

Package ‘ramchoice’

July 11, 2019

Type Package

Title Estimation and Inference in Random Attention Models

Description It is widely documented in psychology, economics and other disciplines that socio-economic agent may not pay full attention to all available alternatives, rendering standard revealed preference theory invalid. This package implements the estimation and inference procedures of Cattaneo, Ma, Masatlioglu and Suleymanov (2019) <arXiv:1712.03448>, which utilizes standard choice data to partially identify and estimate a decision maker's preference. For inference, several simulation-based critical values are provided.

Version 1.1

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Imports MASS

Depends R (>= 3.1.0)

License GPL-2

Encoding UTF-8

RoxygenNote 6.1.1

NeedsCompilation no

Repository CRAN

Date/Publication 2019-07-11 21:57:28 UTC

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ramchoice-package *ramchoice: Estimation and Inference in Random Attention Models*

Description

Information about socio-economic agent's preference (consumer, firm, organization, voter, etc.) is important not only for understanding the decision making process, but also for conducting welfare analysis and providing robust policy recommendations. However, it is widely documented in psychology, economics and other disciplines that decision makers may not pay full attention to all available alternatives, rendering standard revealed preference theory invalid.

This package implements the estimation and inference procedure documented in [Cattaneo, Ma, Masatlioglu and Suleymanov \(2019\)](#), which utilizes standard choice data to partially identify decision maker's preference. For statistical inference, several simulation-based critical values are provided.

The following functions are provided: [rAtte](#) (the main function), [sumData](#), [genMat](#). A simulated dataset [ramdata](#) is also included for illustration purpose.

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References

M. D. Cattaneo, X. Ma, Y. Masatlioglu and E. Suleymanov (2019). [A Random Attention Model](#). *Journal of Political Economy*, forthcoming.

genMat *ramchoice Package: Generate Constraint Matrices*

Description

`genMat` generates constraint matrices which correspond to (i) the monotonic attention assumption, (ii) attentive at binaries restriction, and (iii) preferences specified as the null hypotheses.

This function is embedded in [rAtte](#).

Usage

```
genMat(sumMenu, sumMsize, pref_list = NULL, limDataCorr = TRUE,
       attBinary = 1)
```

Arguments

sumMenu	Numeric matrix, summary of choice problems, returned by <code>sumData</code> .
sumMsize	Numeric matrix, summary of choice problem sizes, returned by <code>sumData</code> .
pref_list	Numeric matrix, each row corresponds to one preference. For example, <code>c(2, 3, 1)</code> means 2 is preferred to 3 and to 1. When set to <code>NULL</code> , the default, <code>c(1, 2, 3, ...)</code> , will be used.
limDataCorr	Boolean, whether assumes limited data (default is <code>TRUE</code>). When set to <code>FALSE</code> , will assume all choice problems are observed.
attBinary	Numeric, between 1/2 and 1 (default is 1), whether additional restrictions (on the attention rule) should be imposed for binary choice problems (i.e., attentive at binaries).

Value

R	Matrices of constraints, stacked vertically.
ConstN	The number of constraints for each preference, used to extract from R individual matrices of constraints.

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References

M. D. Cattaneo, X. Ma, Y. Masatlioglu and E. Suleymanov (2019). [A Random Attention Model](#). *Journal of Political Economy*, forthcoming.

Examples

```
# Load data
data(ramdata)

# Generate summary statistics
summaryStats <- sumData(ramdata$menu, ramdata$choice)

# Generate constraint matrices
constraints <- genMat(summaryStats$sumMenu, summaryStats$sumMsize)
constraints$ConstN
constraints$R[1:10, 1:10]
```

ramdata	<i>ramdata: Simulated Data</i>
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Description

The file contains a standard choice data of 9,000 observations. There are five alternatives in the grand set.

See [rAtte](#) for estimation and inference using the data. [sumData](#) is a low-level function that computes summary statistics, and [genMat](#) generates constraint matrices subject to given preferences.

Format

menu Numeric matrix of 0s and 1s, choice problems (1 indicates an alternative in the choice problem and 0 otherwise).

choice Numeric matrix of 0s and 1s, choices (1 indicates an alternative being chosen).

rAtte	<i>rAtte: Estimation and Inference in Random Attention Models</i>
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Description

Given a random sample of choice problems and choices, [rAtte](#) returns test statistics, critical values and p-values against a collection of preferences. Five methods for choosing critical values are available: (i) GMS: generalized moment selection (plug-in (estimated) moment conditions with shrinkage); (ii) PI: critical values based on plug-in estimated moment conditions (this is not uniformly valid); (iii) LF: critical values based on the least favorable model (plug-in 0 for the moment conditions); (iv) 2MS: two-step moment selection; and (v) 2UB: refined moment selection (plug-in upper bound of moment inequalities).

