Package 'inteli'

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Title Interval Estimation by Likelihood Method

Version 0.1.2

Description Currently used CI method has its limitation when the test statistics are asymmetrical (chi-square test, F-test) or the model functions are non-linear. It can be overcome by using the likelihood functions for the interval estimation. 'inteli' package now supports interval estimation for the mean, variance, variance ratio, binomial distribution, Poisson distribution, odds ratio, risk difference, relative risk and their likelihood function plots. Testing functions are also provided.

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   inteli–package   *Interval Estimation by Likelihood Method*

Description

Parameter estimation via likelihood interval (LI) compared to conventional method (CI).

Details

Currently used CI method has its limitation when the test statistics are asymmetrical (chi-square test, F-test) or the model functions are non-linear. It can be overcome by using the likelihood functions for the interval estimation. 'inteli' package now supports interval estimation for the mean, variance, variance ratio, binomial distribution, Poisson distribution, odds ratio, risk difference, relative risk and their likelihood function plots. Testing functions are also provided.

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References

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| lib | *Likelihood Interval for Probability of Single Sample from Binomial Distribution* |

Description

Likelihood interval for probability of single sample assuming binomial distribution. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

event	number of events from observed data; a numeric vector
total	total number of trials from observed data; a numeric vector
plot	likelihood function plots by LI; default is "all"
conf.level	confidence level for the interval estimation
eps	machine epsilon value; default is 1e-08
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
LI	estimated interval of probability (y/n) by LI
CI	estimated interval of probability (y/n) by CI
plot	likelihood-related plots

Author(s)

Kyun-Seop Bae <k@acr.kr>, Minkyu Kim <mkim@acr.kr>

Examples

```
lib(8, 10)
```

| lim | *Likelihood Interval for Mean of Single Sample from Normal Distribution* |

Description

Likelihood interval for mean of single sample assuming normal distribution. Likelihood function plot is also shown. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

`data`	a numeric vector of data values; mandatory
`plot`	likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.
`conf.level`	confidence level for the interval estimation
`df`	degree of freedom for likelihood interval; default is 1
`k`	cutoff value for likelihood interval. If not specified, F-test is used.

Value

`demo`	basic demographics of data
`LI`	estimated interval of mean by LI
`CI`	estimated interval of mean by CI
`plot`	likelihood-related plots

Author(s)

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Examples

```
lim(rnorm(20, 0, 1))
```

---

liod	*Likelihood Interval for Odds Ratio of 2-by-2 Contingency Table.*

Description

Likelihood interval for odds ratio of 2-by-2 contingency table. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

`exposure.O_event.O`
   a numeric vector of exposure (+) and event (+), 'a' of 2-by-2 table; mandatory
`exposure.O_TOTAL`
   a numeric vector of exposure (+), 'a' + 'b' of 2-by-2 table; mandatory
`exposure.X_event.O`
   a numeric vector of exposure (-) and event (-), 'c' of 2-by-2 table; mandatory
`exposure.X_TOTAL`
   a numeric vector of exposure (-), 'c' + 'd' of 2-by-2 table; mandatory
`plot`   likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.

conf.level	confidence level for the interval estimation
eps	machine epsilon value; default is 1e-08
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
contin_2x2	2-by-2 contingency table
LI	estimated interval of odds ratio by LI
CI	estimated interval of odds ratio by CI
plot	likelihood-related plots

Author(s)

Kyun-Seop Bae <k@acr.kr>, Minkyu Kim <mkim@acr.kr>

Examples

```
liod(21, 43, 16, 67)
liod(21, 43, 16, 67, plot = 0) # faster calculation
```

---

lipois	*Likelihood Interval for Poisson Mean of Single Sample from Poisson Distribution*

