A/B Testing

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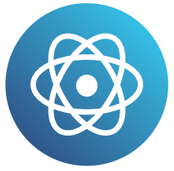


Lis Sulmont
Curriculum Manager, DataCamp

Data science workflow

Data Collection & Storage → Data Preparation → Exploration & Visualization → **Experimentation & Prediction**

What are experiments in data science?

Experiments help drive decisions and draw conclusions

1. **Form a question**
2. **Form a hypothesis**
3. **Collect data**
4. **Test the hypothesis with a statistical test**
5. **Interpret results**

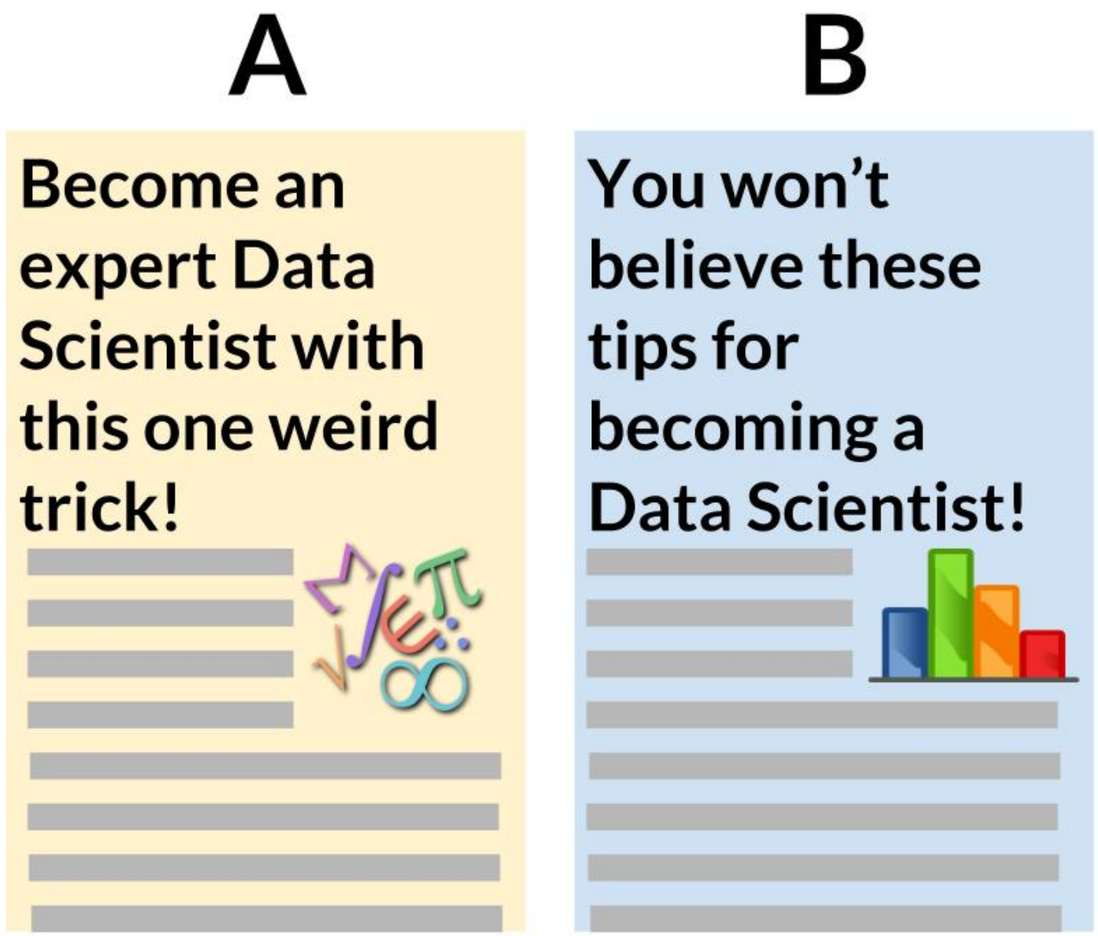
Case study: which is the better blog post title?

Form a question: Does blog title A or blog title B result in more clicks?

Form a hypothesis: Blog title A and blog title B result in the same amount of clicks.

Collect data:

- 50% users will see blog title A
- 50% users will see blog title B
- Track click-through rate until sample size reached

