

lillietest

Lilliefors test

Syntax

```
h = lillietest(x)
h = lillietest(x,alpha)
h = lillietest(x,alpha,distr)
[h,p] = lillietest(...)
[h,p,kstat] = lillietest(...)
[h,p,kstat,critval] = lillietest(...)
[h,p,...] = lillietest(x,alpha,distr,mctol)
```

Description

`h = lillietest(x)` performs a Lilliefors test of the default null hypothesis that the sample in vector `x` comes from a distribution in the normal family, against the alternative that it does not come from a normal distribution. The test returns the logical value `h = 1` if it rejects the null hypothesis at the 5% significance level, and `h = 0` if it cannot. The test treats NaN values in `x` as missing values, and ignores them.

The Lilliefors test is a 2-sided goodness-of-fit test suitable when a fully-specified null distribution is unknown and its parameters must be estimated. This is in contrast to the one-sample Kolmogorov-Smirnov test (see [kstest](#)), which requires that the null distribution be completely specified. The Lilliefors test statistic is the same as for the Kolmogorov-Smirnov test:

$$KS = \max_x |SCDF(x) - CDF(x)|$$

where *SCDF* is the empirical cdf estimated from the sample and *CDF* is the normal cdf with mean and standard deviation equal to the mean and standard deviation of the sample.

`lillietest` uses a table of critical values computed using Monte-Carlo simulation for sample sizes less than 1000 and significance levels between 0.001 and 0.50. The table is larger and more accurate than the table introduced by Lilliefors. Critical values for a test are computed by interpolating into the table, using an analytic approximation when extrapolating for larger sample sizes.

`h = lillietest(x,alpha)` performs the test at significance level `alpha`. `alpha`

is a scalar in the range [0.001, 0.50]. To perform the test at a significance level outside of this range, use the `mctol` input argument.

`h = lillietest(x,alpha,distr)` performs the test of the null hypothesis that `x` came from the location-scale family of distributions specified by `distr`.

Acceptable values for `distr` are 'norm' (normal, the default), 'exp' (exponential), and 'ev' (extreme value). The Lilliefors test can not be used when the null hypothesis is not a location-scale family of distributions.

`[h,p] = lillietest(...)` returns the p -value `p`, computed using inverse interpolation into the table of critical values. Small values of `p` cast doubt on the validity of the null hypothesis. `lillietest` warns when `p` is not found within the tabulated range of [0.001, 0.50], and returns either the smallest or largest tabulated value. In this case, you can use the `mctol` input argument to compute a more accurate p -value.

`[h,p,kstat] = lillietest(...)` returns the test statistic `kstat`.

`[h,p,kstat,critval] = lillietest(...)` returns the critical value `critval` for the test. When `kstat > critval`, the null hypothesis is rejected at significance level `alpha`

`[h,p,...] = lillietest(x,alpha,distr,mctol)` computes a Monte-Carlo approximation for `p` directly, rather than interpolating into the table of pre-computed values. This is useful when `alpha` or `p` lie outside the range of the table. `lillietest` chooses the number of Monte Carlo replications, `mcreps`, large enough to make the Monte Carlo standard error for `p`, $\sqrt{p*(1-p)/mcreps}$, less than `mctol`.

Example

Use `lillietest` to determine if car mileage, in miles per gallon (MPG), follows a normal distribution across different makes of cars:

```
[h,p] = lillietest(MPG)
Warning: P is less than the smallest tabulated value, returning 0.
h =
    1
p =
    1.0000e-003
```

This is clear evidence for rejecting the null hypothesis of normality, but the

p -value returned is just the smallest value in the table of pre-computed values. To find a more accurate p -value for the test, run a Monte Carlo approximation using the `mc tol` input argument:

```
[h,p] = lillietest(MPG,0.05,'norm',1e-4)
h =
    1
p =
    8.3333e-006
```

References

- [1] Conover, W.J., *Practical Nonparametric Statistics*, Wiley, 1980
- [2] Lilliefors, H.W., On the Komogorov–Smirnov test for normality with mean and variance unknown, *J.Am.Stat.Assoc.*, vol. 62, 1967, pp. 399–402
- [3] Lilliefors, H.W., On the Kolmogorov–Smirnov test for the exponential distribution with mean unknown", *J.Am.Stat.Assoc.*, vol. 64, 1969, pp. 387–389

See Also

[jbtest](#), [kstest](#), [kstest2](#), [cdfplot](#)

◀ lhsnorm

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