

Package ‘RESTK’

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Title An Implementation of the RESTK Algorithm

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compute_maxk	<i>Compute the maximum k for a given sample</i>
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Description

compute_maxk returns the estimated quantiles for the chosen probabilities from the input sample. This method uses the sample quantile method number 8 from the default quantile function.

Usage

```
compute_maxk(samp = NULL, probs = NULL, quants = NULL, k_range = c(1, 120))
```

Arguments

samp	Sample of data to model
probs	Probabilities of interest to generate the max_k line
quants	Estimated quantiles of interest to generate the max_k line
k_range	Range of k values for the optimization function

Value

Returns estimated maxk for the sample and quantiles given.

Examples

```
samp <- rnorm(1e3, mean = 100, sd = 10)
probs <- c(1-1e-1, 1-0.5e-1, 1-1e-2)
quants <- c(100, 125, 150)
estimated_max_k <- compute_maxk(samp = samp, probs = probs, quants = quants, k_range = c(1,100))
```

estimate_quantiles_maxk	<i>Estimate Quantiles with Maxk</i>
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Description

estimate_quantiles_maxk use the maxk line obtained to estimate quantiles with MIK

Usage

```
estimate_quantiles_maxk(samp = NULL, maxk_line = NULL, probs_interest = NULL)
```

Arguments

samp sample
 maxk_line maxk line obtained for the probabilities of interest
 probs_interest Probabilities of interest to estimate

Value

Returns the estimation of the quantiles using the maxk line

Examples

```
linear_adjust(min_maxk = c(10, 15, 20),
              probs = c(1-1e-1, 1-1e-2, 1-1e-3),
              probs_interest = c(1-1e-6, 1-1e-7, 1-1e-8))
```

get_min_maxk	<i>Get the minimum maxk</i>
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Description

get_min_maxk get the minimum maxk from a set of maxks and tightness

Usage

```
get_min_maxk(samp_tightness = NULL, k_seq = NULL)
```

Arguments

samp_tightness tightness from a given sample and maxk
 k_seq sequence of maxk to evaluate

Value

Returns the minimum maxk

Examples

```
get_min_maxk(samp_tightness = c(1.5, 1.2, 0.98),
              k_seq = c(20, 30 , 40))
```

linear_adjust	<i>Linear adjust</i>
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Description

linear_adjust function used to project the max_k line into the probabilities of interest

Usage

```
linear_adjust(min_maxk = NULL, probs = NULL, probs_interest)
```

Arguments

min_maxk	minimum maxk found for each probability of interest
probs	Probabilities where maxk was evaluated
probs_interest	Probabilities of interest to estimate

Value

Returns the maxk line for the probabilities of interest

Examples

```
linear_adjust(min_maxk = c(10, 15, 20),
              probs = c(1-1e-1, 1-1e-2, 1-1e-3),
              probs_interest = c(1-1e-6, 1-1e-7, 1-1e-8))
```

RESTK	<i>RESTK</i>
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Description

RESTK function used to project the maxk line into the probabilities of interest

Usage

```
RESTK(
  training_data = NULL,
  validation_data = NULL,
  probs = NULL,
  probs_interest = NULL,
  bootstrap_size = NULL,
  bootstrap_training_sims = NULL,
  bootstrap_validation_sims = NULL
)
```

Arguments

`training_data` training data
`validation_data` validation data
`probs` Probabilities where maxk was evaluated
`probs_interest` Probabilities of interest to estimate
`bootstrap_size` size of bootstrap simulations on the training data
`bootstrap_training_sims` number of bootstrap simulations on the training data
`bootstrap_validation_sims` number of bootstrap simulations on the validation data

Value

Returns the maxk line for the probabilities of interest

Examples

```

training_data <- rnorm(1e3, mean = 100, sd = 10)
validation_data <- rnorm(1e3, mean = 100, sd = 10)
bootstrap_size <- 1000
bootstrap_training_sims <- 10
bootstrap_validation_sims <- 10
probs <- c(1-1e-1, 1-0.5e-1, 1-1e-2)
probs_interest <- c(1-1e-6, 1-1e-7)
maxk_line <- c(100, 125, 150)

estimated_quants <- RESTK(training_data = training_data,
                           validation_data = validation_data,
                           probs = probs,
                           probs_interest = probs_interest,
                           bootstrap_size = bootstrap_size,
                           bootstrap_training_sims = bootstrap_training_sims,
                           bootstrap_validation_sims = bootstrap_validation_sims)

