How can I perform a KPSS test in Python?

Authored by

stats writer

July 1, 2024

The KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test is a statistical method used to determine the stationarity of a time series data. In Python, the KPSS test can be performed using the "kpss" function from the "statsmodels" library. This function takes in the time series data as an input and returns the test statistic and p-value. The test statistic is then compared to a critical value to determine if the data is stationary or not. The result of the KPSS test can help in identifying trends and patterns in the data, making it useful in various data analysis and forecasting tasks. Overall, the "kpss" function in Python provides a simple and efficient way to perform the KPSS test on time series data.

Perform a KPSS Test in Python

A KPSS test can be used to determine if a time series is trend stationary.

This test uses the following null and alternative hypothesis:

H0: The time series is trend stationary.HA: The time series is *not* trend stationary.

If the of the test is less than some significance level (e.g. α = .05) then we reject the null hypothesis and conclude that the time series is not trend stationary.

Otherwise, we fail to reject the null hypothesis.

The following examples show how to perform a KPSS test in Python.

Example 1: KPSS Test in Python (With Stationary Data)

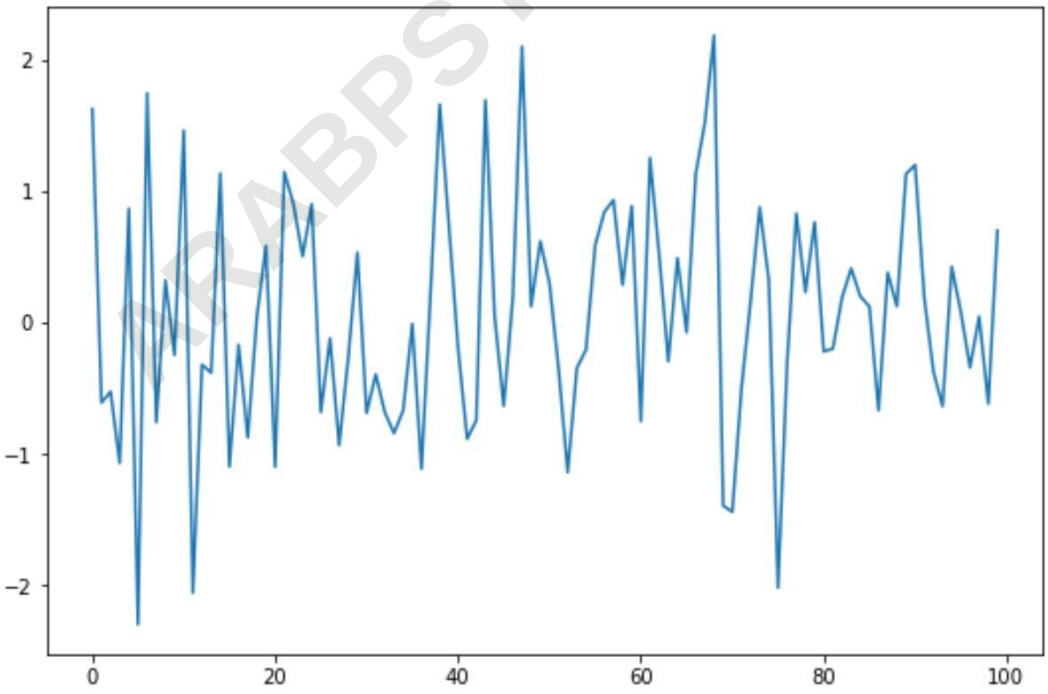
First, let's create some fake data in Python to work with:

import numpy as npimport matplotlib.pyplotas plt

#make this example reproducible
np.random.seed(1)

#create time series data
data = np.random.normal(size=100)

#create line plot of time series data
plt.plot(data)



We can use the kpss() function from the statsmodels package to perform a KPSS test on this time series data:

```
import statsmodels.apias sm

#perform KPSS test
sm.tsa.stattools.kpss(data, regression='ct')

(0.047617848370993,
0.1,
1,
{'10%': 0.119, '5%': 0.146, '2.5%': 0.176, '1%': 0.216})

InterpolationWarning: The test statistic is outside of the range of p-values available
in the look-up table. The actual p-value is greater than the p-value returned.
```

Here's how to interpret the output:

The KPSS test statistic: 0.04776The p-value: 0.1The truncation lag parameter: 1The critical values at 10%, 5%, 2.5%, and 1%

The p-value is 0.1. Since this value is not less than .05,

we fail to reject the null hypothesis of the KPSS test.

