# Forecasting

## STATISTICAL TECHNIQUES IN TABLEAU

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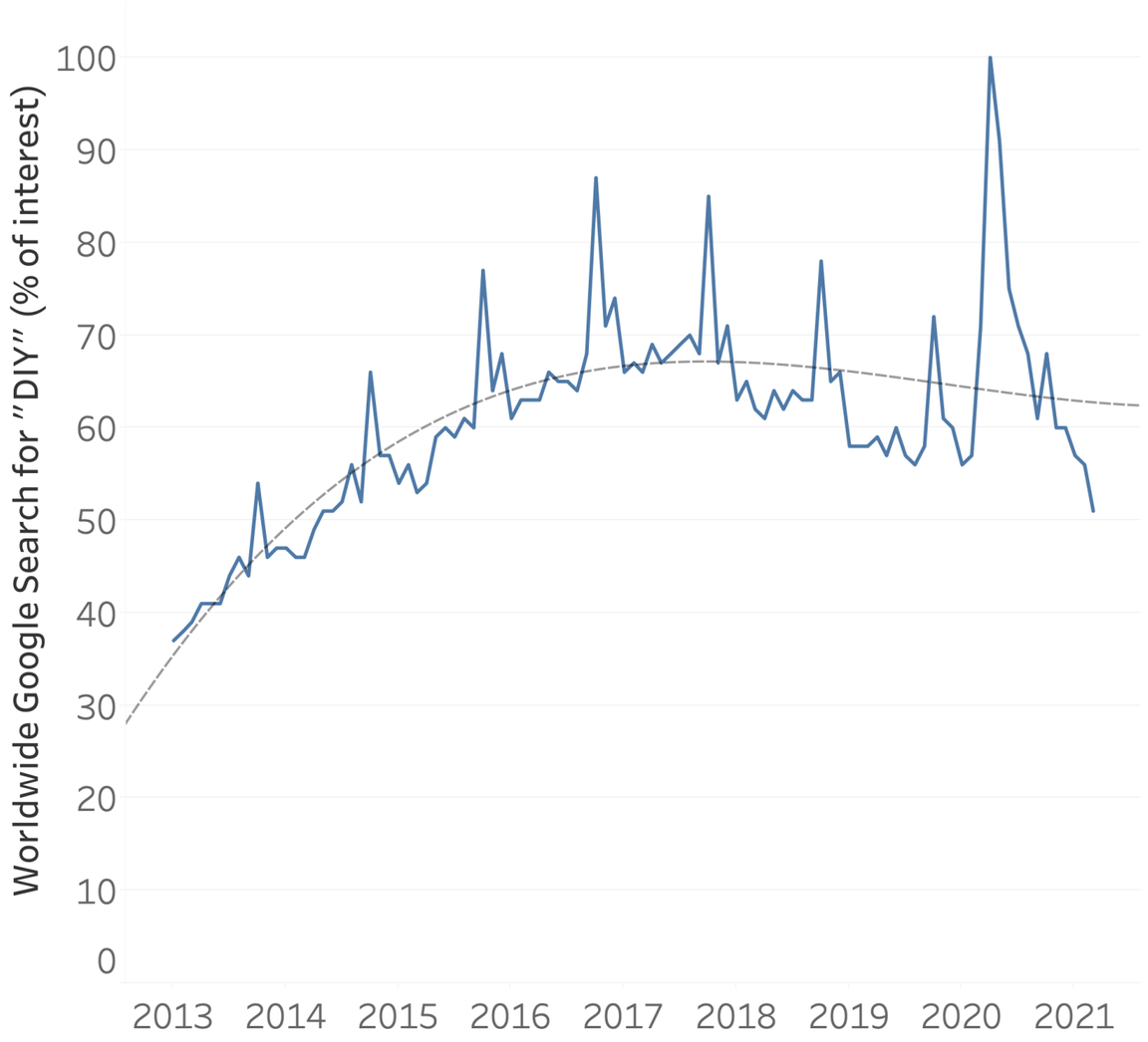
