

# Package ‘poisDoubleSamp’

May 10, 2022

**Version** 1.1.1

**Title** Confidence Intervals with Poisson Double Sampling

**Description** Functions to create confidence intervals for ratios of Poisson rates under misclassification using double sampling. Implementations of the methods described in Kahle, D., P. Young, B. Greer, and D. Young (2016). “Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling.” *Computational Statistics & Data Analysis*, 95:122–132.

**URL** <https://github.com/dkahle/poisDoubleSamp>

**BugReports** <https://github.com/dkahle/poisDoubleSamp/issues>

**LinkingTo** Rcpp

**Imports** Rcpp, stats

**License** MIT + file LICENSE

**RoxygenNote** 7.1.2

**Encoding** UTF-8

**NeedsCompilation** yes

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**Repository** CRAN

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|               |  |
|---------------|--|
| approxMargMLE | <i>Compute the marginal MLE of phi</i> |
|---------------|--|

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### Description

Compute the marginal MLE of the ratio of two Poisson rates in a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets.

### Usage

```
approxMargMLE(
  data,
  N1,
  N2,
  N01,
  N02,
  l = 0,
  u = 1000,
  out = c("par", "all"),
  tol = 1e-10
)
```

### Arguments

|      |   |
|------|---|
| data | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1   | the opportunity size of group 1 for the fallible data   |
| N2   | the opportunity size of group 2 for the fallible data   |
| N01  | the opportunity size of group 1 for the infallible data   |
| N02  | the opportunity size of group 2 for the infallible data   |
| l    | the lower end of the range of possible phi's (for optim)  |
| u    | the upper end of the range of possible phi's (for optim)  |
| out  | "par" or "all" (for the output of optim)  |
| tol  | tolerance parameter for the rmle EM algorithm   |

### Value

a named vector containing the marginal mle of phi

## References

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

## Examples

```
# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)
margMLE(data, N1, N2, N01, N02)
approxMargMLE(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)
margMLE(data, N1, N2, N01, N02) # ~1 min
approxMargMLE(data, N1, N2, N01, N02)

## End(Not run)
```

---

approxMargMLECI

*Compute the profile MLE CI of phi*

---

## Description

Compute the profile MLE confidence interval of the ratio of two Poisson rates in a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets. This uses a C++ implementation of the EM algorithm.

**Usage**

```
approxMargMLECI(
  data,
  N1,
  N2,
  N01,
  N02,
  conf.level = 0.95,
  l = 0.001,
  u = 1000,
  tol = 1e-10
)
```

**Arguments**

|            |   |
|------------|---|
| data       | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1         | the opportunity size of group 1 for the fallible data   |
| N2         | the opportunity size of group 2 for the fallible data   |
| N01        | the opportunity size of group 1 for the infallible data   |
| N02        | the opportunity size of group 2 for the infallible data   |
| conf.level | confidence level of the interval  |
| l          | the lower end of the range of possible phi's (for optim)  |
| u          | the upper end of the range of possible phi's (for optim)  |
| tol        | tolerance used in the EM algorithm to declare convergence   |

**Value**

a named vector containing the marginal mle of phi

**References**

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

**Examples**

```
# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
```

```

margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## End(Not run)

```

---

fullMLE

---

*Compute the full MLEs*


---

### Description

Compute the MLEs of a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets.

### Usage

```
fullMLE(data, N1, N2, N01, N02)
```

### Arguments

|      |   |
|------|---|
| data | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1   | the opportunity size of group 1 for the fallible data   |
| N2   | the opportunity size of group 2 for the fallible data   |
| N01  | the opportunity size of group 1 for the infallible data   |
| N02  | the opportunity size of group 2 for the infallible data   |

### Details

These are the closed-form expressions for the MLEs.

**Value**

a named vector containing the mles of each of the parameters ( $\phi$ ,  $\lambda_{12}$ ,  $\lambda_{21}$ ,  $\lambda_{22}$ ,  $\theta_1$ , and  $\theta_2$ )

**References**

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

**Examples**

```
# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)

## End(Not run)
```

---

margMLE

---

*Compute the marginal MLE of  $\phi$* 


---

**Description**

Compute the marginal MLE of the ratio of two Poisson rates in a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets.

**Usage**

```
margMLE(data, N1, N2, N01, N02, l = 0.001, u = 1000, out = c("par", "all"))
```

**Arguments**

|      |   |
|------|---|
| data | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1   | the opportunity size of group 1 for the fallible data   |
| N2   | the opportunity size of group 2 for the fallible data   |
| N01  | the opportunity size of group 1 for the infallible data   |
| N02  | the opportunity size of group 2 for the infallible data   |
| l    | the lower end of the range of possible phi's (for optim)  |
| u    | the upper end of the range of possible phi's (for optim)  |
| out  | "par" or "all" (for the output of optim)  |

**Value**

a named vector containing the marginal mle of phi

**References**

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

**Examples**

```
# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)
margMLE(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

fullMLE(data, N1, N2, N01, N02)
margMLE(data, N1, N2, N01, N02)
```

```
## End(Not run)
```

---

margMLECI

---

*Compute the marginal MLE confidence interval for the phi*


---

### Description

Compute the marginal MLE confidence interval of the ratio of two Poisson rates in a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets.