```

RESTK_training

RESTK Training

Description

RESTK_training function used to project the maxk line into the probabilities of interest

Usage

```
RESTK_training(
  training_data = NULL,
  probs = NULL,
  probs_interest = NULL,
  bootstrap_size = NULL,
  bootstrap_training_sims = NULL
)
```

Arguments

`training_data` training data

`probs` Probabilities where maxk was evaluated

`probs_interest` Probabilities of interest to estimate

`bootstrap_size` size of bootstrap simulations on the training data

`bootstrap_training_sims`
 number of bootstrap simulations on the training data

Value

Returns the estimated maxk line from the probabilities of interest

Examples

```
training_data <- rnorm(1e3, mean = 100, sd = 10)
probs <- c(1-1e-1, 1-0.5e-1, 1-1e-2)
probs_interest <- c(1-1e-6, 1-1e-7)
bootstrap_size <- 1000
bootstrap_training_sims <- 100

maxk_line <- RESTK_training(training_data = training_data,
                             probs = probs,
                             probs_interest = probs_interest,
                             bootstrap_size = bootstrap_size,
                             bootstrap_training_sims = bootstrap_training_sims)
```

RESTK_validation	<i>RESTK Validation</i>
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Description

RESTK_validation main function for the validation of the RESTK methodology by using the maxk line

Usage

```
RESTK_validation(
  validation_data = NULL,
  maxk_line = NULL,
  probs_interest = NULL,
  bootstrap_size = NULL,
  bootstrap_validation_sims = NULL
)
```

Arguments

`validation_data` validation data

`maxk_line` maxk line obtained from `RESTK_training`

`probs_interest` Probabilities of interest to estimate

`bootstrap_size` size of bootstrap simulations on the validation data

`bootstrap_validation_sims` number of bootstrap simulations on the validation data

Value

Returns the estimated quantiles from the probabilities of interest

Examples

```
validation_data <- rnorm(1e3, mean = 100, sd = 10)
probs_interest <- c(1-1e-6, 1-1e-7)
bootstrap_size <- 1000
bootstrap_validation_sims <- 100
maxk_line <- c(100, 125, 150)
estimated_quants <- RESTK_validation(validation_data = validation_data,
                                     maxk_line = maxk_line,
                                     probs_interest = probs_interest,
                                     bootstrap_size = bootstrap_size,
                                     bootstrap_validation_sims = bootstrap_validation_sims)
```

sample_quantile_estimation

Estimate Quantiles within the Sample

Description

`sample_quantile_estimation` returns the estimated quantiles for the chosen probabilities from the input sample. This method uses the sample quantile method number 8 from the default quantile function.

Usage

```
sample_quantile_estimation(samp = NULL, probs = NULL, bootstrap_sims = NULL)
```

Arguments

samp Sample of data to model
 probs Probabilities of interest to generate the max_k line
 bootstrap_sims Number of bootstrap simulations to estimate the quantiles

Value

Returns estimated quantiles for the chosen probabilities.

Examples

```
samp <- rnorm(1e3, mean = 100, sd = 10)
probs <- c(1-1e-1, 1-0.5e-1, 1-1e-2)
bootstrap_training_sims <- 100
estimated_quantiles <- sample_quantile_estimation(samp = samp,
                                                    probs = probs,
                                                    bootstrap_sims = bootstrap_training_sims)
```

tightness

Tightness function

Description

tightness function used to minimized the tightness as a function of the value of k

Usage

```
tightness(samp = NULL, prob = NULL, quant = NULL, k = NULL)
```

Arguments

samp Sample of data to model
 prob Probability of interest
 quant Quantile of interest
 k value of k to check tightness

Value

Returns the squared difference between the tightness and 1

Examples

```
samp <- rnorm(1e3, mean = 100, sd = 10)
prob <- c(1-1e-2)
k <- 1:100
quant <- qnorm(p = prob, mean = 100, sd = 10)
tightness(samp = samp, prob = prob, quant = quant, k = k)
```

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