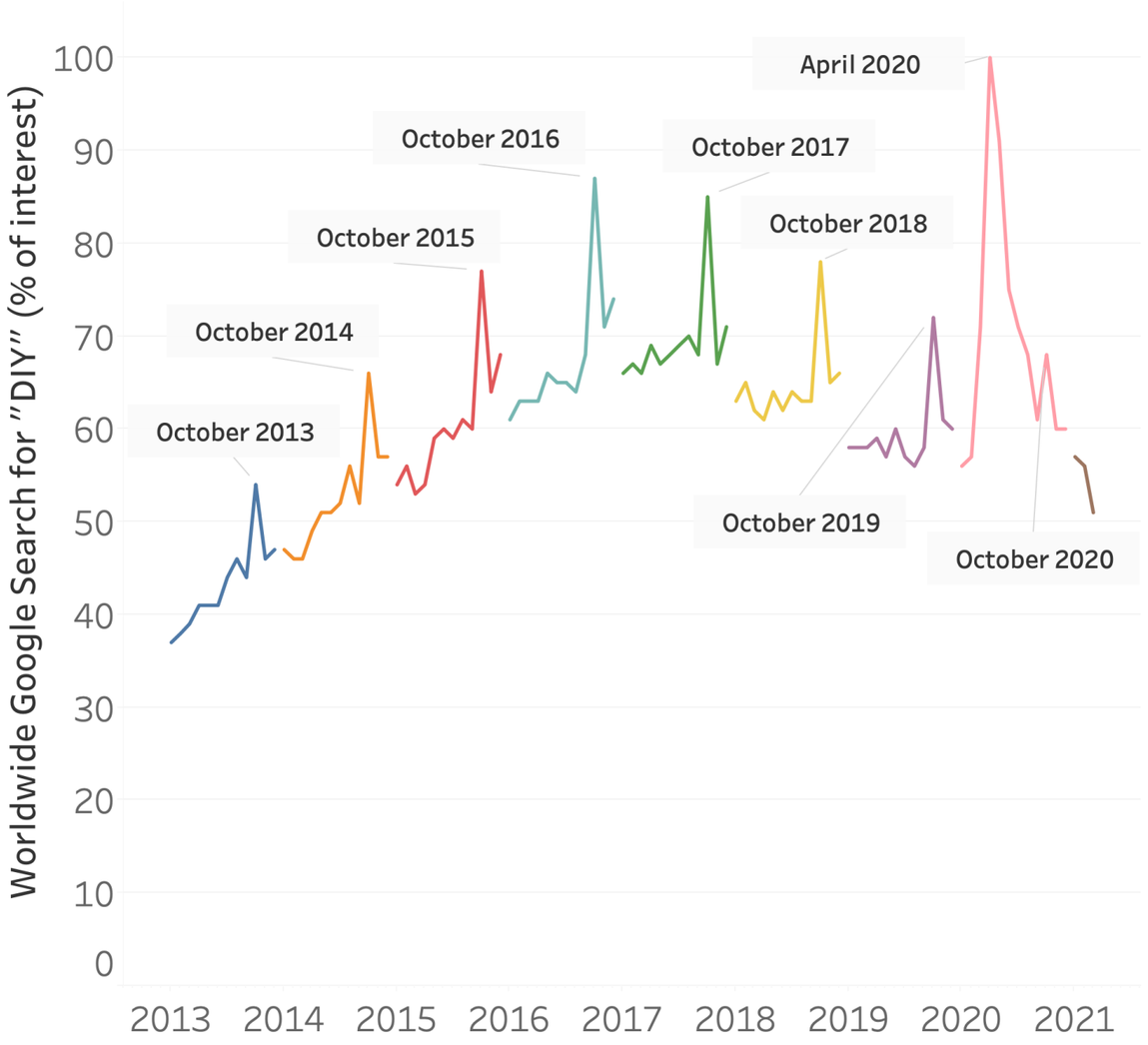
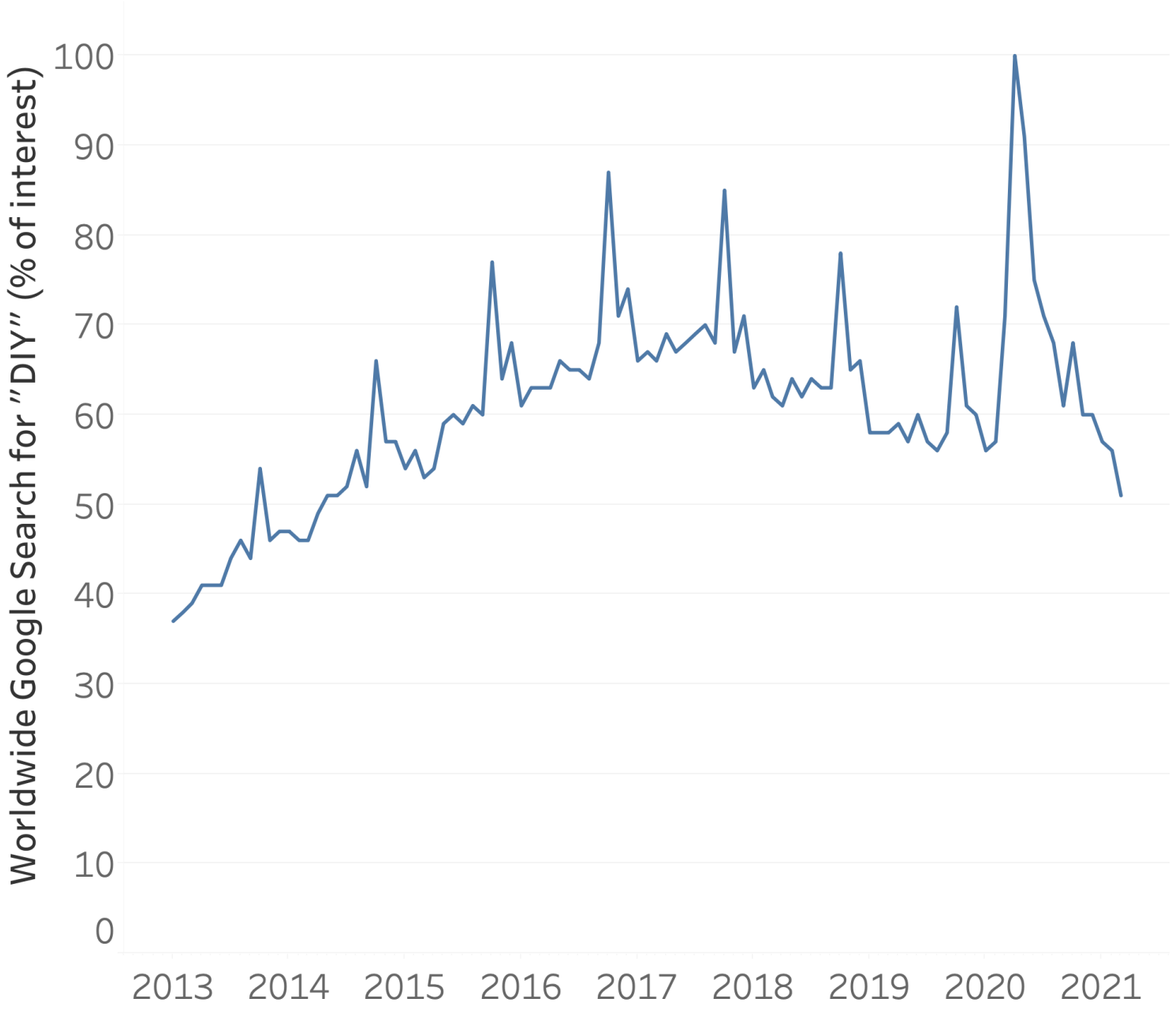
# Correlation vs. autocorrelation