This means we can assume that the time series is trend stationary.

Note 1: The p-value is actually even greater than 0.1, but the lowest value that the kpss() function will output is 0.1.

Example 2: KPSS Test in Python (With Non-Stationary Data)

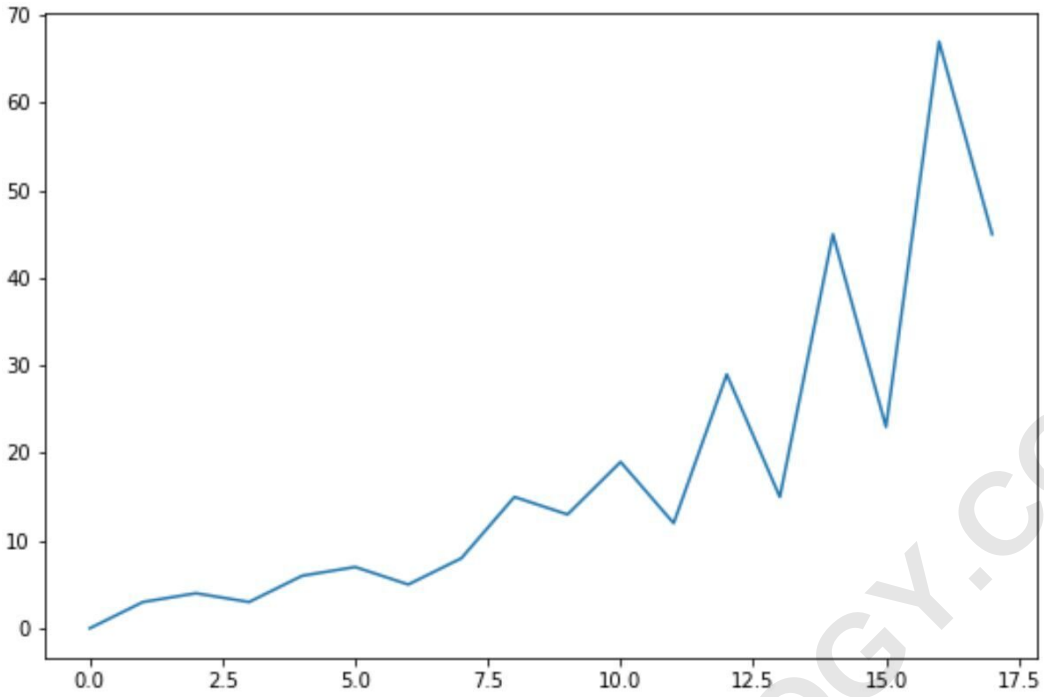
First, let's create some fake data in Python to work with:

```
import numpy as npimport matplotlib.pyplotas plt

#make this example reproducible
np.random.seed(1)

#create time series data
data =np.array()

#create line plot of time series data
plt.plot(data)
```



Once again, we can use the kpss() function from the statsmodels package to perform a KPSS test on this time series data:

```
import statsmodels.apias sm

#perform KPSS test
sm.tsa.stattools.kpss(data, regression='ct')

(0.1509635891084368 5,
0.04586367574296928,
3,
{'10%': 0.119, '5%': 0.146, '2.5%': 0.176, '1%': 0.216})
```

Here's how to interpret the output:

The KPSS test statistic: 0.1509The p-value: 0.0458The truncation lag parameter: 3The critical values at 10%, 5%, 2.5%, and 1%

The p-value is 0.0458. Since this value is less than .05, we reject the null hypothesis of the KPSS test.

This means the time series is *not* trend stationary.

Note: You can find the complete documentation for the kpss() function from the statsmodels package .

Additional Resources

The following tutorials provide additional information on how to work with time series data in Python: