GENERAL ASSEMBLY

Intro to Time Series

Sam Stack

LEARNING OBJECTIVES

- Explain what time series data is.
- Utilize various tactics to analyze Time Series Data
- Explain the challenges of working with Time Series Data.

PRE-WORK

- Working with data in Pandas
- Have Tableau Installed(preferably already running in the the background)

It's about *Time* we got *Series-ous*.

What is a Time Series?

Intro to Time Series: What is Time Series?

- A series of values of a quantity obtained at successive times, often with equal intervals between them.
- A **time series** is a series of data points indexed (or listed or graphed) in time order. Most commonly, a time series is a sequence taken at successive equally spaced points in time.
- A set of observations who have a time bound relation which is represented as an index.

Date	City	Temperature	Weather	Nice Day
2/1/2017	Atlanta	74	windy	yes
2/1/2017	Boston	18	sunny	no
2/1/2017	Green Bay	7	snowy	no
2/1/2017	Pittsburge	40	rainy	no
2/2/2017	Atlanta	60	rainy	no
2/2/2017	Boston	24	windy	no
2/2/2017	Green Bay	20	sunny	yes
2/2/2017	Pittsburge	55	sunny	yes
2/3/2017	Atlanta	64	rainy	no
2/3/2017	Boston	43	rainy	no
2/3/2017	Green Bay	16	windy	no
2/3/2017	Pittsburge	38	windy	no

Intro to Time Series: What is Time Series?

How can time series data pose issues?

Stationarity

Many models make an assumption of stationarity, which means assuming the mean and variance of our values is the same throughout.

This means that while the values (of sales, for example) may shift up and down over time, the mean value of sales is constant, as well as the variance (i.e. there aren't many dramatic swings up or down).

Intro to Time Series: What is Time Series?

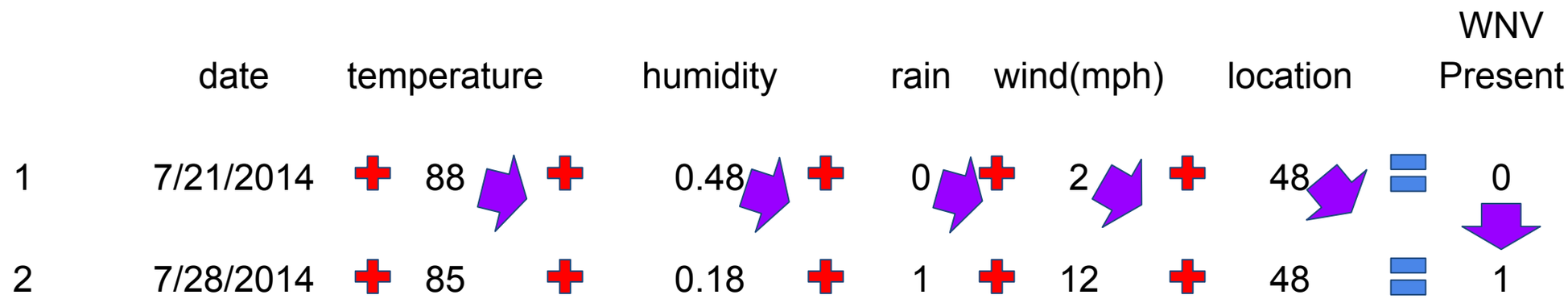
How can time series data pose issues?

- Does not assume **Stationarity**

Intro to Time Series: What is Time Series?

	date	temperature	humidity	rain	wind(mph)	location	WNV Present
2	7/28/2014	85	0.18	1	12	48	1

Intro to Time Series: What is Time Series?



Intro to Time Series: What is Time Series?

How can time series data pose issues?

- Does not assume **Stationarity**
- Observations are no longer *independent.*

Intro to Time Series: What is Time Series?

City	temperature 2/1/2017	weather 2/1/2017	Nice Day?	temperature 2/2/2017	weather 2/2/2017	Nice Day?	temperature 2/3/2017	weather 2/3/2017	Nice Day?
Pittsburg	40	rainy	no	55	sunny	yes	38	windy	no
Boston	18	sunny	no	24	windy	no	43	rainy	no
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Intro to Time Series: What is Time Series?

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Intro to Time Series: What is Time Series?

How can time series data pose issues?

- Does not assume **Stationarity**
- Observations are no longer *independent.*
- Times series can be *stored* in tables and DBs differently

Time Series Analysis

Intro to Time Series: Time Series Analysis

Statistical modeling of time ordered data observations.

- Examining multiple time series to model dynamic relationships

  - Two main goals:
    - Identifying the underlying mechanisms represented by the sequence of observations

    - Forecasting: predicting the future values of a variable described in the time series

Intro to Time Series: Time Series Analysis

As we learned last week, data science is not all modelling.

While time series is somewhat of a beast that is difficult to model there are other useful approaches to analyze the data and gain meaningful and predictive insights.

- Running Aggregates.
- Moving Aggregates.
- Windows
- Granger Causality Test
- etc.

Intro to Time Series: Time Series Analysis

Running Aggregates

- Aggregate measures such as total, mean, variance that include values *up to* a given point in time.

Moving Aggregates.

- Aggregate measures such as total, mean, variance taken during a fixed range of time, such as a ‘5 day average’.

Windows

- Similar to the viewpoint of moving aggregates, windows look at data in a fixed time range and have a variety of uses.*

Intro to Time Series: Time Series Analysis

Bonus: Granger Causality Test

- Method for Time Series Analysis
- Utilized Vector Auto-regression (VAR) Model to calculate causality based on Time Series data.

$$U_t = \sum_{k=1}^{p} A_k U_{t-k} + \varepsilon_t$$

$$F_{Y \to X} \equiv \ln \frac{|\Sigma'_{xx}|}{|\Sigma_{xx}|}$$

Intro to Time Series: Time

As time is going to be important in our time series analysis and modeling we will need them to interpret time the way we humans interpret time. (Which is many ways)

Fortunately Pandas has almost all the date time-i-ness you could ever need with the **DateTime** library; specifically the **DateTime** and **TimeDelta** objects.

Times Series Practice - The DateTime Object

Times Series Practice - The TimeDelta Object

Times Series Practice - Tableau Time Analysis

Intro to Time Series: Stocks from Google

1. Go to https://www.google.com/finance .
2. Ssing google finance search bar, Type in the company's stock code. 'AAPL' is Apple.
3. Click on 'Historic Prices' in the top left under 'Company'.
4. On the right side under 'Export' there should be a '*download as spreadsheet link'.*

Congrats, now you have some stock information.

Extra Resources

- Kiril Ereminko's Advanced Tableau Visualization on Udemy.
- https://github.com/samuel-stack/Portfolio/blob/master/Moving%20Violations%20VS.%20Speed%20Traps/Granger%20Causality%20test%20.ipynb
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Intro to Time Series:

Q & A