Package: glba (via r-universe)

August 25, 2024

Version 0.2.1

Title General Linear Ballistic Accumulator Models

Date 2015-02-15

Author Ingmar Visser

Maintainer Ingmar Visser <i.visser@uva.nl>

Depends R (>= 3.1.2)

Description Analyses response times and accuracies from psychological experiments with the linear ballistic accumulator (LBA) model from Brown and Heathcote (2008). The LBA model is optionally fitted with explanatory variables on the parameters such as the drift rate, the boundary and the starting point parameters. A log-link function on the linear predictors can be used to ensure that parameters remain positive when needed.

License GPL

NeedsCompilation no

Date/Publication 2022-05-02 13:01:52 UTC

Repository https://ingmarvisser.r-universe.dev

RemoteUrl https://github.com/cran/glba

RemoteRef HEAD

RemoteSha 2e43a7bd8ce543cf92056ad7a85d47d74f14b354

Contents

glba-package *Fit LBA models with explanatory variables.*

Description

Fit LBA models with explanatory variables on the parameters.

Details

Package:	glba
Type:	Package
Version:	0.2
Date:	2015-02-11
License:	GPL

See ?lba for examples.

Author(s)

Ingmar Visser (with functions adapted from Brown, Heathcote and Donkin). Maintainer: Ingmar Visser <i.visser@uva.nl>

References

Brown, S. D., and Heathcote, A. (2008). The simplest complete model of choice response time: linear ballistic accumulation. Cognitive psychology, 57(3), 153-178.

Examples

```
# To be added later
```

bh08 *Example data from Brown and Heathcote (2008).*

Description

Example data from Brown and Heathcote (2008); response times and accuracies for three difficulty levels.

Usage

```
data(bh08)
```

Format

A data frame with 3000 observations on the following 3 variables.

`acc` response accuracy

`rt` response times

`diff` difficulty, a factor with levels `easy` `medium` `diff`

Details

Example data from Brown and Heathcote, 2008.

Source

Data from: http://www.newcl.org/members/chris/fitLBA.zip

Brown and Heathcote, Cognitive science, 2008

References

Brown and Heathcote, 2008

Examples

```
data(bh08)
```

---

core — *Core functions to compute the probability density function, cumulative distribution function, and defective distribution of the LBA (see Brown and Heathcote, 2008).*

Description

For internal use only.

Author(s)

Ingmar Visser adapted these functions, to make them fully vectorized in all relevant arguments. Original functions fptpdf, fptcdf and n1PDF are provided by Brown, Heathcote and Donkin and are retrieved from: http://www.newcl.org/members/chris/fitLBA.zip

References

http://www.newcl.org/members/chris/fitLBA.zip

ilpp2 *Implicit learning data from Visser et al (2007).*

Description

Implicit learning data from Visser et al (2007); these data are from blocks 1-12 of participant 2 of Experiment 1.

Usage

```
data(ilpp2)
```

Format

A data frame with 12 blocks of 395 trials of a sequential response time task; observations on the following variables:

`id` participant id

`ses` session number (1-2)

`blk` block number within session (1-6)

`tri` trial location (1-4)

`ans` answer location (1-4)

`rt` response time in seconds

`acc` accuracy (factor with levels 'cor'rect and 'inc'orrect

`acBin` accuracy in binary format

`blk2` block number continuous (1-12)

`tt` trial type; factor with levels 'seq'uential and 'ran'dom

Details

Data from Visser et al (2007), Memory and Cognition.

Source

Visser et al (2007), Memory and Cognition.

References

Visser et al (2007), Memory and Cognition.

Examples

```
data(ilpp2)
```

internal *Utility functions for internal use.*

Description

Functions for specifying, printing and altering the submodels for each of the parameters.

Author(s)

Ingmar Visser

lba *Specify and fit lba models.*

Description

Specification of lba models with explanatory variables on the parameters. Models are fitted using full information maximum likelihood.

