8.02 Time Series I

Time Series

- Series of data points indexed in time order

- Sequence taken at successive equally spaced points in time

- Exhibits multiple trends – cyclic, growth, seasonal

- ML outcomes are influenced by time series trends

Time Series Applications

- Cyclic: Higher social media engagement rates during lunch hour

- Growth: 20% higher YoY sales revenue

- Seasonal: Higher staycation bookings during school holiday seasons

Time Series Data

- Sequence of data points

- Timestamp

- Regular Intervals

- Measurements

Measure_DateTime	X	Y
2/10/2019 0:00:00	10	30
2/10/2019 0:00:10	11	40
2/10/2019 0:00:20	10	33
2/10/2019 0:00:30	9	38
2/10/2019 0:00:40	10	51
2/10/2019 0:00:50	8	22
2/10/2019 0:01:00	11	30
2/10/2019 0:01:10	10	40
2/10/2019 0:01:20	10	43
2/10/2019 0:01:30	10	45
2/10/2019 0:01:40	11	47
2/10/2019 0:01:50	9	38

Time Series Frequency

- Fixed interval between measurements

- Varies by application

Measurement	Time Unit
CPU Utilization	Microseconds
Network I/O	Seconds
Units Produced	Minutes
Customers Served	Hours
Packages Delivered	Days
Auto Accidents	Month
Company Profit	Quarterly
Births and Deaths	Annually

Time Series Unit of Measure

- What do numbers represent?

- Varies by application

Measurement	Time Unit
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Time Series - Common Metric Types

- Counter (track instances of an event)
  - Example: Count the number of cars passing through the petrol kiosk

- Gauge (numerical measure that can be positive or negative)
  - Example: Estimate Singapore's temperature today

- Summary (calculates values over time window such as count or rates)
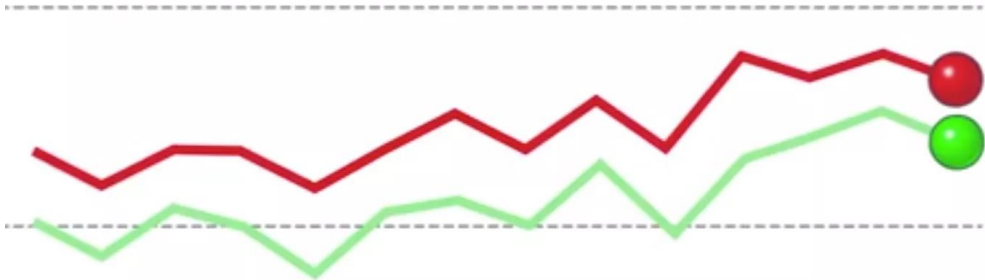 - Example: YoY Increase in Company Profits

Autocorrelation

- Autocorrelation represents the degree of similarity between a given time series and a lagged version of itself over successive time intervals.

- Autocorrelation measures the relationship between a variable's current value and its past values.

- An autocorrelation of +1 represents a perfect positive correlation, while an autocorrelation of negative 1 represents a perfect negative correlation.

- Example: Financial analysts use autocorrelation to measure how much influence past prices for a stock have on its future price.

Autocorrelation

- Autocorrelation can also be referred to as lagged correlation or serial correlation, as it measures the relationship between a variable's current value and its past values.