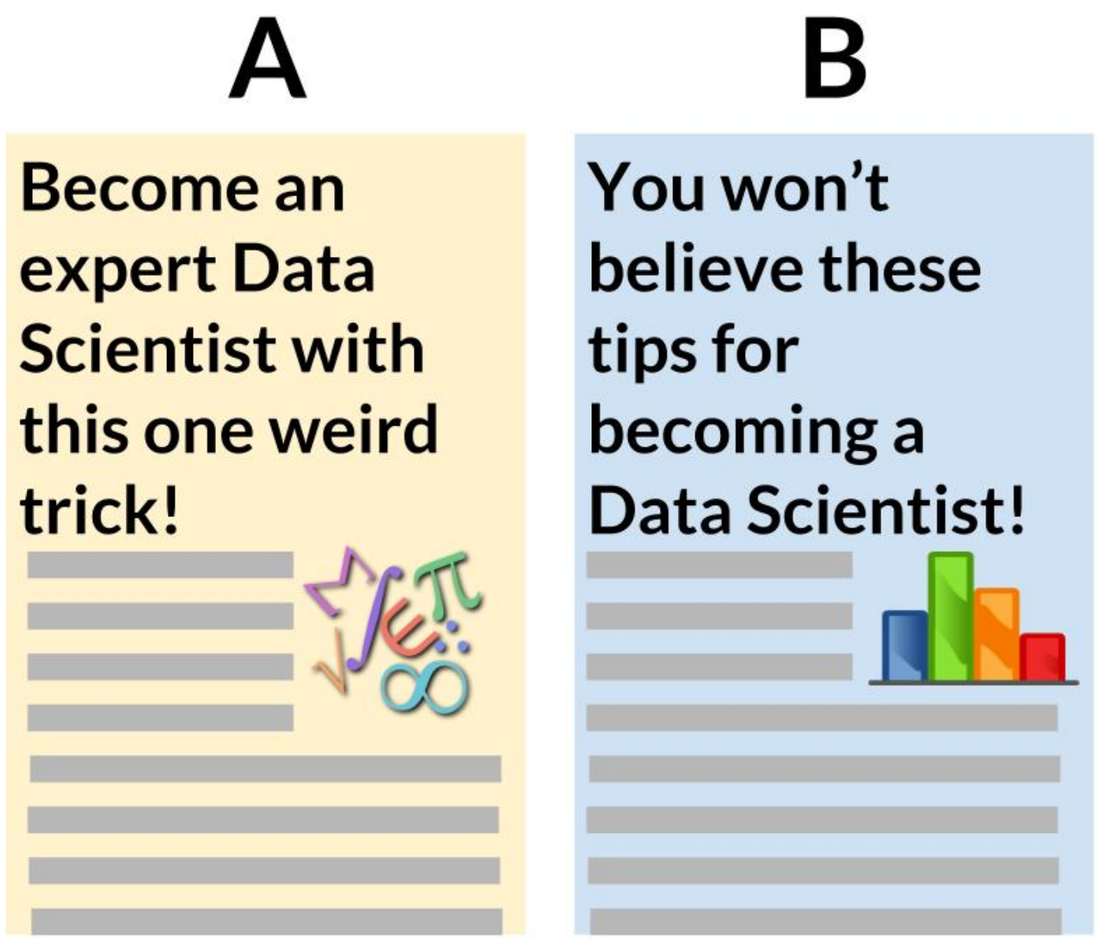


Case study: which is the better blog post title?

Test the hypothesis with a statistical test: Is the difference in titles' click-through rates significant?

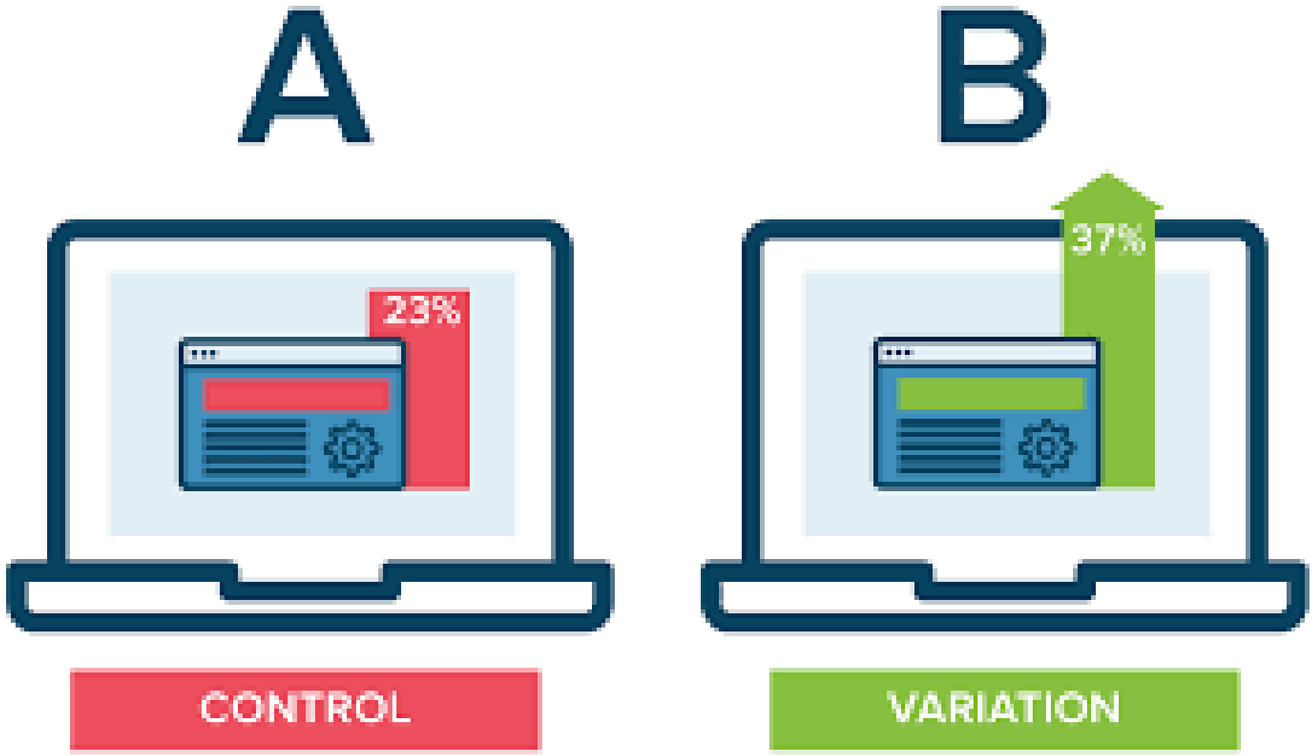
Interpret results:

