ sex + stade + delay, data=dataK, inter=365,
                        size=32, decay=0.01, maxit=100, MaxNWts=10000)

print(splann)
```

survivalPLANN *Survival Neural Network by Using the PLANN Method*

Description

This function allows to compute a neural network using the PLANN method.

Usage

```
survivalPLANN(formula, data, inter, size = 32, decay = 0.01,
                          maxit = 100, MaxNWts = 10000, trace = FALSE, ...)
```

Arguments

formula	a formula object, with the response on the left of a ~ operator, and the terms on the right. The response must be a survival object as returned by the Surv function.
data	A data frame in which to look for the variables included in the formula.
inter	A numeric value representing the length of the intervals.
size	A numeric value for the number of units in the hidden layer. Default is set to 32
decay	A numeric value for the parameter for weight decay. Default is set to 0.01
maxit	A numeric value for the maximum number of iterations. Default is set to 100.
MaxNWts	The maximum allowable number of weights. There is no intrinsic limit in the code, but increasing MaxNWts will probably allow fits that are very slow and time-consuming. Default is set to 10000
trace	A logical argument for tracing optimization. Default is set to FALSE.
...	Further arguments passed to or from other methods.

Details

The nnet loss function parameter is fixed to entropy as Biganzoli's PLANN method minimize the cross-entrophy loss function which correspondS to maximizing the loglikelihood.

Value

formula	The formula object.
fitsurvivalnet	The fitted nnet object.
data	The data frame given with the computed Intervals column added.
data_dup	The base data frame with the duplicated rows based on the Intervals column.
call	The function call for the creation of the nnet object.
inter	The interval length.
size	The number of units in the hidden layer.
decay	The value of the parameter for weight decay.
maxit	The value of the parameter for maxit.
MaxNWts	The value of the parameter for MaxNWts.
coefnames	The name(s) of the covariate(s) used in the model.
y	The values of time and event.
x	The model covariates values.
intervals	The intervals limits values.
missing	The rows with a missing value in the data base.

References

Biganzoli E, Boracchi P, Mariani L, and et al. Feed forward neural networks for the analysis of censored survival data: a partial logistic regression approach. Stat Med, 17:1169-86, 1998.

Examples

```
data(dataK)

splann <- survivalPLANN(Surv(time, event) ~ sex + stade + delay, data=dataK, inter=365,
                        size=32, decay=0.01, maxit=100, MaxNWts=10000)

print(splann)
```

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