抽样方法

针对非等间距的时间序列（如高频交易），需要定义一个时间间隔重新抽样，形成等距的时间序列。

方法一 首先用原始数据fit一条曲线，然后按照新的时间点取曲线上对应的值，或者算抽样时间间隔内数据点的加权平均，权值可以是数据点之间的时间差之类。

1. spectrum

R function: spectrum

The spectrum function estimates the spectral density of a time series.

1. sampling rate / frequency
2. frequency

R function: frequency/deltat

1. detection the period of time series

first method:

 the chi-square periodogram test for the computation of circadian period

1. **Equally-spaced** data sets (with one measurement per line) are expected.
2. Regardless of the resolution of the computations, the test of significance (used to determine whether the computed period is statistically significant) assumes that you have at least 10 days of data. With fewer days, the computed value will still be accurate, but the significance test will be less sensitive.
3. The probability indicated here incorporates correction for multiple testing (all periods between 19 and 27 hours). The need for this correction is arguable. If the test fails to identify significant rhythmicity, you may try a more lenient level of significance. The critical value of Qp to be exceeded at a given significance level is the value of the chi-square statistic for (P − 1) degrees of freedom (where P is the period in number of bins).

The resolution of the computed period will depend on the resolution (bin size) of your data. For a resolution of 0.1 hour, you need a bin size of 6 minutes.

<http://www.circadian.org/periodogram.html>

reference:

1) Enright, J. T. (1965). The search for rhythmicity in biological time-series. *Journal of Theoretical Biology* **8**: 426-468.  
2) Sokolove, P. G. and Bushell, W. N. (1978). The chi square periodogram: its utility for analysis of circadian rhythms. *Journal of Theoretical Biology* **72**: 131-160.  
3) Refinetti, R. (1993). Comparison of six methods for the determination of the period of circadian rhythms. *Physiology and Behavior* **54**: 869-875.  
4) Refinetti, R. (2004). Non-stationary time series and the robustness of circadian rhythms.*Journal of Theoretical Biology* **227**: 571-581.

second method:

R function: spec.pgram

spec.pgram calculates the periodogram using a fast Fourier transform, and optionally smooths the result with a series of modified Daniell smoothers (moving averages giving half weight to the end values).

third method:

Fast Fourier Transform

Anomaly Detection for Airbnb's Payment Platform - Airbnb Engineering

fourth method:

<http://stats.stackexchange.com/questions/1207/period-detection-of-a-generic-time-series?noredirect=1&lq=1>

package::{xts}—periodicity

1. multiple period detect???

<http://www.analyticbridge.com/forum/topics/challenge-of-the-week-detecting-multiple-periodicity-in-time-seri>

1. **Multi-step approach to find periods of time-series data**

<http://dept.astro.lsa.umich.edu/~msshin/science/code/MultiStep_Period/>

1. David Palmer: The Fast Chi-squared Period Search

<http://public.lanl.gov/palmer/fastchi.html>