Package 'RESTK'

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Title An Implementation of the RESTK Algorithm

Version 1.0.1

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`compute_maxk` *Compute the maximum k for a given sample*

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`
Estimate Quantiles with Maxk

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))
```

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get_min_maxk *Get the minimum maxk*

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 *Linear adjust*

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 *RESTK*

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` *RESTK Validation*

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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