Package 'bayeslist'

March 20, 2025

Title Bayesian Analysis of List Experiments with Prior Information

Version 0.0.1.5

Author Xiao Lu [aut, cre],
Richard Traunmüller [aut]

Maintainer Xiao Lu <xiao.lu.research@gmail.com>

Description Estimates Bayesian models of list experiments with informative priors. It includes functionalities to estimate different types of list experiment models with varying prior information. See Lu and Traunmüller (2021) <doi:10.2139/ssrn.3871089> for examples and details of estimation.

License MIT + file LICENSE

Encoding UTF-8

LazyData true

Biarch true

Depends R (>= 3.5.0)

Imports methods, Formula, Rcpp (>= 0.12.0), rstan (>= 2.18.1), rstantools (>= 2.1.1), ggplot2 (>= 3.3.3)

LinkingTo BH (>= 1.66.0), Rcpp (>= 0.12.0), RcppEigen (>= 0.3.3.3.0), RcppParallel (>= 5.0.1), rstan (>= 2.18.1), StanHeaders (>= 2.18.0)

SystemRequirements GNU make

RoxygenNote 7.3.2

NeedsCompilation yes

Repository CRAN

Date/Publication 2025-03-20 04:00:02 UTC

Contents

`bayeslist-package` *The 'bayeslist' package.*

Description

Estimate list experiment data applying full Bayesian approaches.

Author(s)

Maintainer: Xiao Lu <xiao.lu.research@gmail.com>

Authors:

- Richard Traunmüller

`bayeslist` *Fitting Bayesian sensitive item models*

Description

The main function for estimating Bayesian sensitive item models. The function returns a `bayeslist` object that can be further investigated using standard functions such as `summary`, `plot`, `print`, `predict`, and `coef`. The model can be passed using a `formula` as in `lm()`. Convergence diagnotics can be performed using either `print(object, "mcmc")` or `plot(object, "trace")`.

Usage

```
bayeslist(
  formula,
  data,
  treat,
  J,
  type = "outcome",
  nsim = 1000,
  burnin = NULL,
  thin = 1,
  CIsize = 0.95,
  nchain = 1,
  seeds = 12345,
  vb = FALSE,
  only_vb = FALSE,
  prior = NULL,
  direct_item = NULL,
  direct_item_misreport = NULL,
  double_list = NULL,
  double_list_treat = NULL,
  aux_info = NULL,
  aux_g = NULL,
  aux_h = NULL,
  BL_a = NULL,
  BL_b = NULL,
  conjugate_distance = FALSE,
  conjugate_k = NULL,
  predictvar = NULL,
  predictvar_type = "binary",
  parallel = TRUE,
  robust = FALSE
)
```

Arguments

formula	An object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data	A data frame containing the variables in the model.
treat	Variable name of the treatment.
J	Number of control items.
type	Type of the model. Options include "outcome", "predict", "misreport", for the sensitive item outcome model, predictor model and misreport model, respectively.
nsim	The number of iterations.
burnin	The number of burnin iterations.
thin	Thinning parameter.

CIsize	The size of posterior confidence interval.
nchain	The number of parallel chains.
seeds	Random seeds to replicate the results.
vb	Logic. If TRUE, variational approximation will be used to supply initial values. The default is FALSE.
only_vb	Logic. If TRUE, only variational approximation will be calculated. The default is FALSE.
prior	Prior types. Options include "auxiliary", "double_list", "direct_item", and "BL" for beta-logistic prior. If NULL, no informative priors will be used.
direct_item	Variable name of the direct item.
direct_item_misreport	Variable name of the direct item for the misreporting model.
double_list	Variable name of the second list.
double_list_treat	Treatment variable of the second list.
aux_info	Auxiliary information for the informative priors. list(G,h,g), where: G (number of subgroups), h (auxiliary information for each subgroup), and g (subgroup indicator). If is.NULL, the following two parameters need to be specified when estimating the model with prior = "auxiliary".
aux_g	Auxiliary information for the informative priors: name of the variable indicating the group of each observation.
aux_h	Auxiliary information for the informative priors: name of the variable containing information of prevalence for each group
BL_a	The first shape hyperparameter for the beta-logistic prior, indicating the prior number of affirmative answers to the sensitive item.
BL_b	The second shape hyperparameter for the beta-logistic prior, indicating the prior number of non-affirmative answers to the sensitive item.
conjugate_distance	Logic. Indicating whether conjugate distance prior should be used. The default is FALSE.
conjugate_k	Degrees of freedom to be scaled by conjugate distance prior. The default is NULL.
predictvar	Variable name of the outcome to be predicted.
predictvar_type	The type of the outcome variable to be predicted. Options include "linear" and "binary". The default is "binary".
parallel	Logic. Indicating whether to do paralell computing. The default is TRUE.
robust	Logic. Indicating whether to impose robust constraints on the intercept-only model. The default is FALSE.