Usage

```
lba(rt, response, data, weights,
sddr = ~1,
sp = ~1,
bound = ~1,
nond = ~1,
drift = ~1,
scaling = "sum",
loglink = c(FALSE, FALSE, FALSE, FALSE),
sdstart=0.1,
startpars,
fixed = NULL,
method = "L-BFGS-B",
hessian = FALSE,
lower = -Inf,
upper = Inf,
fit=TRUE,
debug=FALSE)

## S3 method for class 'lba'
logLik(object, ...)
## S3 method for class 'lba'
print(x, ...)
## S3 method for class 'lba'
summary(object, ...)
```

```
tablba(object)
```

Arguments

rt	The name of the response time variable in data.frame 'data'.
response	The name of the response time variable in data.frame 'data'.
data	Data.frame containing the variables.
weights	Optional case weights.
sddr	The model for the standard deviation of the drift rate, see Details.
sp	The model for the start point parameter, see Details.
bound	The model for the boundary parameter, see Details.
nond	The model for the non-decision time, see Details.
drift	The model for the drift rate parameter, see Details.
scaling	Options for making the model identifiable; options are "sum" or "fixedSD".
loglink	Wheter parameters (sddr, sp, nond, and bound) should be fitted using a log link function (to avoid boundary estimation issues).
sdstart	Starting value of the standard deviation of the drift rates in case argument scaling uses option "fixedSD".
startpars	Vector of starting values for the parameters. This is currently a required argument as no automatic starting values are available.
fixed	Logical; when startpars is given 'fixed' can be used to specify whether parameters should remain fixed during estimation; sometimes required for more stable estimation.
method	Optimization method; passed to optim.
hessian	Logical; indicating whether the estimated hessian at the minimum; passed to optim.
lower, upper	lower and upper boundaries for the parameters; only applicable with optimization method 'L-BFGS-B' is used.
fit	Logical; indicating whehter the model should be fit, ie, its parameters optimized or not. Default is TRUE.
debug	Logical, default is FALSE; prints out detailed information on submodels, parameters et cetera during optimization.
object	a (fitted) lba model.
x	a (fitted) lba model.
...	not currently in use.

Details

The 5 sub-models of the LBA model can be specified using a formula. Eg, `nond=~diff`, specifies a model in which the nondecision time is modeled as function of `difficulty`; `diff` may be a factor or numerical variable.

Identification of the model is attained by having the drift rates for alternatives in `response` sum to unity or by having a fixed standard deviation of the drift rates. These options are specified by scaling="sum" or scaling="fixedSD", respectively. In the latter case, the value of the fixed standard deviation is assumed to be the first value of `startpars`.

If `hessian` is set to TRUE, `optim` is used to get the Hessian at the maximum likelihood estimates of the parameters. This is used in turn to compute standard errors. The `summary` function pretty prints a table of parameter estimates, standard errors, z- and p-values. The `summary` function also prints the separate sub-model specifications and the parameter estimates. The `print` function prints basic information and a (named) vector of parameter estimates.

Value

The `lba` function returns a list with the following components:

`pars`	The values of fitted parameters.
`logl`	The optimized log likelihood
`convergence`	Convergence information from `optim`
`hessian`	Only included if `hessian` was set to TRUE
`ses`	Only included if `hessian` was set to TRUE and the hessian is non-singular
`fixed`	Vector of logical's indicating whether parameters were fixed
`model`	List of 5 sub-models of the LBA model, see Details above.
`npar`	The number of parameters of the model
`freepars`	The number of freely estimated parameters of the model
`nobs`	The number of observations, used in computing the BIC
`call`	The (matched) call to the `lba` function

Function `tablba` returns a `data.frame` with columns:

`value`	The estimated (or fixed) parameter value
`se`	The standard error of the parameter computed from the Hessian
`z`	The z-ratio of `value` and `se`
`p`	The p-value associated with `z`

Author(s)

Ingmar Visser

References

LBA models as in Brown and Heathcote, Cognitive science, 2008.