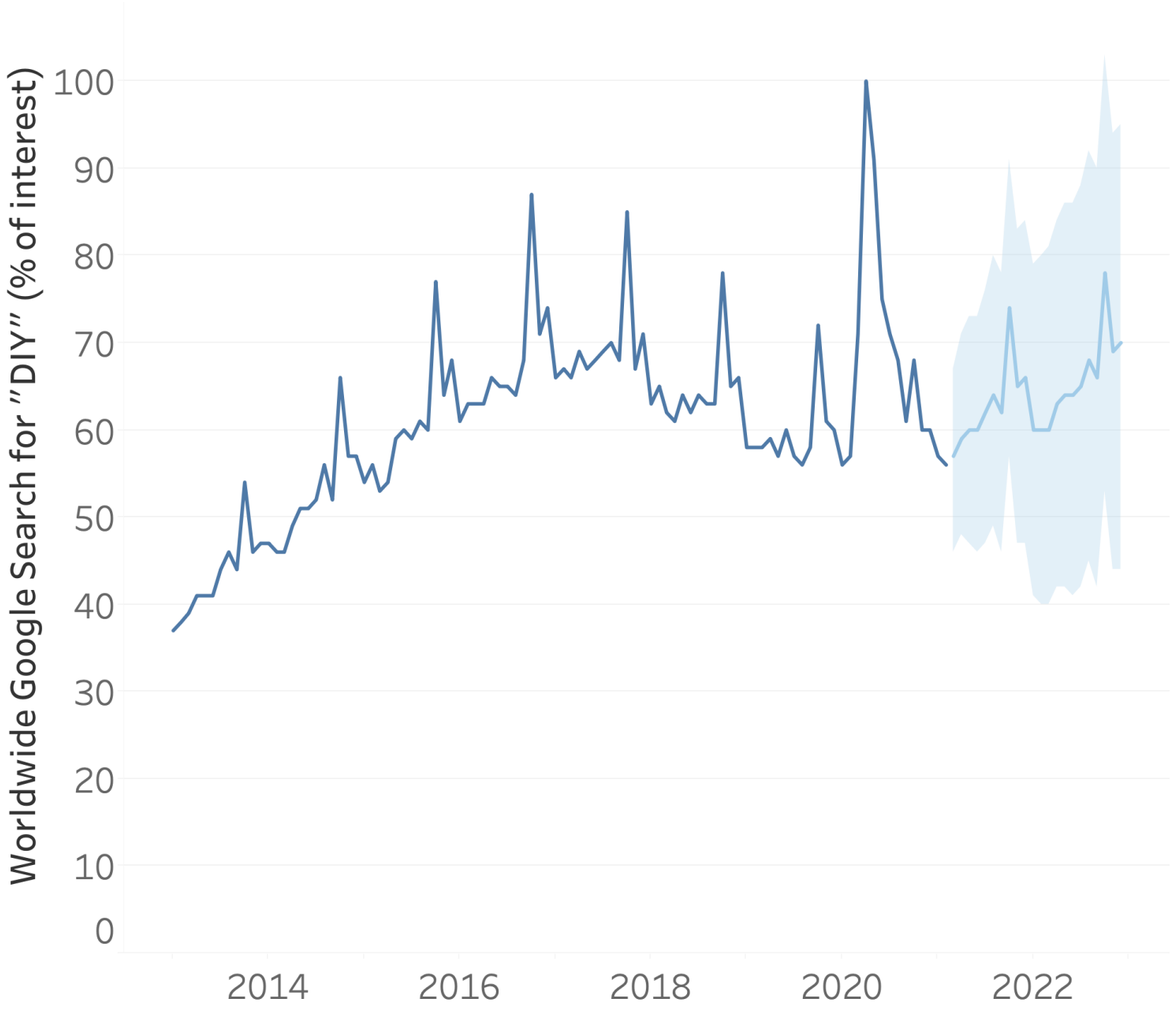



# Correlation vs. autocorrelation




- Autocorrelation: repeating pattern correlates with itself
- Time series: a value measured repeatedly over time, in discrete time-intervals
- Time series analysis: general term for analysis on time series