- Choose a title
- Or ask more questions and design another experiment!



What is A/B Testing?

AKA Champion/Challenger Testing



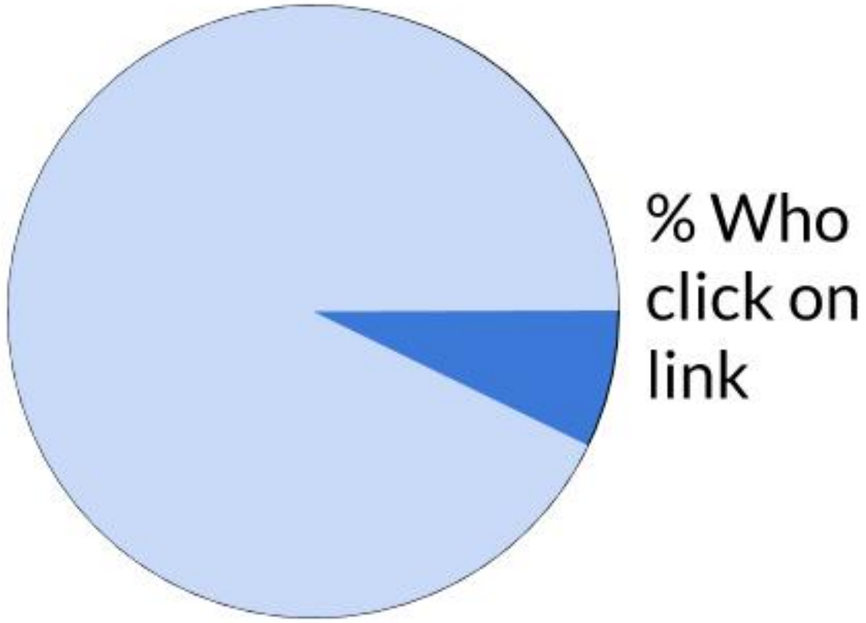
Terminology Review

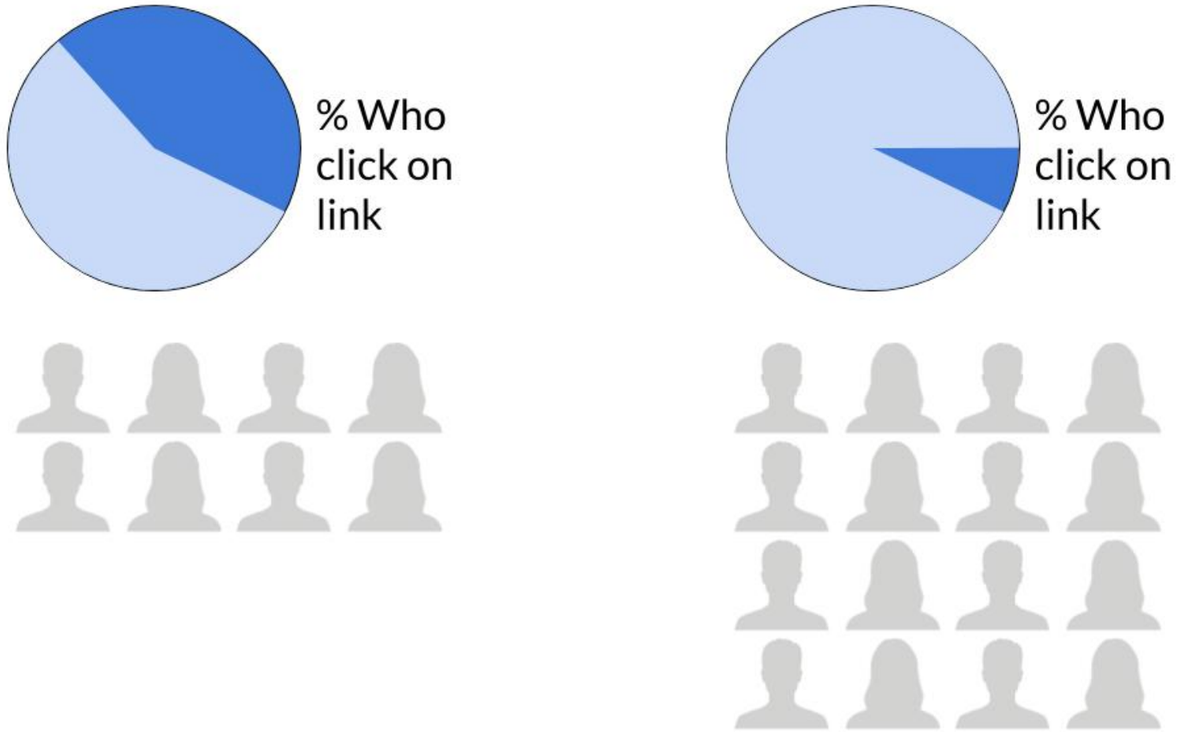
- **Sample size:** number of data points used
- **Statistical significance:** result is likely not due to chance
  - Given assumptions of statistical model
  - Use **statistical tests** to calculate this:
    - e.g., t-test, Z-test, ANOVA, Chi-square test

