Package 'tidydp'

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Type Package

Title Tidy Differential Privacy

Version 0.1.0

Description A tidy-style interface for applying differential privacy to data frames. Provides pipe-friendly functions to add calibrated noise, compute private statistics, and track privacy budgets using the epsilon-delta differential privacy framework. Implements the Laplace mechanism (Dwork et al. 2006 <doi:10.1007/11681878_14>) and the Gaussian mechanism for achieving differential privacy as described in Dwork and Roth (2014) <doi:10.1561/0400000042>.

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Encoding UTF-8

RoxygenNote 7.3.3

Imports magrittr, stats

Suggests testthat (>= 3.0.0), knitr, rmarkdown

VignetteBuilder knitr

URL https://github.com/ttarler/tidydp

BugReports https://github.com/ttarler/tidydp/issues

NeedsCompilation no

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Repository CRAN

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Contents

`check_privacy_budget` *Check Privacy Budget*

Description

Checks if a proposed operation would exceed the privacy budget

Usage

```
check_privacy_budget(budget, epsilon_required, delta_required = 0)
```

Arguments

`budget`	A privacy budget object
`epsilon_required`	Epsilon required for the operation
`delta_required`	Delta required for the operation (default: 0)

Value

Logical indicating if budget is sufficient

Examples

```
budget <- new_privacy_budget(epsilon_total = 1.0)
check_privacy_budget(budget, epsilon_required = 0.5)
```

`dp_add_noise` *Add Differentially Private Noise to Data Frame Columns*

Description

Adds calibrated Laplace or Gaussian noise to specified numeric columns in a data frame to achieve differential privacy. This is the primary function for column-level privacy.

Usage

```
dp_add_noise(
  data,
  columns,
  epsilon,
  delta = NULL,
  lower = NULL,
  upper = NULL,
  mechanism = NULL,
  .budget = NULL
)
```

Arguments

data	A data frame
columns	Character vector of column names to add noise to
epsilon	Privacy parameter (smaller = more privacy, more noise)
delta	Privacy parameter for Gaussian mechanism (default: NULL, uses Laplace)
lower	Named numeric vector of lower bounds for each column
upper	Named numeric vector of upper bounds for each column
mechanism	Either "laplace" or "gaussian" (auto-selected based on delta if NULL)
.budget	Optional privacy budget object to track expenditure

Value

Data frame with noise added to specified columns

Examples

```
data <- data.frame(age = c(25, 30, 35, 40), income = c(50000, 60000, 70000, 80000))
private_data <- data %>%
  dp_add_noise(
    columns = c("age", "income"),
    epsilon = 0.1,
    lower = c(age = 0, income = 0),
    upper = c(age = 100, income = 200000)
  )
```

---

dp_count *Differentially Private Count*

Description

Computes a differentially private count of rows, optionally grouped by specified columns.

Usage

```
dp_count(data, epsilon, delta = NULL, group_by = NULL, .budget = NULL)
```

Arguments

data	A data frame
epsilon	Privacy parameter
delta	Privacy parameter (default: NULL, uses Laplace mechanism)
group_by	Character vector of column names to group by (optional)
.budget	Optional privacy budget object to track expenditure

Value

Data frame with (possibly grouped) counts

Examples

```
data <- data.frame(city = c("NYC", "LA", "NYC", "LA", "NYC"),
                   age = c(25, 30, 35, 40, 45))
# Overall count
dp_count(data, epsilon = 0.1)

# Grouped count
data %>% dp_count(epsilon = 0.1, group_by = "city")
```

---

dp_mean *Differentially Private Mean*

Description

Computes a differentially private mean of a numeric column.

Usage

```
dp_mean(
  data,
  column,
  epsilon,
  delta = NULL,
  lower = NULL,
  upper = NULL,
  group_by = NULL,
  .budget = NULL
)
```

Arguments

data	A data frame
column	Column name to compute mean of
epsilon	Privacy parameter
delta	Privacy parameter (default: NULL, uses Laplace mechanism)
lower	Lower bound of the data range
upper	Upper bound of the data range
group_by	Character vector of column names to group by (optional)
.budget	Optional privacy budget object to track expenditure

Value

Data frame with (possibly grouped) private means

Examples

```
data <- data.frame(city = c("NYC", "LA", "NYC", "LA"),
                   income = c(50000, 60000, 70000, 80000))
data %>% dp_mean("income", epsilon = 0.1, lower = 0, upper = 200000, group_by = "city")
```

---

dp_sum *Differentially Private Sum*

Description

Computes a differentially private sum of a numeric column.

Usage

```
dp_sum(
  data,
  column,
  epsilon,
  delta = NULL,
  lower = NULL,
  upper = NULL,
  group_by = NULL,
  .budget = NULL
)
```

Arguments

data	A data frame
column	Column name to compute sum of
epsilon	Privacy parameter
delta	Privacy parameter (default: NULL, uses Laplace mechanism)
lower	Lower bound of the data range
upper	Upper bound of the data range
group_by	Character vector of column names to group by (optional)
.budget	Optional privacy budget object to track expenditure

Value

Data frame with (possibly grouped) private sums

Examples

```
data <- data.frame(city = c("NYC", "LA", "NYC", "LA"),
                   sales = c(100, 200, 150, 250))
data %>% dp_sum("sales", epsilon = 0.1, lower = 0, upper = 1000, group_by = "city")
```

---

new_privacy_budget *Create a New Privacy Budget*

Description

Initializes a privacy budget tracker for managing epsilon and delta across multiple differentially private operations. The budget uses composition theorems to track cumulative privacy loss.

Usage

```
new_privacy_budget(epsilon_total, delta_total = 1e-05, composition = "basic")
```

Arguments

epsilon_total	Total epsilon budget available
delta_total	Total delta budget available (default: 1e-5)
composition	Method for budget composition: "basic" or "advanced" (default: "basic")

Value

A privacy budget object (list with class "privacy_budget")

Examples

```
budget <- new_privacy_budget(epsilon_total = 1.0, delta_total = 1e-5)
```

---

print.privacy_budget *Print Privacy Budget*

Description

Print Privacy Budget

Usage

```
## S3 method for class 'privacy_budget'
print(x, ...)
```

Arguments

x	A privacy budget object
...	Additional arguments (unused)

Value

Returns the privacy budget object invisibly. Called primarily for the side effect of printing budget information to the console, including total epsilon and delta budgets, amounts spent, remaining budget, composition method, and number of operations executed.

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