# Forecasting

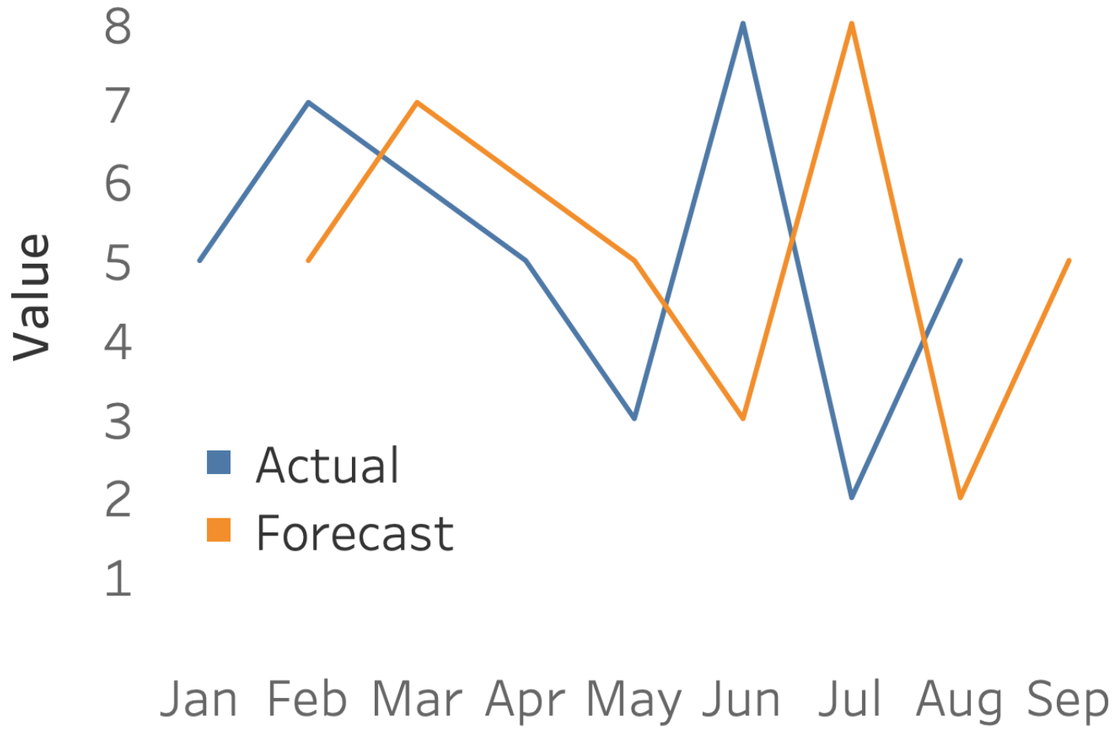



- Predictions about the future based on historical data
- Estimation: probability where future data points will fall, using confidence intervals
- Used in
  - supply chain management
  - earthquakes
  - hormone levels
  - market stocks
  - sports performance
  - weather

# Naive forecast

$$F_{t+1} = A_t$$

| Month $t$ | Actual $A$ | Forecast $F$ |
|---|---|---|
| January | 5 | |
| February | 7 | 5 |
| March | 6 | 7 |
| April | 5 | 6 |
| May | 3 | 5 |
| June | 8 | 3 |
| July | 2 | 8 |
| August | | 2 |



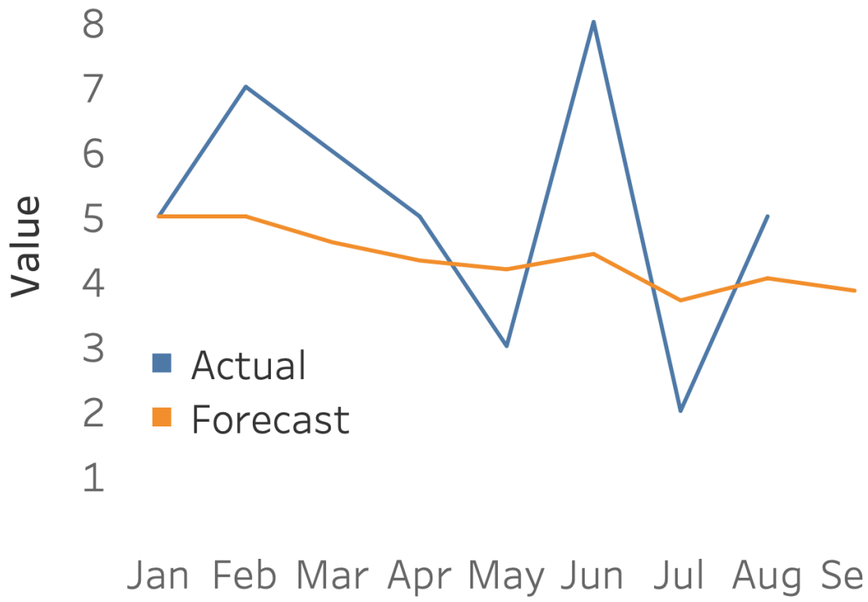

- Useful for benchmarking

# Exponential smoothing

$$F_{t+1} = F_t + \alpha(A_t - F_t)$$

| Month $t$ | Actual $A$ | Forecast $F$ |
|---|---|---|
| January | 5 | 5 |
| February | 7 | 5 |
| March | 6 | 4,6 |
| April | 5 | 4,32 |
| May | 3 | 4,184 |
| June | 8 | 4,4208 |
| July | 2 | 3,70496 |
| August | 5 | 4,045952 |

- Predictions will be influenced more by recent value changes than the past




- Tableau will run many models and select the best one

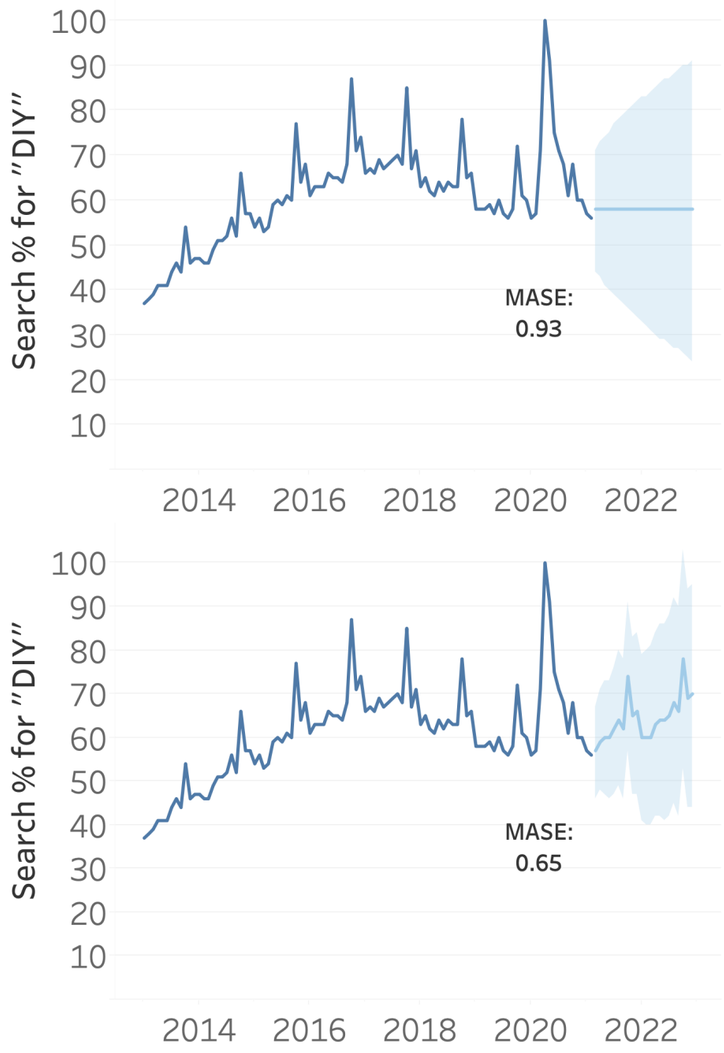
# Mean absolute error (MAE)