A/B Testing Steps

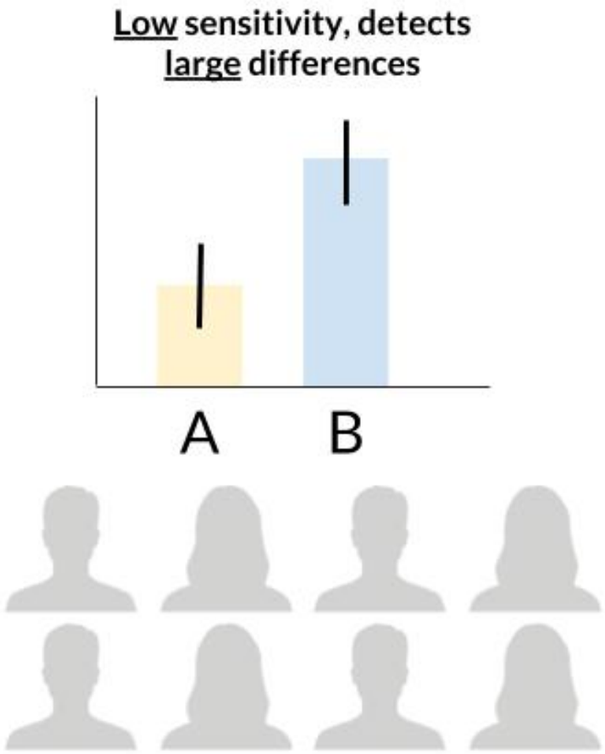
- Picking a metric to track
- Calculating sample size
- Running the experiment
- Checking for significance

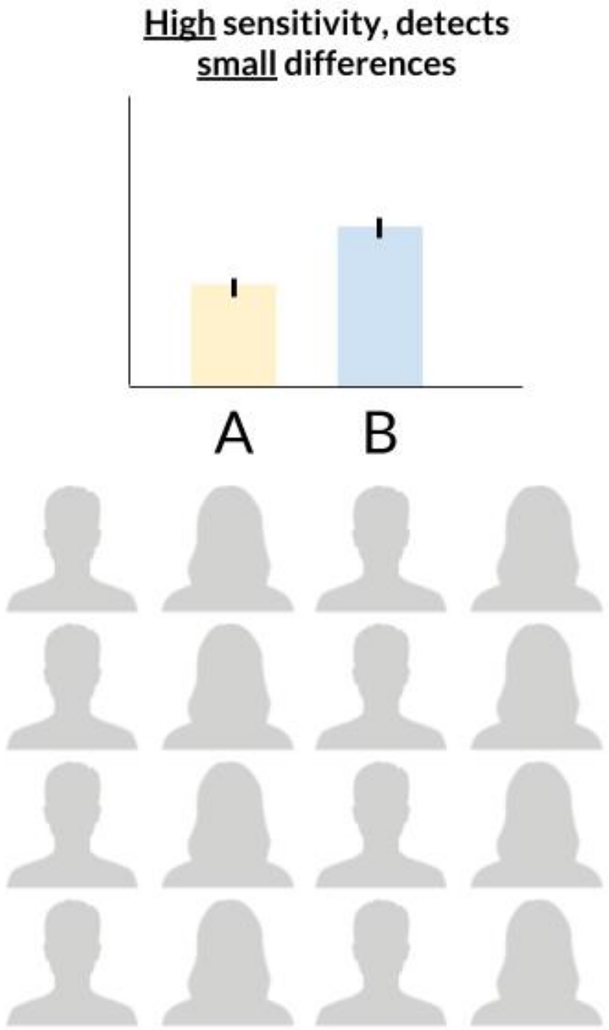
Pick a metric to track: click-through rate