### Usage

```
margMLECI(data, N1, N2, N01, N02, conf.level = 0.95, l = 1e-10, u = 1e+10)
```

### Arguments

|            |   |
|------------|---|
| data       | the vector of counts of the fallible data ( $z_{11}$ , $z_{12}$ , $z_{21}$ , $z_{22}$ ) followed by the infallible data ( $m_{011}$ , $m_{012}$ , $m_{021}$ , $m_{022}$ , $y_{01}$ , $y_{02}$ ) |
| N1         | the opportunity size of group 1 for the fallible data   |
| N2         | the opportunity size of group 2 for the fallible data   |
| N01        | the opportunity size of group 1 for the infallible data   |
| N02        | the opportunity size of group 2 for the infallible data   |
| conf.level | confidence level of the interval  |
| l          | the lower end of the range of possible phi's (for optim)  |
| u          | the upper end of the range of possible phi's (for optim)  |

### Value

a named vector containing the lower and upper bounds of the confidence interval

### References

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.



**Examples**

```

# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## End(Not run)

```

---

poisDoubleSamp

*poisDoubleSamp : Confidence intervals with Poisson double sampling*


---

**Description**

Functions to create confidence intervals for ratios of Poisson rates under misclassification using double sampling. Implementations of the methods described in Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

---

 profMLECI

---

*Compute the profile MLE CI of phi*


---

**Description**

Compute the profile MLE confidence interval of the ratio of two Poisson rates in a two-sample Poisson rate problem with misclassified data given fallible and infallible datasets. This uses a C++ implementation of the EM algorithm.

**Usage**

```
profMLECI(
  data,
  N1,
  N2,
  N01,
  N02,
  conf.level = 0.95,
  l = 0.001,
  u = 1000,
  tol = 1e-10
)
```

**Arguments**

|            |   |
|------------|---|
| data       | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1         | the opportunity size of group 1 for the fallible data   |
| N2         | the opportunity size of group 2 for the fallible data   |
| N01        | the opportunity size of group 1 for the infallible data   |
| N02        | the opportunity size of group 2 for the infallible data   |
| conf.level | confidence level of the interval  |
| l          | the lower end of the range of possible phi's (for optim)  |
| u          | the upper end of the range of possible phi's (for optim)  |
| tol        | tolerance used in the EM algorithm to declare convergence   |

**Value**

a named vector containing the marginal mle of phi

**References**

Kahle, D., P. Young, B. Greer, and D. Young (2016). "Confidence Intervals for the Ratio of Two Poisson Rates Under One-Way Differential Misclassification Using Double Sampling." *Computational Statistics & Data Analysis*, 95:122–132.

**Examples**

```

# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## End(Not run)

```

---

waldCI

*Compute the Wald confidence interval*


---

**Description**

Compute the Wald confidence interval of a two-sample Poisson rate with misclassified data given fallible and infallible datasets.

**Usage**

```
waldCI(data, N1, N2, N01, N02, conf.level = 0.95)
```

**Arguments**

|            |   |
|------------|---|
| data       | the vector of counts of the fallible data (z11, z12, z21, z22) followed by the infallible data (m011, m012, m021, m022, y01, y02) |
| N1         | the opportunity size of group 1 for the fallible data   |
| N2         | the opportunity size of group 2 for the fallible data   |
| N01        | the opportunity size of group 1 for the infallible data   |
| N02        | the opportunity size of group 2 for the infallible data   |
| conf.level | confidence level of the interval  |

**Value**

a named vector containing the lower and upper bounds of the confidence interval

**Examples**

```
# small example
z11 <- 34; z12 <- 35; N1 <- 10;
z21 <- 22; z22 <- 31; N2 <- 10;
m011 <- 9; m012 <- 1; y01 <- 3; N01 <- 3;
m021 <- 8; m022 <- 8; y02 <- 2; N02 <- 3;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## Not run:

# big example :
z11 <- 477; z12 <- 1025; N1 <- 16186;
z21 <- 255; z22 <- 1450; N2 <- 18811;
m011 <- 38; m012 <- 90; y01 <- 15; N01 <- 1500;
m021 <- 41; m022 <- 200; y02 <- 9; N02 <- 2500;
data <- c(z11, z12, z21, z22, m011, m012, m021, m022, y01, y02)

waldCI(data, N1, N2, N01, N02)
margMLECI(data, N1, N2, N01, N02)
profMLECI(data, N1, N2, N01, N02)
approxMargMLECI(data, N1, N2, N01, N02)

## End(Not run)
```

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