| Month | Actual | Forecast | Error | Absolute Error |
|---|---|---|---|---|
| January | 5 | | | |
| February | 7 | 5 | 2 | 2 |
| March | 6 | 7 | -1 | 1 |
| April | 5 | 6 | -1 | 1 |
| May | 3 | 5 | -2 | 2 |
| June | 8 | 3 | 5 | 5 |
| July | 2 | 8 | -6 | 6 |
| August | 5 | 2 | 3 | 3 |
| September | | 5 | **MAE** | **2.86** |

# Mean absolute scaled error (MASE)

$$MASE = \frac{MAE_{model}}{MAE_{naive}}$$

- MASE compares MAE of your model with MAE of naive forecast
- Typically between `0` (good) and `1` (bad), or higher (even worse)
- You can customize options in Tableau, but out-of-the-box forecast is acceptable by default



# Let's practice!

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# Tableau: forecasting

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# Let's practice!

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# Clustering

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# Supervised vs. unsupervised machine learning

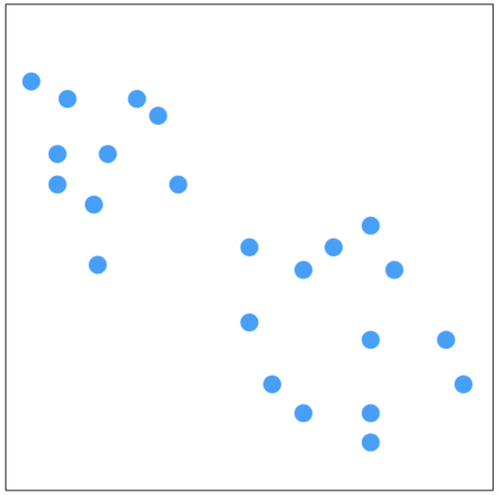
## Supervised learning

- Apply known relationship between variables on new, unseen data
- E.g. regression, exponential smoothing

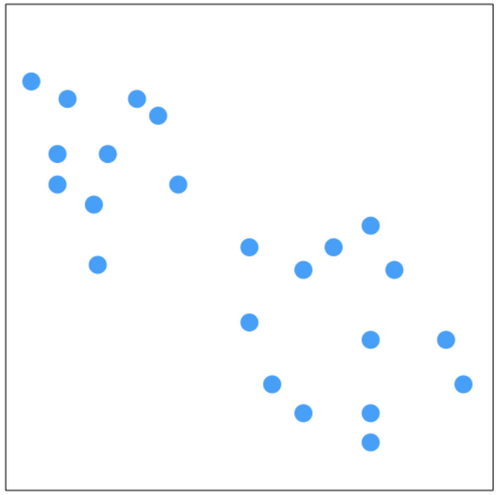
## Unsupervised learning

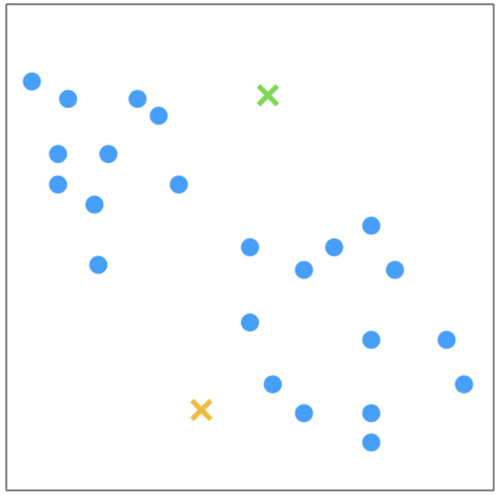
- Looks for similar data points and detects patterns
- E.g. clustering