Examples

```
data(bh08)

# reduce the data set for faster runtimes
bh1 <- bh08[c(1:300,1001:1300,2001:2300),]

# remove extreme RTs
bh1 <- bh1[bh1$rt>.180&bh1$rt<2,]

# starting values based on the quantile parameter
# estimates from Brown and Heathcote, 2008:
# pars <- c(.25,.3,.1,.2,.9,.75,.6)

# fit the model with starting values
pars <- c(.25,.3,.1,.2,.9,.75,.6)
m1 <- lba(rt=rt,response=acc,drift=~diff-1,data=bh1,
 startpars=pars)

m1

summary(m1)

## Not run:
 # use random starting values instead
 set.seed(2)
 m1 <- lba(rt=rt,response=acc,drift=~diff-1,data=bh08,
 startpars=pars, hessian=TRUE)

 summary(m1)

 # get the parameters
 pp <- m1$pars
 # simulate some data from the model for the three conditions
 set.seed(1)
 dt1 <- rlba(1000, b=pp[3]+pp[2], A=pp[2], vs=c(pp[5],1-pp[5]),
  s=pp[1], t0=pp[4], truncdrifts=TRUE)
 dt2 <- rlba(1000, b=pp[3]+pp[2], A=pp[2], vs=c(pp[6],1-pp[6]),
  s=pp[1], t0=pp[4], truncdrifts=TRUE)
 dt3 <- rlba(1000, b=pp[3]+pp[2], A=pp[2], vs=c(pp[7],1-pp[7]),
  s=pp[1], t0=pp[4], truncdrifts=TRUE)
 dt <- rbind(dt1,dt2,dt3)
 dt$diff <- gl(3,1000)
 dt$resp <- ifelse(dt$resp==2,0,1)

 # remove extreme RTs
 dt <- dt[dt$rt>.180&dt$rt<2,]

 # refit the model with the simualted data
 m1rf <- lba(rt=rt,response=resp,drift=~diff-1,data=dt,startpars=pp)

 data(numpp1)
```

```
set.seed(9)
m2 <- lba(rt=rt,response=acc,drift=~diff+block,data=numpp1,
startpars=c(0.25,runif(4),0,0), scaling="fixedSD",
 sdstart=0.25, hessian=TRUE)
tablba(m2)


## End(Not run)
```

---

numpp1 *Example data from a numerosity task.*

Description

Example data from a numerosity task. Participant is required to categorize a display of randomly placed dots into 'few' or 'many'.

Usage

```
data(numpp1)
```

Format

A data frame with 186 observations on the following 10 variables. Extreme data are removed.

`stim` file name of the stimulus

`trial` trial number

`acc` accuracy in binary format

`rt` response time in seconds

`nr` required response; factor with levels 'few' and 'many'

`block` block number (1-5)

`dots` number of dots in the display

`diff` absolute value of 'dots'-50

`df2` dichotomized version of 'diff'

`id` participant id

Details

Example data from a numerosity task.

Source

Unpublished data.

References

Unpublished data.

Examples

```
data(numpp1)
```

`rlba` *Generate data from an LBA model.*

Description

Generate data from an LBA model.

Usage

```
rlba(n, b, A, vs, s, t0, st0 = 0, truncdrifts = TRUE)
```

Arguments

`n`	The number of random variates required.
`b`	The boundary parameter.
`A`	The start point parameter.
`vs`	The drift rates for each of the accumulators.
`s`	The standard deviation of the drift rates.
`t0`	The non-decision time.
`st0`	Variability of the non-decision time, uniformly distributed as t0+U(0,st0).
`truncdrifts`	Logical; whether drifts that are generated should be truncated at zero. Negative RTs may result when set to FALSE.

Details

No more details.

Value

A data.frame with two variables, 'rt' and 'resp', for the response time and the response, respectively.

Author(s)

Ingmar Visser, function adapted from Brown and Heathcote.

http://www.newcl.org/publications/2008/lbasoftware.htm

References

Function adapted from Brown and Heathcote.

http://www.newcl.org/publications/2008/lbasoftware.htm

Examples

```
# to be added later
```

Index