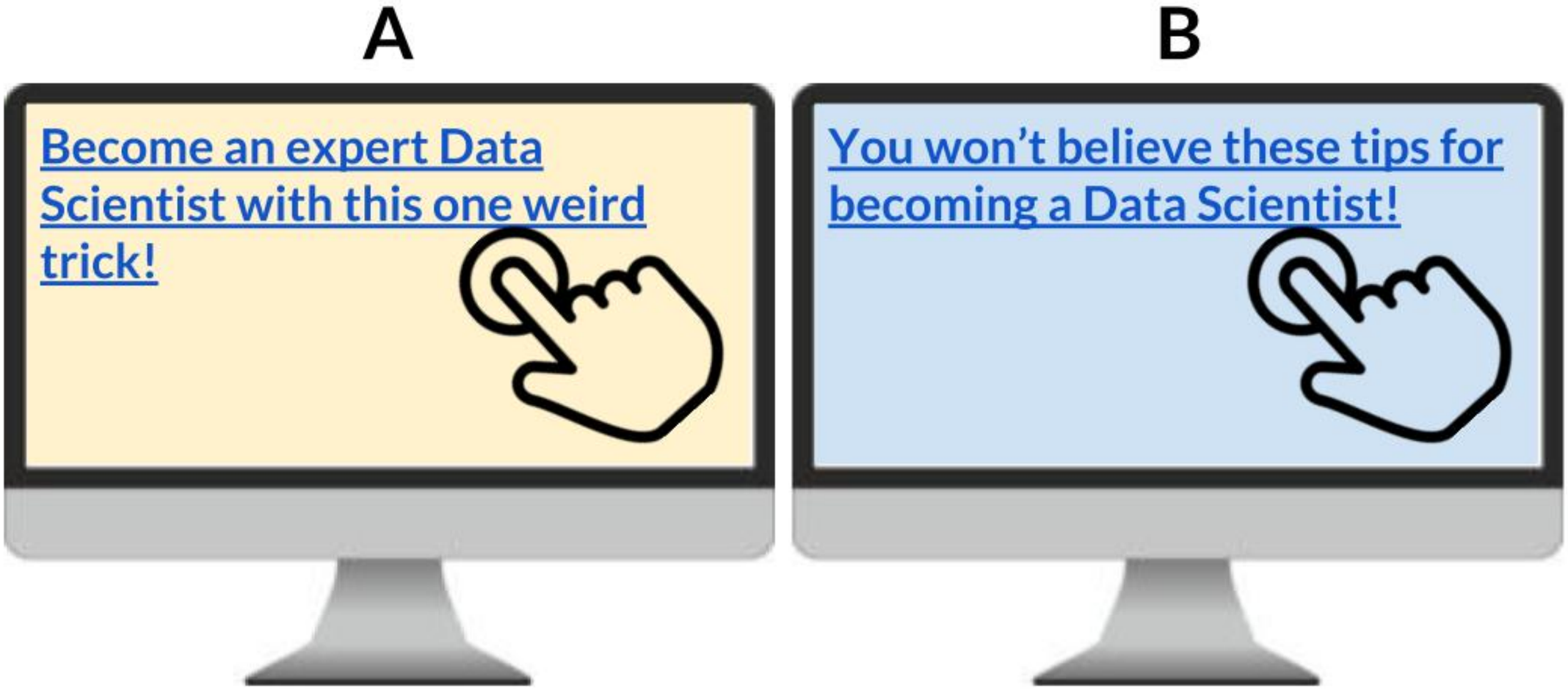
- Baseline metric to gauge any changes
  - *How often people generally click on a link to our blogs*
- If the rate is much larger or smaller than 50%, we need a large sample size
  - Click rate is typically small (<3%)