# k-means clustering

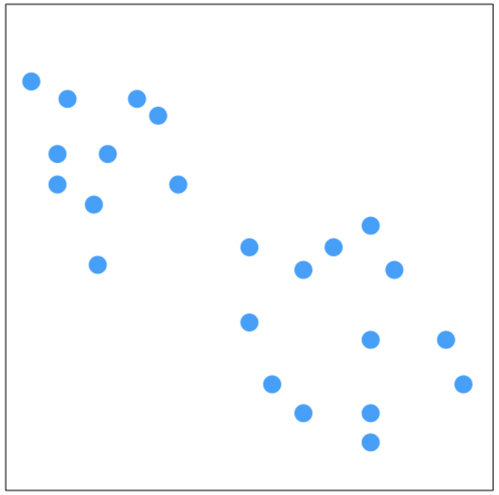


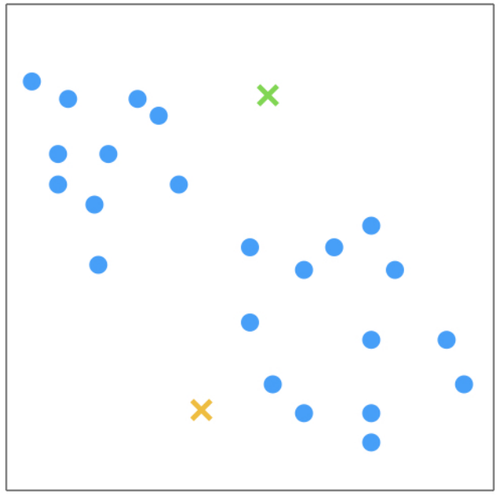
# k-means clustering

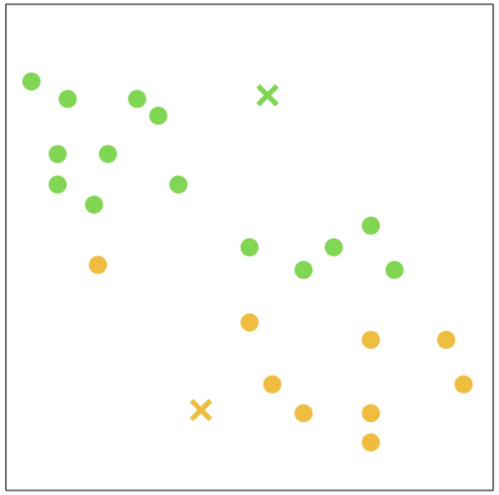




# k-means clustering







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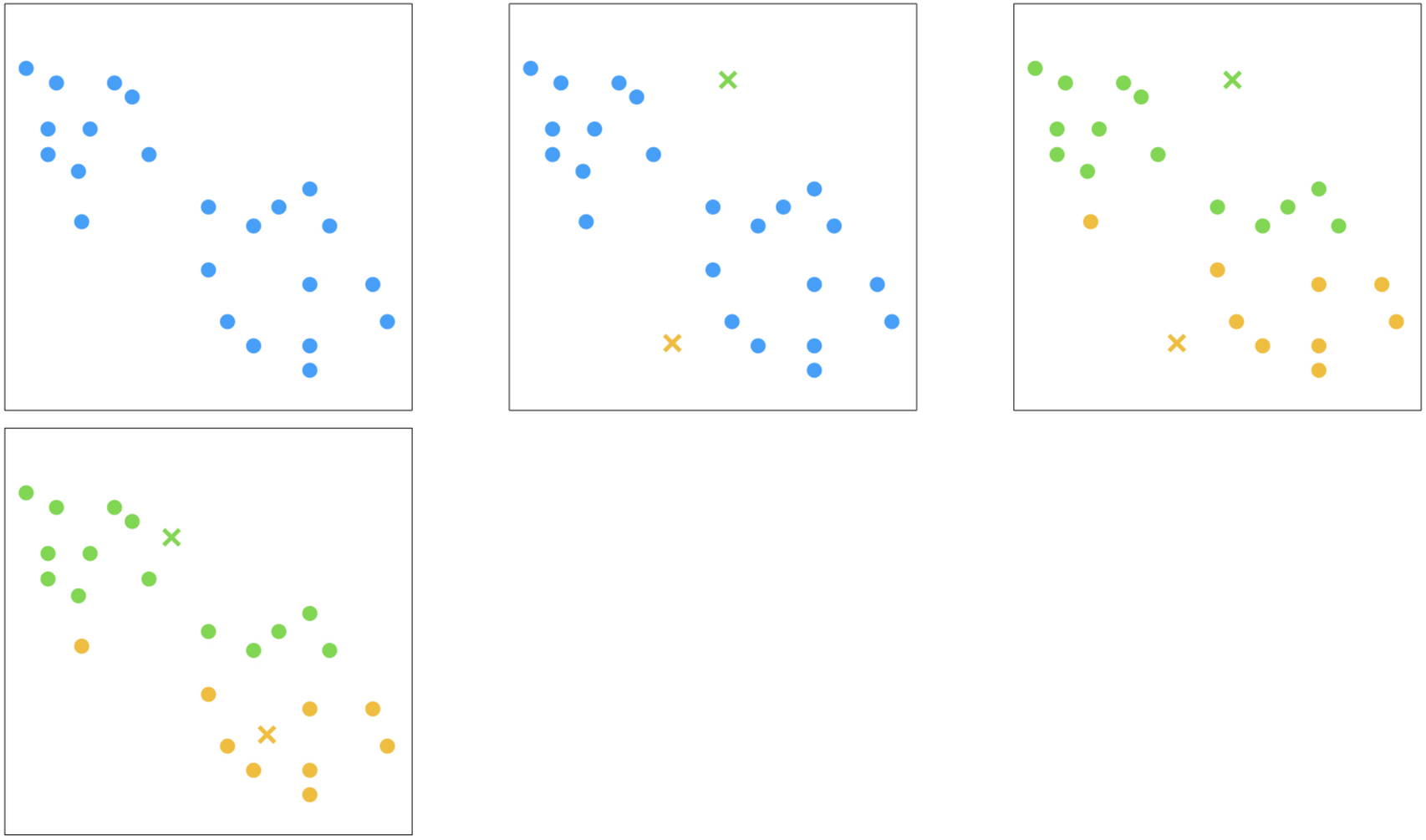