Description

Likelihood interval for Poisson mean of single sample assuming Poisson distribution. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

event	number of events; a numeric vector
unit.time	unit time for Poisson mean; default is 1
data.size	sample size. If not specified, size is assumed to be 1. For LI being more precise, sample size must be considered.
conf.level	confidence level for the interval estimation
eps	machine epsilon value; default is 1e-08
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
LI	estimated interval of Poisson mean by LI
CI	estimated interval of Poisson mean by CI
plot	likelihood-related plots

Author(s)

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Examples

```
lipois(8)
lipois(event = 8, unit.time = 3)
lipois(event = 8, unit.time = 3, data.size = 6)
```

---

lir	*Likelihood Interval for Variance Ratio of Two Samples from Normal Distribution*

Description

Likelihood interval for variance ratio of two samples assuming normal distribution. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended. Sample size is not allocated.

Arguments

num.data	a numeric vector of data values, variance value at the numerator position; mandatory
denom.data	a numeric vector of data values, variance value at the denominator position; mandatory
plot	likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.
conf.level	confidence level for the interval estimation
df	degree of freedom for likelihood interval; default is 2.4
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
LI	estimated interval of variance ratio by LI
LI.sdR	estimated interval of standard deviation ratio by LI
CI	estimated interval of variance by CI
plot	likelihood-related plots

Author(s)

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Examples

```
lir(rnorm(30, 0, 1), rnorm(20, 0, 1))
```

---

lird   *Likelihood Interval for Risk Difference of 2-by-2 Contingency Table.*

Description

Likelihood interval for risk difference of 2-by-2 contingency table. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

exposure.O_event.O
: a numeric vector of exposure (+) and event (+), 'a' of 2-by-2 table; mandatory

exposure.O_TOTAL
: a numeric vector of exposure (+), 'a' + 'b' of 2-by-2 table; mandatory

exposure.X_event.O
: a numeric vector of exposure (-) and event (-), 'c' of 2-by-2 table; mandatory

exposure.X_TOTAL
: a numeric vector of exposure (-), 'c' + 'd' of 2-by-2 table; mandatory

plot
: likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.

conf.level
: confidence level for the interval estimation

eps
: machine epsilon value; default is 1e-08

k
: cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo
: basic demographics of data

contin_2x2
: 2-by-2 contingency table

LI
: estimated interval of risk difference by LI

CI
: estimated interval of risk difference by CI

plot
: likelihood-related plots

Author(s)

Kyun-Seop Bae <k@acr.kr>, Minkyu Kim <mkim@acr.kr>

Examples

```
lird(21, 43, 16, 67)
lird(21, 43, 16, 67, plot = 0) # faster calculation
```

---

lirr *Likelihood Interval for Relative Risk of 2-by-2 Contingency Table.*

Description

Likelihood interval for relative risk of 2-by-2 contingency table. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

exposure.O_event.O
a numeric vector of exposure (+) and event (+), 'a' of 2-by-2 table; mandatory

exposure.O_TOTAL
a numeric vector of exposure (+), 'a' + 'b' of 2-by-2 table; mandatory

exposure.X_event.O
a numeric vector of exposure (-) and event (-), 'c' of 2-by-2 table; mandatory

exposure.X_TOTAL
a numeric vector of exposure (-), 'c' + 'd' of 2-by-2 table; mandatory

plot   likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.

conf.level   confidence level for the interval estimation

eps   machine epsilon value; default is 1e-08

k   cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo   basic demographics of data

contin_2x2   2-by-2 contingency table

LI   estimated interval of relative risk by LI

CI   estimated interval of relative risk by CI

plot   likelihood-related plots

Author(s)

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Examples

```
lirr(21, 43, 16, 67)
lirr(21, 43, 16, 67, plot = 0) # faster calculation
```

---

liv   *Likelihood Interval for Variance of Single Sample from Normal Distribution*

Description

Likelihood interval for variance of single sample assuming normal distribution. Likelihood function plot is also shown. For faster calculation speed, plot option '0' is recommended.