Value

A `bayeslist` object. An object of class `bayeslist` contains the following elements

`Call` The matched call.

`formula` Symbolic representation of the model.

`type` Model type

`nsim` Number of iterations.

`Burnin` Number of burnin iterations.

`thin` Thinning.

`seeds` Random seeds for reproducibility. The default is 12345.

`CIsize` Size of the posterior confidence interval.

`data` Data used.

`X` Independent variables.

`Y` Dependent variables.

`xnames` Names of the independent variables.

`stanfit` Output from stan.

`sampledf` Posterior samples.

`summaryout` Summary of the stan-fit object.

`npars` Number of control variables.

`only_vb` Whether only viariational approximation is used.

`prior` Informative prior types.

`direct_item` Direct item.

`double_list` The second list.

`aux_info` Auxiliary information.

`ulbs` Upper and lower bounds based on the specified confidence interval.

`means` Mean estimates.

`treat` Treatment.

`outcome` Outcome to be predicted.

`direct` Direct item for the misreport model.

`robust` Robust indicator.

References

Lu, X. and Traunmüller, R. (2021). Improving Studies of Sensitive Topics Using Prior Evidence: A Unified Bayesian Framework for List Experiments, SSRN, doi:10.2139/ssrn.3871089.

Examples

```
# Estimate sensitive item outcome model using Sri Lanka data on male sexual violence
# Load Sri Lanka list experiment data
data(srilanka)

# Model 1: intercept-only outcome model without prior information:
mod1 <- bayeslist(sexaussault ~ 1, data = srilanka, treat = "treatment", J = 3,
type = "outcome", nsim = 200, thin = 1, CIsize = 0.95, nchain = 1,
seeds = 342321, prior = NULL, parallel = TRUE)
summary(mod1) # summary of estimates
predict(mod1) # predicted prevalence for each observation
plot(mod1,"trace") # trace plot
plot(mod1,"coef") # coefficient plot
plot(mod1, only_prev = TRUE) # prevalence plot


# Model 2: multivariate outcome model without prior information:
mod2 <- bayeslist(sexaussault ~ age + edu, data = srilanka, treat = "treatment", J = 3,
type = "outcome", nsim = 200, thin = 1, CIsize = 0.95, nchain = 1,
seeds = 342321, prior = NULL, parallel = TRUE)
summary(mod2) # summary of estimates
predict(mod2) # predicted prevalence for each observation
plot(mod2,"trace") # trace plot
plot(mod2,"coef") # coefficient plot
plot(mod2) # prevalence + coefficient plot

# Model 3: intercept-only outcome model with prior information from medicolegal reports, i.e.,
# with a prior beta-logistic distribution BL(38, 146).
a <- 38; b <-146
mod3 <- bayeslist(sexaussault ~ 1, data = srilanka, treat = "treatment", J = 3,
type = "outcome", nsim = 200, thin = 1, CIsize = 0.95, nchain = 1,
seeds = 342321, prior = "BL", BL_a = a, BL_b = b,, parallel = TRUE)
summary(mod3)
predict(mod3)
plot(mod3,"trace")
plot(mod3,"coef")
plot(mod3, only_prev = TRUE)

# Model 4: multivariate outcome model with prior information from a direct item.
# Load London list experiment data
data(london)
mod4 <- bayeslist(listCount ~ agegrp + gender + social_grade + qual,data = london, J = 4,
treat = "listTreat", seeds = 4597, nsim = 200, nchain = 1,
prior = "direct_item", direct_item = "baselineTurnout")
summary(mod4)
predict(mod4)
plot(mod4,"trace")
plot(mod4,"coef")
plot(mod4)
```

coef.bayeslist *Extract coefficients from a* bayeslist *object*

Description

Create a table of coefficient results from a bayeslist object.

