Package ‘ramchoice’

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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.

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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


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 `sumData`.
sumMsie Numeric matrix, summary of choice problem sizes, returned by `sumData`.
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, ...)`, will be used.
limDataCorr Boolean, whether assumes limited data (default is TRUE). When set to FALSE, 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

Examples
```r
# Load data
data(ramdata)

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

# Generate constraint matrices
c constraints <- genMat(summaryStats$sumMenu, summaryStats$sumMsie)
constraints$ConstN
constraints$R[1:10, 1:10]
```
ramdata: Simulated Data

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: Estimation and Inference in Random Attention Models

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, ...), 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 `sumData`.

constraints

Matrices of constraints, generated by `genMat`.

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


Examples

```r
# 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


Examples

```r
# 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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