[sumData](#) is a low-level function that generates summary statistics, and [genMat](#) can be used to construct the constraint matrices. The simulated dataset [ramdata](#) is also provided for illustration.

Usage

```
rAtte(menu, choice, pref_list = NULL, method = "GMS",
      nCritSimu = 2000, BARatio2MS = 0.1, BARatio2UB = 0.1,
      MNRatioGMS = NULL, limDataCorr = TRUE, attBinary = 1)
```

Arguments

menu	Numeric matrix of 0s and 1s, the collection of choice problems.
choice	Numeric matrix of 0s and 1s, the collection of choices.
pref_list	Numeric matrix, each row corresponds to one preference. For example, $c(2, 3, 1)$ means 2 is preferred to 3 and to 1. When set to NULL, the default, $c(1, 2, 3, \dots)$, will be used.

method	String, the method for constructing critical values. Default is GMS (generalized moment selection). Other available options are LF (least favorable model), PI (plug-in method), 2MS (two-step moment selection), 2UB (two-step moment upper bound), or ALL (report all critical values).
nCritSimu	Integer, number of simulations used to construct the critical value. Default is 2000.
BARatio2MS	Numeric, beta-to-alpha ratio for two-step moment selection method. Default is 0.1.
BARatio2UB	Numeric, beta-to-alpha ratio for two-step moment upper bound method. Default is 0.1.
MNRatioGMS	Numeric, shrinkage parameter. Default is $\sqrt{1/\log(N)}$, where N is the sample size.
limDataCorr	Boolean, whether assumes limited data (default is TRUE). When set to FALSE, it will be assumed that all choice problems are observed.
attBinary	Numeric, between 1/2 and 1 (default is 1), whether additional restriction on the attention rule should be imposed for binary choice problems (i.e., attentive at binaries).

Value

sumStats	Summary statistics, generated by <code>sumData</code> .
constraints	Matrices of constraints, generated by <code>genMat</code> .
Tstat	Test statistic.
critVal	Critical values.
pVal	P-values (only available for GMS, LF and PI).
method	Method for constructing critical value.

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References

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Examples

```
# Load data
data(ramdata)

# Set seed, to replicate simulated critical values
```

```

set.seed(42)

# Inference based on the standard random attention model
result <- rAtte(menu = ramdata$menu, choice = ramdata$choice, method = "GMS",
  pref_list=matrix(c(1, 2, 3, 4, 5,
                    2, 1, 3, 4, 5,
                    2, 3, 4, 5, 1,
                    5, 4, 3, 2, 1), ncol=5, byrow=TRUE))
summary(result)

# Inference employing additional restrictions for binary choice problems
result2 <- rAtte(menu = ramdata$menu, choice = ramdata$choice, method = "GMS", attBinary = 2/3,
  pref_list=matrix(c(1, 2, 3, 4, 5,
                    2, 1, 3, 4, 5,
                    2, 3, 4, 5, 1,
                    5, 4, 3, 2, 1), ncol=5, byrow=TRUE))
summary(result2)

```

sumData

ramchoice Package: Generate Summary Statistics

Description

sumData generates summary statistics. Given a collection of choice problems and corresponding choices, sumData calculates the number of occurrences of each choice problem, as well as the estimated choice rule.

This function is embedded in [rAtte](#).

Usage

```
sumData(menu, choice)
```

Arguments

menu	Numeric matrix of 0s and 1s, the collection of choice problems.
choice	Numeric matrix of 0s and 1s, the collection of choices.

Value

sumMenu	Summary of choice problems, with repetitions collapsed.
sumProb	Estimated choice rules as sample averages for different choice problems.
sumN	Effective sample size for each menu.
sumMsize	Size of each choice problem.
sumProbVec	Estimated choice rule as sample averages, collapsed into a column vector.
Sigma	Estimated variance-covariance matrix for the choice rule, scaled by relative sample sizes.

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References

M. D. Cattaneo, X. Ma, Y. Masatlioglu and E. Suleymanov (2019). [A Random Attention Model](#). *Journal of Political Economy*, forthcoming.

Examples

```
# Load data
data(ramdata)

# Generate summary statistics
summaryStats <- sumData(ramdata$menu, ramdata$choice)
nrow(summaryStats$sumMenu)
min(summaryStats$sumN)

summaryStats$sumMenu[1, ]
summaryStats$sumProb[1, ]
summaryStats$sumN[1]
```

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