Usage

```
## S3 method for class 'bayeslist'
coef(object, ...)
```

Arguments

object	A bayeslist object from running the main function bayeslist.
...	Further arguments to be passed according to coef.

Value

A table of coefficients with their corresponding lower and upper bounds.

logistic *Logistic function*

Description

Standard logistic function.

Usage

```
logistic(x)
```

Arguments

x	A scalar or vector to be logit-transformed.

Value

logit-transformed value

london *The 2017 London List Experiment*

Description

This dataset is the 2017 London list experiment on voter turnout fielded via online YouGov survey of a sample of 3189 Greater Londoners.The main question reads as follows: The next question deals with the recent general election on 8th June. Here is a list of four (five) things that some people did and some people did not do during the election campaign or on Election Day. Please say how many of these things you did. Here are the four (five) things: (1) Discussed the election with family and friends; (2) (Voted in the election); (3) Criticised a politician on social media; (4) Avoided watching the leaders debates; (5) Put up a poster for a political party in my window or garden. How many of these things did you do? The second item in bracket is the sensitive item. In addition to the above list, there is a direct question asking about turnout: Talking with people about the recent general election on 8th June, we have found that a lot of people didn't manage to vote. How about you, did you manage to vote in the general election?

Format

A data frame containing the following 18 variables for 3189 observations.

ID	integer	Respondent ID number.
age	integer	Respondent age in years.
agegrp	factor	Respondent age group.
gender	factor	YouGov panel measure of gender.
social_grade	factor	YouGov panel measure of respondent social grade.
qual	factor	Measure of highest educational qualification from YouGov panel.
validationfactor	factor	Detailed measure of turnout validation outcome for respondent.
validturnout	integer	Summary measure of true respondent turnout.
direct	integer	Response to direct turnout question asked of list experiment control group.
baselineTurnout	integer	Response to baseline direct turnout question after the election.
listTreat	integer	Indicator for list experiment treatment group.
listCount	integer	Reported item count for list experiment question.
qtime	numeric	Time taken to answer list experiment question, in seconds.
recallfirst	character	Respondent recall of first item from list question. Open text response.
recalllast	character	Respondent recall of last item from list question. Open text response.
recallfirst.hand.correct	factor	Did respondent correctly recall first list experiment item?
recalllast.hand.correct	factor	Did respondent correctly recall last list experiment item?
comfort	numeric	How comfortable do you feel revealing whether you did/did not vote in last election?

Source

The full data set is available at doi:10.7910/DVN/W90Q7B)

References

Kuhn, P. M., & Vivyan, N. (2021). The misreporting trade-off between list experiments and direct questions in practice: Partition validation evidence from two countries. Political Analysis, 1-22.

`plot.bayeslist` *Plot bayeslist object*

Description

General plot function for `bayeslist` objects, which dispatches the chosen type of plotting to the corresponding function.

Usage

```
## S3 method for class 'bayeslist'
plot(x, type = "prevalence", ...)
```

Arguments

`x`	A `bayeslist` object to be plotted.
`type`	Character string giving the type of plotting. The options are `"trace"` for trace plots, `"prevalence"` for prevalence plots. The default is "prevalence".
`...`	Additional arguments to be passed to subsequent plot functions (check the See Also section).

Value

None.

See Also

`plot_trace.bayeslist` and `plot_coef.bayeslist`.

`plot_coef.bayeslist` *Make coefficient plots for a* `bayeslist` *object*

Description

`plot_coef.bayeslist` is used to produce coefficient plots from a `bayeslist` object.

Usage

```
plot_coef.bayeslist(object, ...)
```

Arguments

object	A bayeslist object from running the main function bayeslist.
...	Additional parameters to be passed to stan_plot.

Value

None.

---

plot_prevalence.bayeslist

Plots of prevalence for bayeslist

Description

plot_prevalence.bayeslist is used to produce plots of prevalence from a bayeslist object from the main function bayeslist.

Usage

```
plot_prevalence.bayeslist(
  object,
  covariate_names = NULL,
  only_prev = FALSE,
  xlim = NULL,
  inverse = FALSE,
  digit = 3,
  ...
)
```

Arguments

object	A bayeslist object from running the main function bayeslist.
covariate_names	Names of covariates.
only_prev	Indicating whether only prevalence will be plotted. The default is FALSE.
xlim	Limits of x-axis.
inverse	Indicating whether prevalence should be calculated in the reverse order. The default is FALSE.
digit	Digit number to be displayed.
...	Additional parameters to be passed.