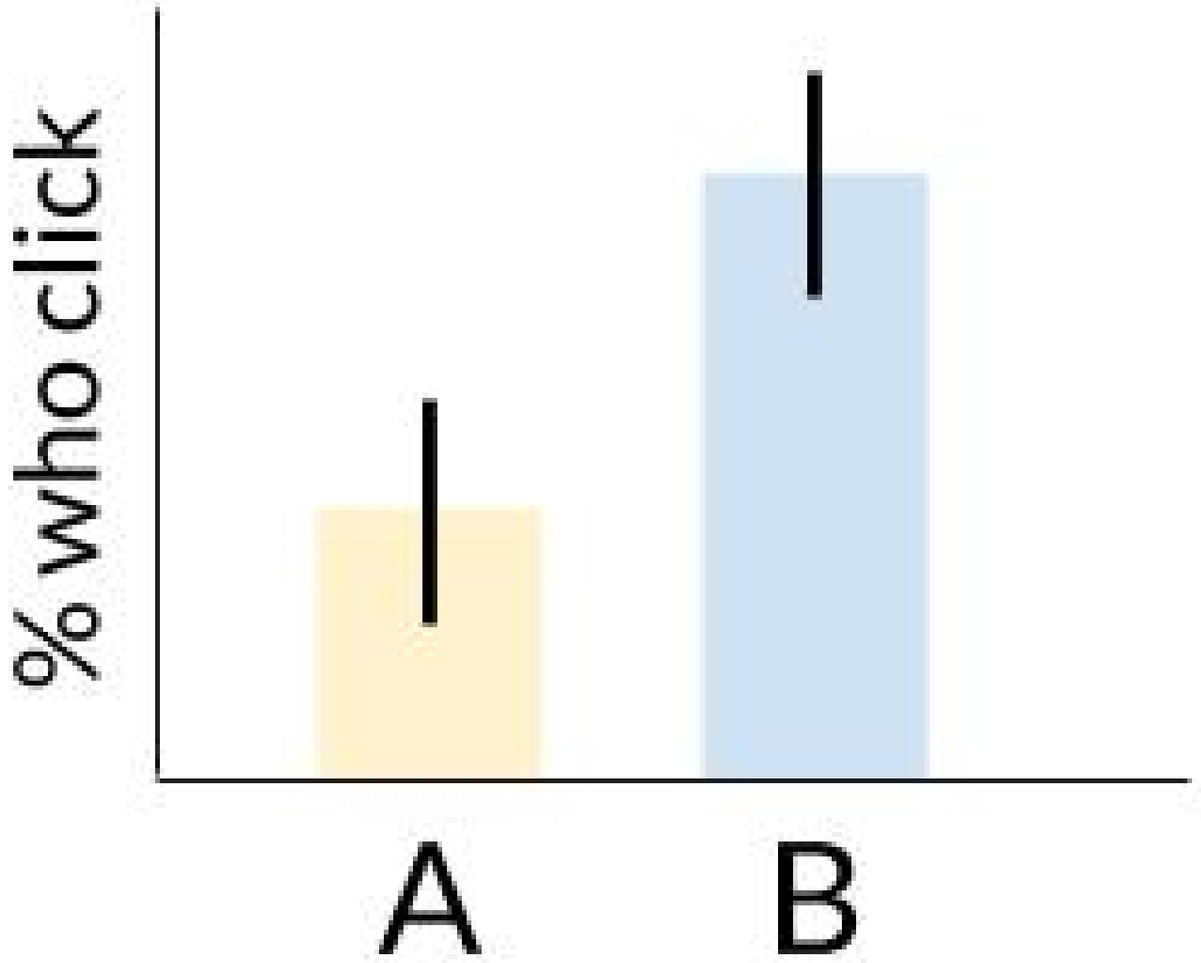


Larger sample sizes allow us to detect smaller changes

Run your experiment



Check for significance



What if the results aren't significant?

- Difference is smaller than the threshold we chose
- Running our test longer won't help
- Still might be a difference; it's just small and insignificant to us

Let's practice!

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Time series forecasting

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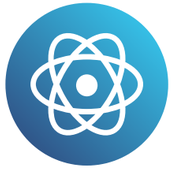


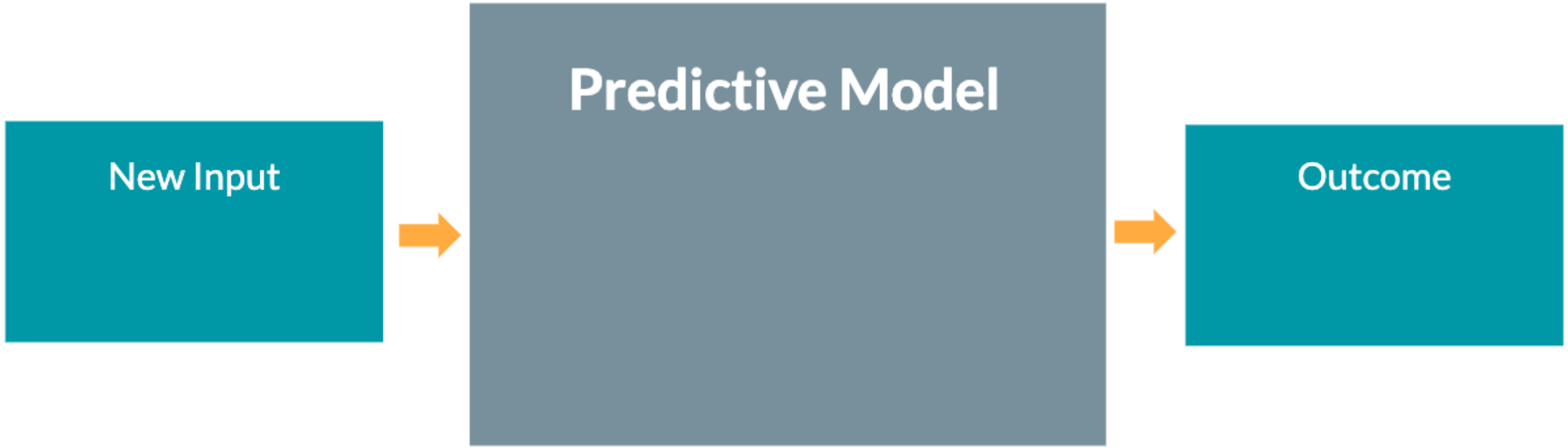
Lis Sulmont
Curriculum Manager

Modeling in data science

What is a statistical model?

