Package 'dragonking'

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Type Package

Title Statistical Tools to Identify Dragon Kings

Version 0.1.0

Description Statistical tests and test statistics to identify events in a dataset that are dragon kings (DKs). The statistical methods in this package were reviewed in Wheatley & Sornette (2015) <doi:10.2139/ssrn.2645709>.

License GPL-3

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URL https://github.com/rrrlw/dragonking

BugReports https://github.com/rrrlw/dragonking/issues

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Author Raoul Wadhwa [aut, cre],
Christian Kelley [aut],
Daniel Qin [aut],
Osaulenko Viacheslav [aut],
Judit Szente [aut],
Peter Erdi [aut]

Maintainer Raoul Wadhwa <raoulwadhwa@gmail.com>

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R topics documented:

`dixon_stat` *Dixon test statistic to identify dragon kings (DKs)*

Description

`dixon_stat` calculates the DIxon test statistic to determine whether there is significant support for the existence of `r` DKs in `vals`. This test is less susceptible to swamping and masking, but is also less powerful than the SS and SRS test statistics.

Usage

```
dixon_stat(vals, r)
```

Arguments

`vals`	numeric vector with at least 3 elements
`r`	integer indicating number of DKs in `vals`

Value

Dixon test statistic

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Dixon WJ (1950). Analysis of extreme values. *Ann Math Stat*, **21**(4): 488-506. <doi:10.1214/aoms/1177729747>

Likes J (1967). Distribution of Dixon's statistics in the case of an exponential population. *Metrika*, **11**(1): 46-54. <doi:10.1007/bf02613574>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# calculate test statistic for DKs
dixon_stat(temp, r = 3)
```

dk_test *Statistical test to identify dragon kings (DKs)*

Description

dk_test runs the DK test on the user parameters and returns a test statistic and corresponding p-value to aid in determining whether there is significant support for the existence of r DKs in vals.

Usage

```
dk_test(vals, r)
```

Arguments

vals	numeric vector with at least 3 elements
r	integer indicating number of DKs in vals

Value

DK test statistic and p-value (F distribution)

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Pisarenko VF, Sornette D (2012). Robust statistical tests of dragon-kings beyond power law distributions. *Eur Phys J Special Topics*, **205**: 95-115. <doi:10.1140/epjst/e2012-01564-8>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# test for DKs, where r is number of DKs thought to be in temp
results <- dk_test(temp, r = 3)

# print out test statistic (should be large) and p-value (should be small)
print(paste("Test statistic =", results["Test Statistic"]))
print(paste("p-value =", results["p-value"]))
```

dragonking *dragonking: Statistical tools for identifying dragon kings*

Description

This package provide statistical methods to identify events in a dataset that are dragon kings (DKs). The statistical methods in this package were reviewed in: Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28.

mrs_stat *Max-robust-sum (MRS) test statistic to identify dragon kings (DKs)*

Description

`mrs_stat` calculates the MRS test statistic to determine whether there is significant support for the existence of `r` DKs in `vals`. This test avoids denominator masking.

Usage

```
mrs_stat(vals, r, m)
```

Arguments

`vals`	numeric vector with at least 3 elements
`r`	integer indicating number of DKs in `vals`
`m`	pre-specified maximum number of DKs in `vals`

Value

MRS test statistic

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# calculate test statistic for DKs
mrs_stat(temp, r = 2, m = 3)
```

`ms_stat` *Max-sum (MS) test statistic to identify dragon kings (DKs)*

Description

`ms_stat` calculates the MS test statistic to determine whether there is significant support for the existence of `r` DKs in `vals`. This statistic is less susceptible to swamping, but is also less powerful in the case of clustered outliers, in comparison to the SS and SRS test statistics.

Usage

```
ms_stat(vals, r)
```

Arguments

`vals`	numeric vector with at least 3 elements
`r`	integer indicating number of DKs in `vals`

Value

MS test statistic

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Hawkins DM (1980). Identification of outliers, vol. 11. *Chapman and Hall*. ISBN: 9789401539944

Kimber AC (1982). Tests for many outliers in an exponential sample. *Appl Statist*, **31**(3): 263-71. <doi:10.2307/2348000>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# calculate test statistic for DKs
ms_stat(temp, r = 3)
```

srs_stat *Sum-robust-sum (SRS) test statistic to identify dragon kings (DKs)*

Description

srs_stat calculates the SRS test statistic to determine whether there is significant support for the existence of r DKs in vals. This test provides robustness to denominator masking.

Usage

```
srs_stat(vals, r, m)
```

Arguments

vals	numeric vector with at least 3 elements
r	integer indicating number of DKs in vals
m	pre-specified maximum number of DKs in vals

Value

SRS test statistic

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Iglewicz B, Martinez J (1982). Outlier detection using robust measures of scale. *J Stat Comput Simul*, **15**(4): 285-93. <doi:10.1080/00949658208810595>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# calculate test statistic for DKs
srs_stat(temp, r = 2, m = 3)
```

ss_stat *Sum-sum (SS) test statistic to identify dragon kings (DKs)*

Description

ss_stat calculates the SS test statistic to determine whether there is significant support for the existence of r DKs in vals. This test is susceptible to swamping.

Usage

```
ss_stat(vals, r)
```

Arguments

vals	numeric vector with at least 3 elements
r	integer indicating number of DKs in vals

Value

SS test statistic

References

Wheatley S, Sornette D (2015). Multiple outlier detection in samples with exponential & pareto tails: Redeeming the inward approach & detecting dragon kings. Swiss Finance Institute Research Paper Series No. 15-28. <doi:10.2139/ssrn.2645709>

Balakrishnan K (1996). Exponential distribution: Theory, methods and applications. *CRC Press*. pp. 228-30. ISBN: 9782884491921

Chikkagoudar MS, Kunchur SH (1983). Distributions of test statistics for multiple outliers in exponential samples. *Commun Stat Theory Methods*, **12**: 2127-42. <doi:10.1080/03610928308828596>

Lewis T, Fieller NRJ (1979). A recursive algorithm for null distributions for outliers: I gamma samples. *Technometrics*, **21**(3): 371-6. <doi:10.2307/1267762>

Examples

```
# generate a numeric vector with DKs
temp <- c(rexp(100),   # exponentially distributed RV
          15, 15, 15)  # DK elements

# calculate test statistic for DKs
ss_stat(temp, r = 3)
```

Index