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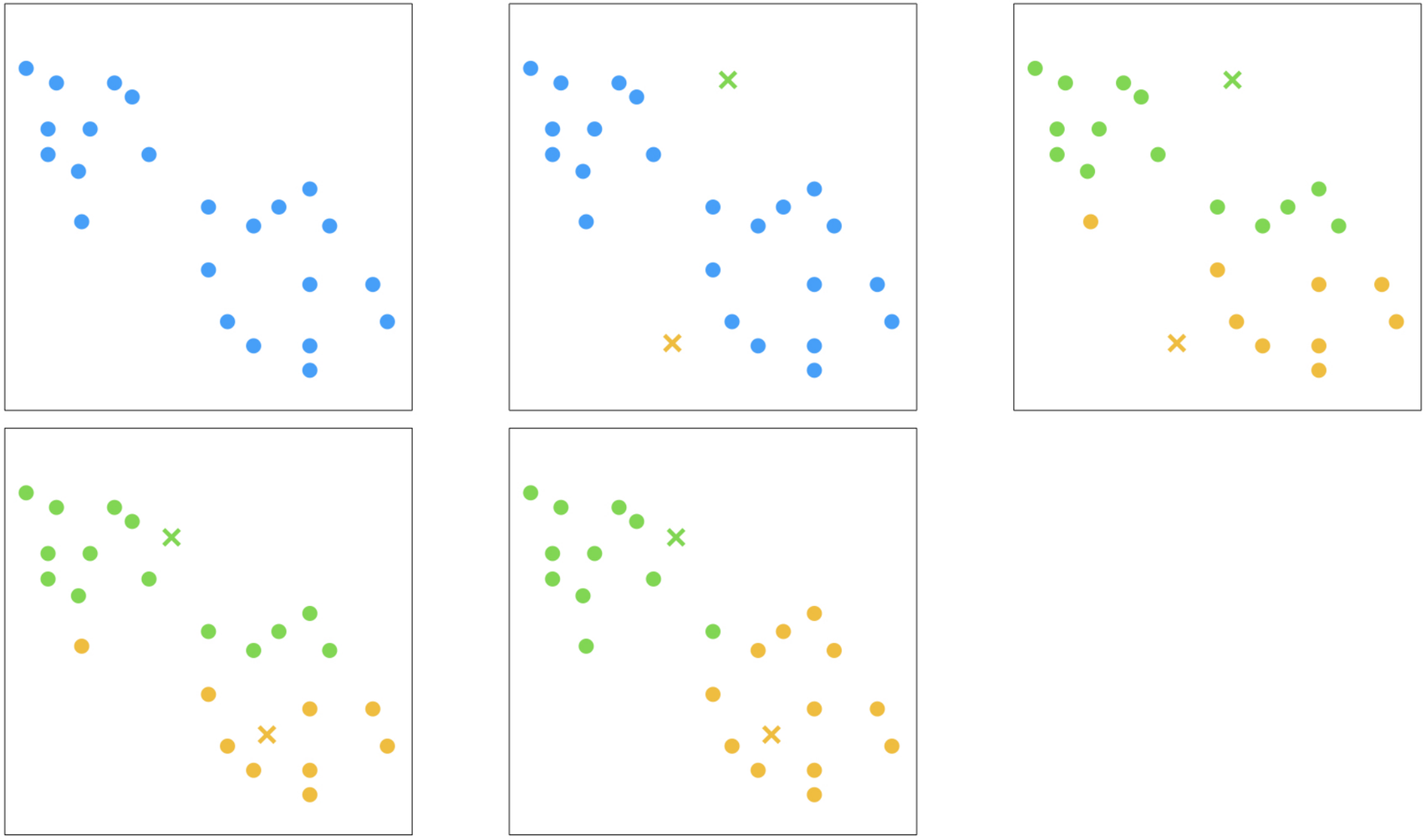
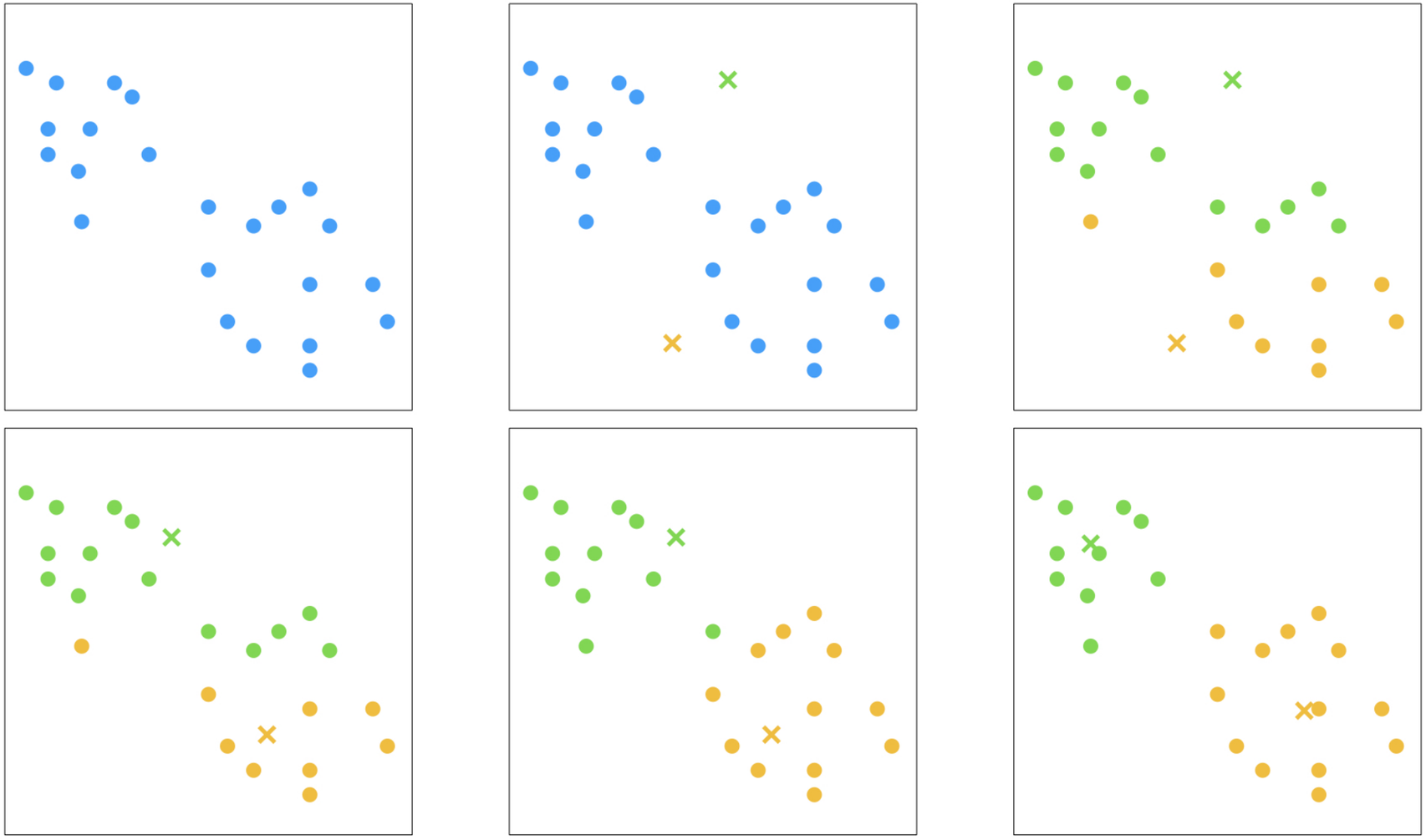
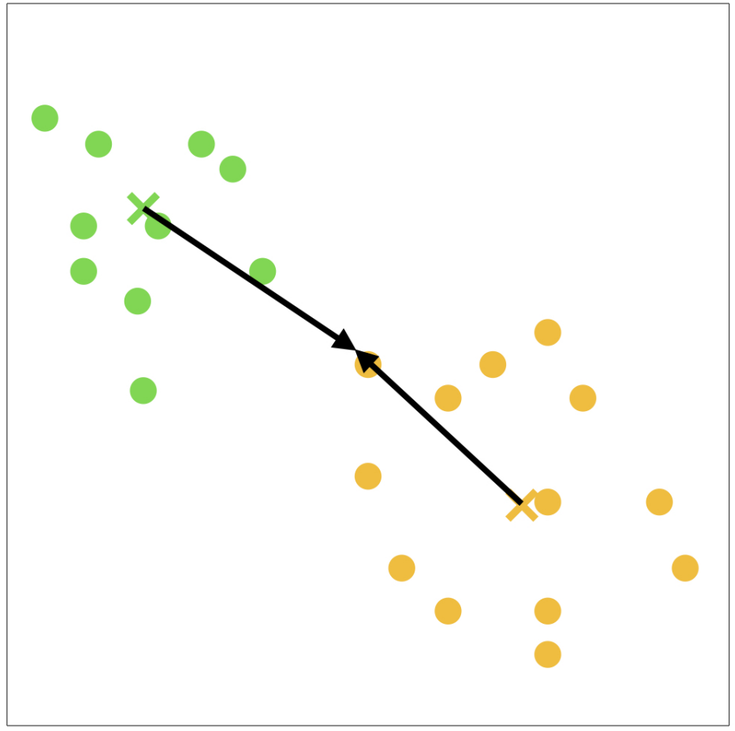


