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Statistical functions (**`scipy.stats`**) (../stats.html)

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scipy.stats.boxcox

scipy.stats.boxcox(*x*, *lmbda=None*, *alpha=None*) **[source] (http://github.com/scipy/scipy/blob/v0.16.1/scipy/stats/morestats.py#L726)**

Return a positive dataset transformed by a Box-Cox power transformation.

Parameters:

x : *ndarray*

Input array. Should be 1-dimensional.

lmbda : *{None, scalar}, optional*

If *lmbda* is not None, do the transformation for that value.

If *lmbda* is None, find the lambda that maximizes the log-likelihood function and return it as the second output argument.

alpha : *{None, float}, optional*

If `alpha` is not None, return the `100 * (1-alpha)%` confidence interval for *lmbda* as the third output argument. Must be between 0.0 and 1.0.

Returns:

boxcox : *ndarray*

Box-Cox power transformed array.

maxlog : *float, optional*

If the *lmbda* parameter is None, the second returned argument is the lambda that maximizes the log-likelihood function.

(min_ci, max_ci) : *tuple of float, optional*

If *lmbda* parameter is None and `alpha` is not None, this returned tuple of floats represents the minimum and maximum confidence limits given `alpha`.

See also:

Previous topic

scipy.stats.mood (scipy.stats.mood.html)

Next topic

scipy.stats.boxcox_normmax (scipy.stats.boxcox_normmax.h

probplot (scipy.stats.probplot.html#scipy.stats.probplot), boxcox_normplot (scipy.stats.boxcox_normplot.html#scipy.stats.boxcox_normplot), boxcox_normmax (scipy.stats.boxcox_normmax.html#scipy.stats.boxcox_normmax), boxcox_llf (scipy.stats.boxcox_llf.html#scipy.stats.boxcox_llf)

Notes

The Box-Cox transform is given by:

```
y = (x**lmbda - 1) / lmbda,  for lmbda > 0
    log(x),                  for lmbda = 0
```

boxcox requires the input data to be positive. Sometimes a Box-Cox transformation provides a shift parameter to achieve this; boxcox does not. Such a shift parameter is equivalent to adding a positive constant to *x* before calling boxcox.

The confidence limits returned when `alpha` is provided give the interval where:

\[\begin{split}llf(\hat{\lambda}) - llf(\lambda) < \frac{1}{2}\chi^2(1 - \alpha, 1),\end{split}\]
with `llf` the log-likelihood function and \(\chi^2\) the chi-squared function.

References

G.E.P. Box and D.R. Cox, “An Analysis of Transformations”, Journal of the Royal Statistical Society B, 26, 211-252 (1964).

Examples

>>>

```
>>> from scipy import stats
>>> import matplotlib.pyplot as plt
```

We generate some random variates from a non-normal distribution and make a probability plot for it, to show it is non-normal in the tails:

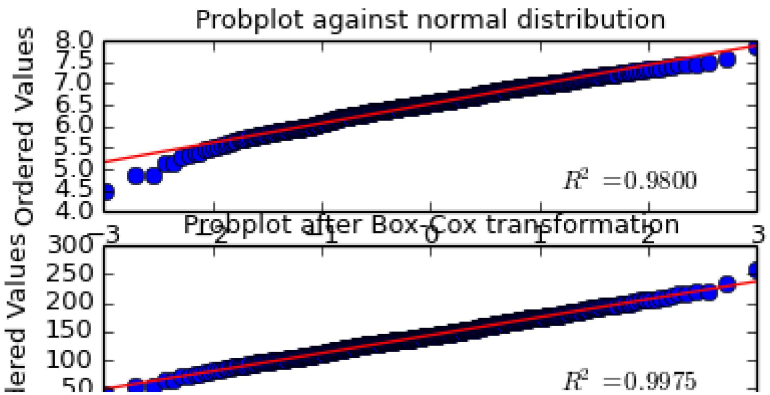
```
>>> fig = plt.figure()
>>> ax1 = fig.add_subplot(211)
>>> x = stats.loggamma.rvs(5, size=500) + 5
>>> stats.probplot(x, dist=stats.norm, plot=ax1)
>>> ax1.set_xlabel('')
>>> ax1.set_title('Probplot against normal distribution')
```

We now use boxcox to transform the data so it’s closest to normal:

```
>>> ax2 = fig.add_subplot(212)
>>> xt, _ = stats.boxcox(x)
>>> stats.probplot(xt, dist=stats.norm, plot=ax2)
>>> ax2.set_title('Probplot after Box-Cox transformation')
```

```
>>> plt.show()
```

(Source code (../generated/scipy-stats-boxcox-1.py))


Probplot against normal distribution
Ordered Values
R^2 =0.9800
Probplot after Box-Cox transformation
lered Values
R^2 =0.9975