scipy.stats.spearmanr

scipy.stats.spearmanr(*a*, *b=None*, *axis=0*, *nan_policy='propagate'*) [source] (https://github.com/scipy/scipy/blob/v1.4.1/scipy/stats/stats.py#L3725-L3877)

Calculate a Spearman correlation coefficient with associated p-value.

The Spearman rank-order correlation coefficient is a nonparametric measure of the monotonicity of the relationship between two datasets. Unlike the Pearson correlation, the Spearman correlation does not assume that both datasets are normally distributed. Like other correlation coefficients, this one varies between -1 and +1 with 0 implying no correlation. Correlations of -1 or +1 imply an exact monotonic relationship. Positive correlations imply that as x increases, so does y. Negative correlations imply that as x increases, y decreases.

The p-value roughly indicates the probability of an uncorrelated system producing datasets that have a Spearman correlation at least as extreme as the one computed from these datasets. The p-values are not entirely reliable but are probably reasonable for datasets larger than 500 or so.

Parameters:

a, b : *1D or 2D array_like, b is optional*

One or two 1-D or 2-D arrays containing multiple variables and observations. When these are 1-D, each represents a vector of observations of a single variable. For the behavior in the 2-D case, see under `axis`, below. Both arrays need to have the same length in the `axis` dimension.

axis : *int or None, optional*

If axis=0 (default), then each column represents a variable, with observations in the rows. If axis=1, the relationship is transposed: each row represents a variable, while the columns contain observations. If axis=None, then both arrays will be raveled.

nan_policy : *{'propagate', 'raise', 'omit'}, optional*

Defines how to handle when input contains nan. The following options are available (default is 'propagate'):

- 'propagate': returns nan
- 'raise': throws an error
- 'omit': performs the calculations ignoring nan values

Returns:

correlation : *float or ndarray (2-D square)*

Spearman correlation matrix or correlation coefficient (if only 2

variables are given as parameters. Correlation matrix is square with length equal to total number of variables (columns or rows) in `a` and `b` combined.

pvalue : *float*

The two-sided p-value for a hypothesis test whose null hypothesis is that two sets of data are uncorrelated, has same dimension as rho.

References

1 Zwillinger, D. and Kokoska, S. (2000). CRC Standard Probability and Statistics Tables and Formulae. Chapman & Hall: New York. 2000. Section 14.7

Examples

```
>>> from scipy import stats
>>> stats.spearmanr([1,2,3,4,5], [5,6,7,8,7])
(0.82078268166812329, 0.088587005313543798)
>>> np.random.seed(1234321)
>>> x2n = np.random.randn(100, 2)
>>> y2n = np.random.randn(100, 2)
>>> stats.spearmanr(x2n)
(0.059969996999699973, 0.55338590803773591)
>>> stats.spearmanr(x2n[:,0], x2n[:,1])
(0.059969996999699973, 0.55338590803773591)
>>> rho, pval = stats.spearmanr(x2n, y2n)
>>> rho
array([[ 1.        ,  0.05997   ,  0.18569457,  0.06258626],
       [ 0.05997   ,  1.        ,  0.110003  ,  0.02534653],
       [ 0.18569457,  0.110003  ,  1.        ,  0.03488749],
       [ 0.06258626,  0.02534653,  0.03488749,  1.        ]])
>>> pval
array([[ 0.        ,  0.55338591,  0.06435364,  0.53617935],
       [ 0.55338591,  0.        ,  0.27592895,  0.80234077],
       [ 0.06435364,  0.27592895,  0.        ,  0.73039992],
       [ 0.53617935,  0.80234077,  0.73039992,  0.        ]])
>>> rho, pval = stats.spearmanr(x2n.T, y2n.T, axis=1)
>>> rho
array([[ 1.        ,  0.05997   ,  0.18569457,  0.06258626],
       [ 0.05997   ,  1.        ,  0.110003  ,  0.02534653],
       [ 0.18569457,  0.110003  ,  1.        ,  0.03488749],
       [ 0.06258626,  0.02534653,  0.03488749,  1.        ]])
>>> stats.spearmanr(x2n, y2n, axis=None)
(0.10816770419260482, 0.1273562188027364)
>>> stats.spearmanr(x2n.ravel(), y2n.ravel())
(0.10816770419260482, 0.1273562188027364)
```

```
>>> xint = np.random.randint(10, size=(100, 2))
>>> stats.spearmanr(xint)
(0.052760927029710199, 0.60213045837062351)
```

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