**What all is returned from feat\_acf()**

The feat\_acf() function computes a selection of the autocorrelations discussed here. It will return six or seven features:

* the first autocorrelation coefficient from the original data;
* the sum of squares of the first ten autocorrelation coefficients from the original data;
* the first autocorrelation coefficient from the differenced data;
* the sum of squares of the first ten autocorrelation coefficients from the differenced data;
* the first autocorrelation coefficient from the twice differenced data;
* the sum of squares of the first ten autocorrelation coefficients from the twice differenced data;
* For seasonal data, the autocorrelation coefficient at the first seasonal lag is also returned.

The feat\_stl() function returns several more features other than those discussed above.

* seasonal\_peak\_year indicates the timing of the peaks — which month or quarter contains the largest seasonal component. This tells us something about the nature of the seasonality. In the Australian tourism data, if Quarter 3 is the peak seasonal period, then people are travelling to the region in winter, whereas a peak in Quarter 1 suggests that the region is more popular in summer.
* seasonal\_trough\_year indicates the timing of the troughs — which month or quarter contains the smallest seasonal component.
* spikiness measures the prevalence of spikes in the remainder component RtRt of the STL decomposition. It is the variance of the leave-one-out variances of RtRt.
* linearity measures the linearity of the trend component of the STL decomposition. It is based on the coefficient of a linear regression applied to the trend component.
* curvature measures the curvature of the trend component of the STL decomposition. It is based on the coefficient from an orthogonal quadratic regression applied to the trend component.
* stl\_e\_acf1 is the first autocorrelation coefficient of the remainder series.
* stl\_e\_acf10 is the sum of squares of the first ten autocorrelation coefficients of the remainder series.

The remaining features in the feasts package, not previously discussed, are listed here for reference. The details of some of them are discussed later in the book.

* coef\_hurst will calculate the Hurst coefficient of a time series which is a measure of “long memory”. A series with long memory will have significant autocorrelations for many lags.
* feat\_spectral will compute the (Shannon) spectral entropy of a time series, which is a measure of how easy the series is to forecast. A series which has strong trend and seasonality (and so is easy to forecast) will have entropy close to 0. A series that is very noisy (and so is difficult to forecast) will have entropy close to 1.
* box\_pierce gives the Box-Pierce statistic for testing if a time series is white noise, and the corresponding p-value. This test is discussed in Section [5.4](https://otexts.com/fpp3/diagnostics.html#diagnostics).
* ljung\_box gives the Ljung-Box statistic for testing if a time series is white noise, and the corresponding p-value. This test is discussed in Section [5.4](https://otexts.com/fpp3/diagnostics.html#diagnostics).
* The kkth partial autocorrelation measures the relationship between observations kk periods apart after removing the effects of observations between them. So the first partial autocorrelation (k=1k=1) is identical to the first autocorrelation, because there is nothing between consecutive observations to remove. Partial autocorrelations are discussed in Section [9.5](https://otexts.com/fpp3/non-seasonal-arima.html#non-seasonal-arima). The feat\_pacf function contains several features involving partial autocorrelations including the sum of squares of the first five partial autocorrelations for the original series, the first-differenced series and the second-differenced series. For seasonal data, it also includes the partial autocorrelation at the first seasonal lag.
* unitroot\_kpss gives the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) statistic for testing if a series is stationary, and the corresponding p-value. This test is discussed in Section [9.1](https://otexts.com/fpp3/stationarity.html#stationarity).
* unitroot\_pp gives the Phillips-Perron statistic for testing if a series is non-stationary, and the corresponding p-value.
* unitroot\_ndiffs gives the number of differences required to lead to a stationary series based on the KPSS test. This is discussed in Section [9.1](https://otexts.com/fpp3/stationarity.html#stationarity)
* unitroot\_nsdiffs gives the number of seasonal differences required to make a series stationary. This is discussed in Section [9.1](https://otexts.com/fpp3/stationarity.html#stationarity).
* var\_tiled\_mean gives the variances of the “tiled means” (i.e., the means of consecutive non-overlapping blocks of observations). The default tile length is either 10 (for non-seasonal data) or the length of the seasonal period. This is sometimes called the “stability” feature.
* var\_tiled\_var gives the variances of the “tiled variances” (i.e., the variances of consecutive non-overlapping blocks of observations). This is sometimes called the “lumpiness” feature.
* shift\_level\_max finds the largest mean shift between two consecutive sliding windows of the time series. This is useful for finding sudden jumps or drops in a time series.
* shift\_level\_index gives the index at which the largest mean shift occurs.
* shift\_var\_max finds the largest variance shift between two consecutive sliding windows of the time series. This is useful for finding sudden changes in the volatility of a time series.
* shift\_var\_index gives the index at which the largest variance shift occurs.
* shift\_kl\_max finds the largest distributional shift (based on the Kulback-Leibler divergence) between two consecutive sliding windows of the time series. This is useful for finding sudden changes in the distribution of a time series.
* shift\_kl\_index gives the index at which the largest KL shift occurs.
* n\_crossing\_points computes the number of times a time series crosses the median.
* longest\_flat\_spot computes the number of sections of the data where the series is relatively unchanging.
* stat\_arch\_lm returns the statistic based on the Lagrange Multiplier (LM) test of Engle (1982) for autoregressive conditional heteroscedasticity (ARCH).
* guerrero computes the optimal λλ value for a Box-Cox transformation using the Guerrero method (discussed in Section [3.1](https://otexts.com/fpp3/transformations.html#transformations)).