Arguments

data	a numeric vector of data values; mandatory
plot	likelihood function plots by LI; default is "all". 'OBJ', 'O1', '1' is objective function plot; 'OFV', 'O2', '2' is log likelihood function plot; 'LRT', 'O3', '3' is log LRT function plot.
conf.level	confidence level for the interval estimation
df	degree of freedom for likelihood interval; default is 1.2
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
LI	estimated interval of variance by LI
LI.sd	estimated interval of standard deviation by LI
CI	estimated interval of variance by CI
plot	likelihood-related plots

Author(s)

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Examples

```
liv(rnorm(30, 0, 1))
```

---

qlib   *Testing Function for Probability from Binomial Distribution*

Description

Testing function for variance ratio of two samples assuming normal distribution by LI method. O2 type likelihood function plot is also shown.

Arguments

event	number of events from observed data; a numeric vector
total	total number of trials from observed data; a numeric vector
test.val	a numeric vector of testing value for probability
conf.level	confidence level for the interval estimation
eps	machine epsilon value; default is 1e-08
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
interval	estimated interval by LI and CI.
stat	statistical values, such as p-value and likelihood ratio
verdict	estimation result as a sentence
plot	log likelihood function plot (O2 type)

Author(s)

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Examples

```
qlib(8, 13, 0.7)
qlib(3, 10, 0.8)
```

---

qlim   *Testing Function for Mean Difference of Two Samples from Normal Distribution by LI Method*

Description

Testing function for mean difference of two samples assuming normal distribution by LI method. O2 type likelihood function plot is also shown.

Arguments

set.a	a numeric vector of former data values; mandatory
set.b	a numeric vector of latter data values; mandatory
conf.level	confidence level for the interval estimation
df	degree of freedom for likelihood interval; default is 1
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
interval	estimated interval by LI and CI. PE is mean(set.a) - mean(set.b).
stat	statistical values, such as p-value and likelihood ratio
verdict	estimation result as a sentence
plot	log likelihood function plot (O2 type)

Author(s)

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Examples

```
x <- rnorm(30, 0, 1)
y <- rnorm(20, 0, 1)
qlim(x, y)
```

---

qlipois   *Testing Function for Poisson Mean from Poisson Distribution*

Description

Testing function for Poisson mean of single sample assuming Poisson distribution by LI method. O2 type likelihood function plot is also shown.

Arguments

data	a numeric vector of data values; mandatory
test.val	a numeric vector of testing value for Poisson mean; mandatory
conf.level	confidence level for the interval estimation
eps	machine epsilon value; default is 1e-08
k	cutoff value for likelihood interval. If not specified, F-test is used.

Value

demo	basic demographics of data
interval	estimated interval by LI and CI.
stat	statistical values, such as p-value and likelihood ratio
verdict	estimation result as a sentence
plot	log likelihood function plot (O2 type)

Author(s)

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Examples

```
qlipois(rnorm(20, 1, 1), 1)
```

---

qliv   *Testing Function for Variance Ratio of Two Samples from Normal Dis-*
                               tribution

Description

Testing function for variance ratio of two samples assuming normal distribution by LI method. O2 type likelihood function plot is also shown. Smaller sample is allocated to be in the nominator for more accurate and precise estimation.

Arguments

`set.a`	a numeric vector of data values; mandatory, pre-allocation
`set.b`	a numeric vector of data values; mandatory, pre-allocation
`conf.level`	confidence level for the interval estimation
`df`	degree of freedom for likelihood interval; default is 2.4
`k`	cutoff value for likelihood interval. If not specified, F-test is used.

Value

`demo`	basic demographics of data
`interval`	estimated interval by LI and CI.
`stat`	statistical values, such as p-value and likelihood ratio
`verdict`	estimation result as a sentence
`plot`	log likelihood function plot (O2 type)

Author(s)

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Examples

```
x <- rnorm(30, 0, 1)
y <- rnorm(20, 0, 1)
qliv(x, y) # x placed in the denominator
```

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