Practical Time Series Analysis Chapter 1

Time series analysis is “the endeavor of extracting meaningful summary and statistical information from points arranged in chronological order.” (Nielsen)
Time series data and its analysis are increasingly important as continuous monitoring and data collection become more and more common. Its analysis comes especially handy when we want to **forecast** based on patterns and insights we obtain from the time-series data.

One can also apply time series analysis to non-time series data. Even if there is no passage of time in the data, if there is “a unique and meaningful ordering of the x-axis (shapes of wine spectra), with a concrete meaning of distance along the axis,” time series analysis still applies.

We can also take time-series data to non-time-series data (topological time series) and preserve some of the information -Takens.

(What are some examples of time series)

- government climate data
- Commercial data
- Yoga pose + gait analysis + topological time series

Potential Problems with time series data

- incomplete time stamps (missing data)
- Time axes can be horizontal or vertical in your data (?)
- Varying notions of time (aggregate vs. individual)
    - Do I want to know the total absenteeism per unit time perspective or to look at absenteeism per ID for those reported in the data set? First case will have a single time series, while the latter case woulld have multiple time series with overlapping timestamps.

Forecasting Questions examples and answers

1. An email recipients reaction to emails over time: Did they open the emails or not?
    1. Generate a 2D histogram of member responses to email over time with a member specific time line to get an idea of whether memebers develop fatigue from emails (Chp3)
2. Turn donation/purchase predictions into a time series forecasting problem (Chp4)
3. Predict typical **patterns of trajectories** for member behavior in important situations: Is there a typical pattern of events that indicates when a. Member is about to leave your organization?
    1. Chp7: state space methods of time series

Things to consider (1) Lookahead

A look ahead is to find out something about the future earlier than you ought to know it.
Ex) applying a member's current status to an analysis of past data would be a look ahead because we are inputting something into a time series model that could not be known at the time.

Resources for Time Series Data

- UCI ML Repository: https://perma.cc/M3XC-M9HU
  - Absenteeism.csv
- UEA and. UCR Time Series Classification Repository: https://perma.cc/56Q5-YPNT
- Government Time Series data: https://perma.cc/EA5R-TP5L
  - Temperature/precipitation for all weather stations across the US.
- Bureau of Labor Statistics (Unemployment rate) https://www.bls.gov/
  - Good for visualization and exploratory purposes