# k-means clustering



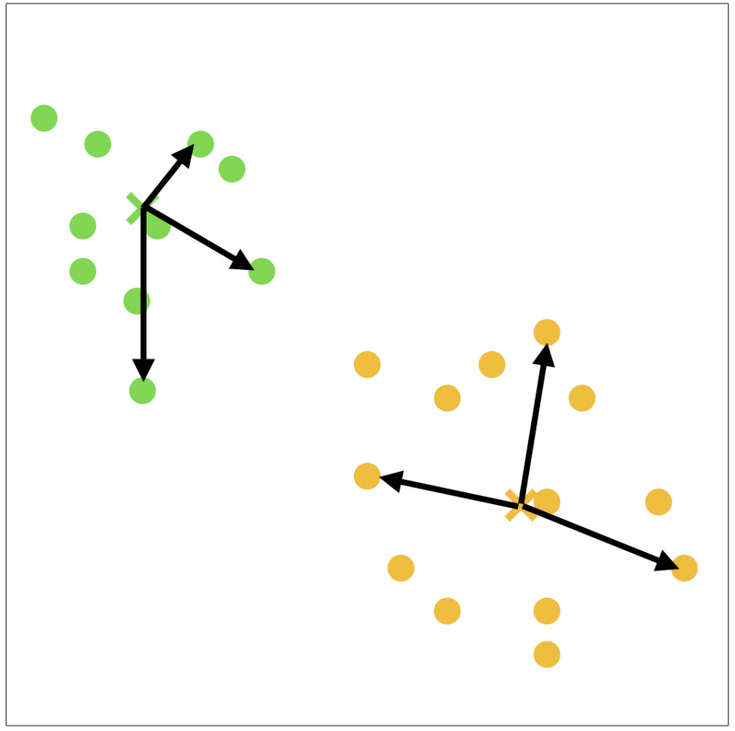
# Assess clustering quality

Between-group sum of squares



- The higher, the better

Within-group sum of squares



- The lower, the better

# Let's practice!

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# Tableau: clustering

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# Let's practice!

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# Congratulations!

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# Statistical techniques in Tableau

## Univariate EDA

- Tables
- Bar plots
- Histograms
- Box plots

## Bivariate EDA

- Trend lines
- Regression models

## Measures of spread

- Summary card
- Reference lines/bands
- Distribution bands
- Standard error & confidence intervals

## Machine learning

- Forecasting
- Clustering

# See you in the next course!

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