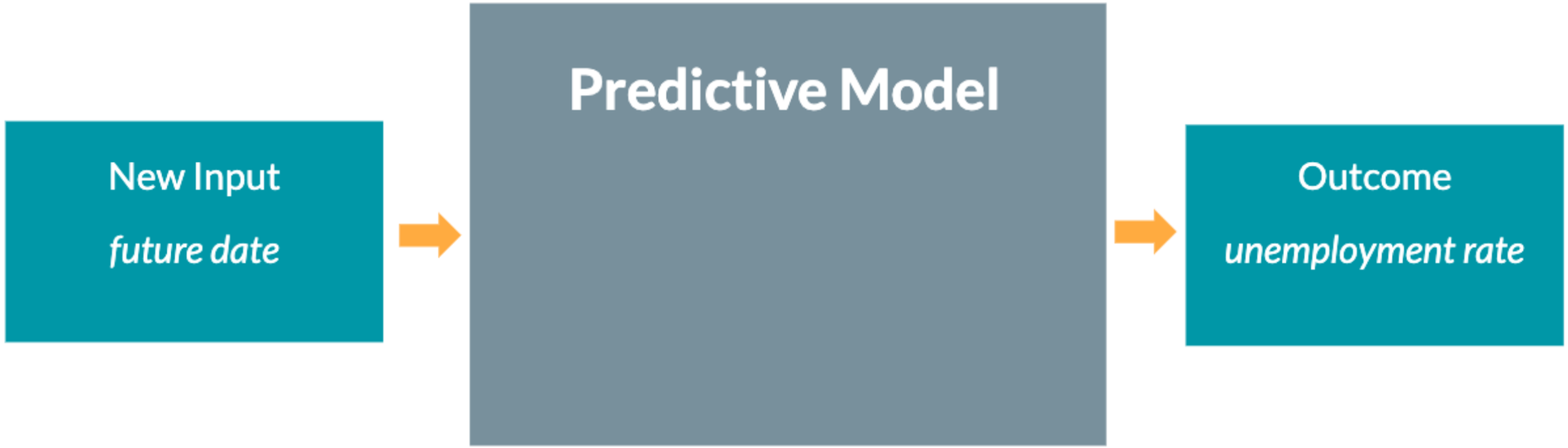
- Represent a real-world process with statistics
- Mathematical relationships between variables, including random variables
- Based on statistical assumptions and historical data

Predictive modeling



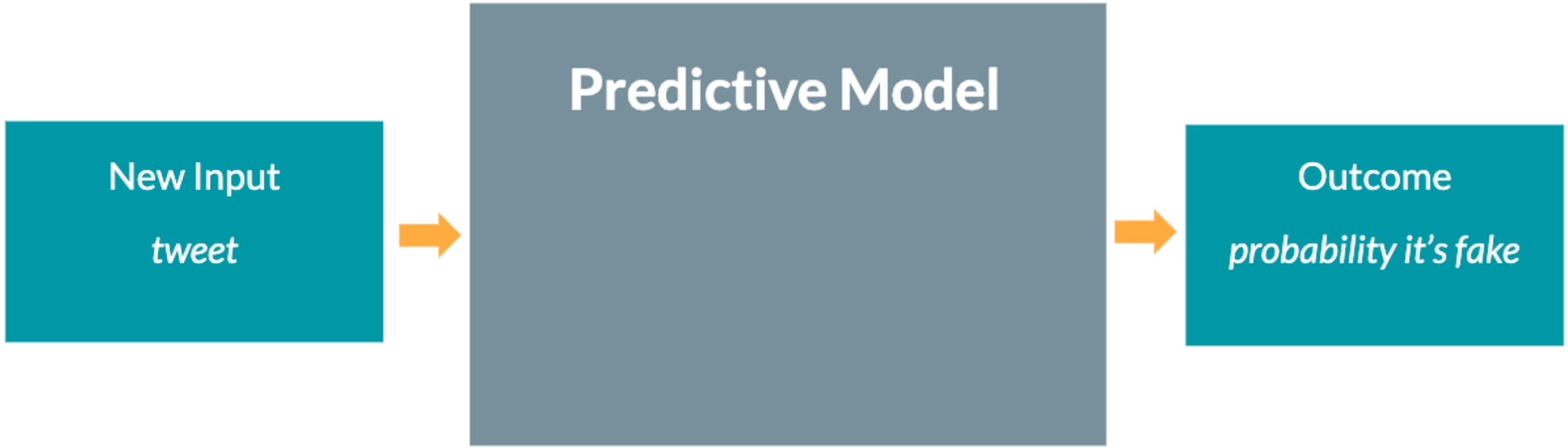
- Enter new input(s) and model predicts an outcome