Value

None.

plot_trace.bayeslist *Trace plots for bayeslist*

Description

plot_trace.bayeslist is used to produce trace plots from a bayeslist object from the main function bayeslist.

Usage

```
plot_trace.bayeslist(object, ...)
```

Arguments

object	A bayeslist object from running the main function bayeslist.
...	Additional parameters to be passed to traceplot.

Value

None.

predict.bayeslist *Predicted prevalence from a* bayeslist *object*

Description

Prediction function for bayeslist objects.

Usage

```
## S3 method for class 'bayeslist'
predict(object, ...)
```

Arguments

object	A bayeslist object to be summarized.
...	Additional arguments to be passed to summary function.

Value

None.

See Also

print_text.bayeslist, print_mcmc.bayeslist, print_coef.bayeslist.

print.bayeslist *Print returns from a* bayeslist *object*

Description

General print function for bayeslist objects, which dispatches the chosen type of printing to the corresponding function.

Usage

```
## S3 method for class 'bayeslist'
print(x, type = "text", ...)
```

Arguments

x	A bayeslist object to be printed.
type	Character string giving the type of printing, such as "text", "mcmc", "coef".
...	Additional arguments to be passed to print functions (check the See Also section).

Value

None.

See Also

print_text.bayeslist, print_mcmc.bayeslist, print_coef.bayeslist.

print_coef.bayeslist *Print coefficients of a* bayeslist *object*

Description

print_coef.bayeslist prints out coefficients from a bayeslist object from running the main function bayeslist.

Usage

```
print_coef.bayeslist(object, digits = 3)
```

Arguments

object	A bayeslist object.
digits	Number of digits to display.

Value

None.

print_mcmc.bayeslist *Print convergence diagnostics from a* bayeslist *object*

Description

print_mcmc.bayeslist prints a number of diagnostics about the convergence of a bayeslist objects.

Usage

```
print_mcmc.bayeslist(object, ...)
```

Arguments

object	A bayeslist object.
...	Additional arguments to be passed to the print function.

Value

None.

print_text.bayeslist *Print the main results from a* bayeslist *object.*

Description

Print the main results from a bayeslist object.

Usage

```
print_text.bayeslist(object, digits = 3)
```

Arguments

object	A bayeslist object.
digits	Number of digits to display.

Value

None.

srilanka *The Sri Lanka List Experiment on Wartime Sexual Violence*

Description

This dataset, which includes male respondents from Tamil, is a subset of the list experiment administered in Sri Lanka on wartime sexual violence.The main question reads as follows: Now we would like to ask you some more questions about what happened during the war. Please refer to the following list and tell me how many of these experiences happened to you during the war. Please don't tell me which specific statements you believe to be true, only how many: (1) I won money in a lottery or competition; (2) I was involved in an accident; (3) I received help from a stranger; (4) (I was personally sexually assaulted.) The forth item in bracket is the sensitive item. In addition to the above list, there are also two direct questions asking about sexual abuse.

Format

A data frame containing the following 9 variables for 247 observations.

sexaussault	integer	Reported item count for list experiment question.
sexaussault_d	integer	First direct item.
sexaussault_d2	integer	Second direct item.
treatment	integer	Indicator for list experiment treatment group.
age	numeric	Age.
edu	integer	Education.
eastern	integer	Whether the respondent comes from eastern Tamil.
assist.army	integer	Whether the respondent has assisted rebel groups.
displace	integer	Displacement.

References

Traunmüller, R., Kijewski, S., & Freitag, M. (2019). The silent victims of sexual violence during war: Evidence from a list experiment in Sri Lanka. Journal of conflict resolution, 63(9), 2015-2042. doi:10.1177/0022002719828053

summary.bayeslist *Summary of a* bayeslist *object*

Description

General summary function for bayeslist objects.

Usage

```
## S3 method for class 'bayeslist'
summary(object, ...)
```

Arguments

`object`	A `bayeslist` object to be summarized.
`...`	Additional arguments to be passed to summary function.

Value

None.

See Also

`print_text.bayeslist`, `print_mcmc.bayeslist`, `print_coef.bayeslist`.

Index