

# ST 565 Time Series - Project

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## Outlier Detection in Time Series

We are interested in learning about the detection of outliers in time series data. Suppose we have a time series that we want to model as a (seasonal) ARIMA process, but the process that the series represents may have been affected by some unusual events, or there may be errors in the measurement or recording of the time series data. How can we identify unusual observations in order to investigate them and/or adjust the time series so that our model is not thrown off by the anomalies?

We plan to turn in a written report covering the following topics:

- Models for several types of outliers: innovational outlier (IO), additive outlier (AO), temporary change (TC), and level shift (LS)
- How these types of outliers affect an ARIMA model (to make things simpler, we won't consider models with seasonal components)
- An iterative algorithm described by Chen and Liu (1993) that simultaneously detects outliers and estimates both outlier effects and model parameters
- The implementation of this algorithm in the `tsoutliers` R package
- An example application of the algorithm to the `ipi` dataset in `tsoutliers`, which contains economic indices from several European countries from 1999/2000 to 2013 (one major outlier being the 2008 economic crisis), or another dataset if we find one that's more illustrative of the different outlier types

We plan to use following references:

- Wei, William W.S., "Time Series Analysis", Chapter 9: Intervention Analysis and Outlier Detection (1990)
- Chen, Chung and Lon-Mu Liu, "Joint Estimation of Model Parameters and Outlier Effects in Time Series", J. Amer. Stat. Assoc. (1993)
- R documentation of `tsoutliers`