Predictive modeling



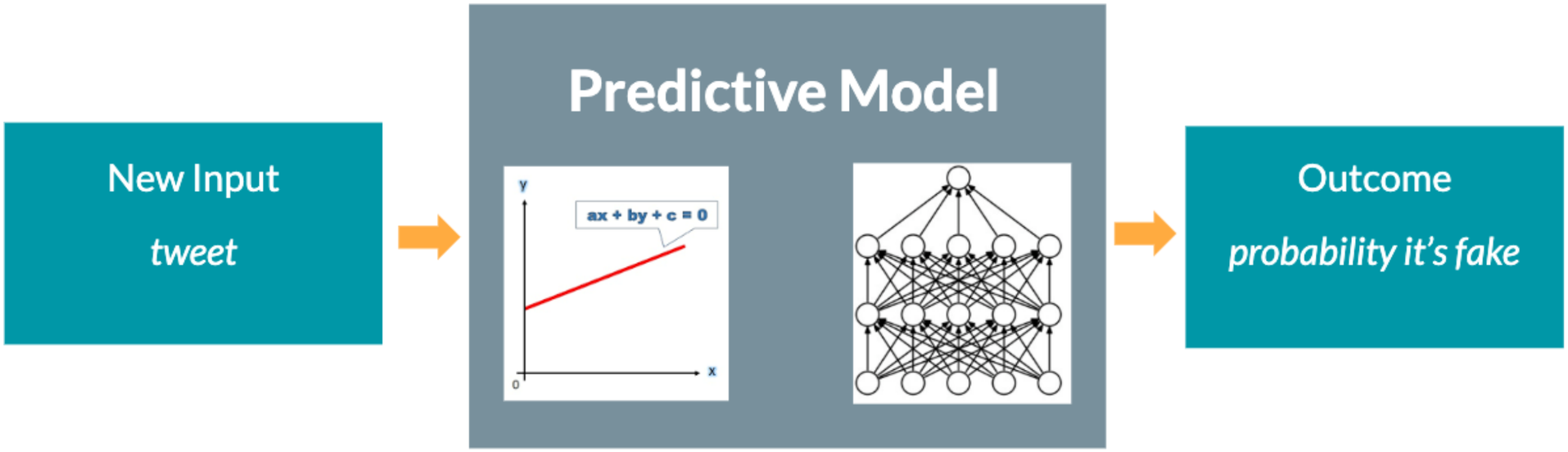
- Enter new input(s) and model predicts an outcome

Predictive modeling



- Enter new input(s) and model predicts an outcome
  - Probability of an outcome

Predictive modeling

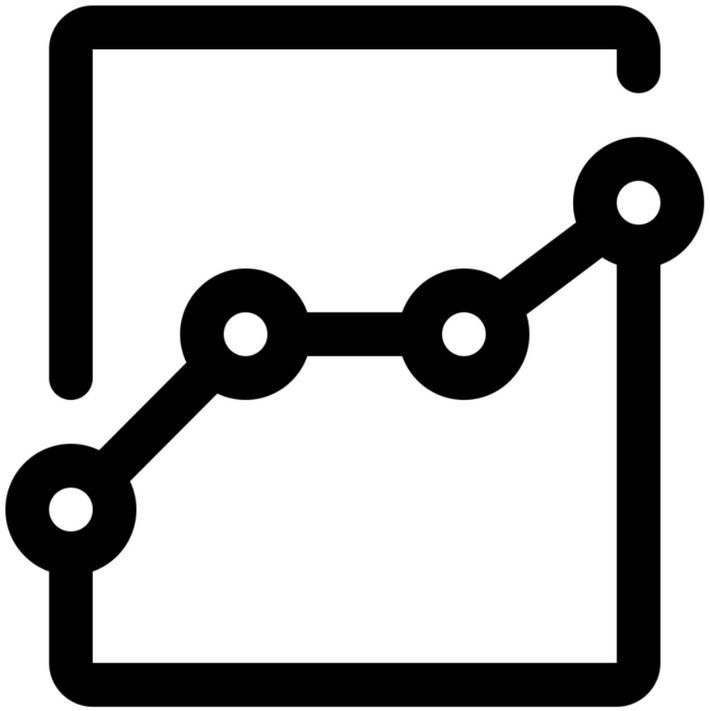


- Enter new input(s) and model predicts an outcome
  - Probability of an outcome
- Ranges in complexity, from a linear equation to a deep learning algorithm

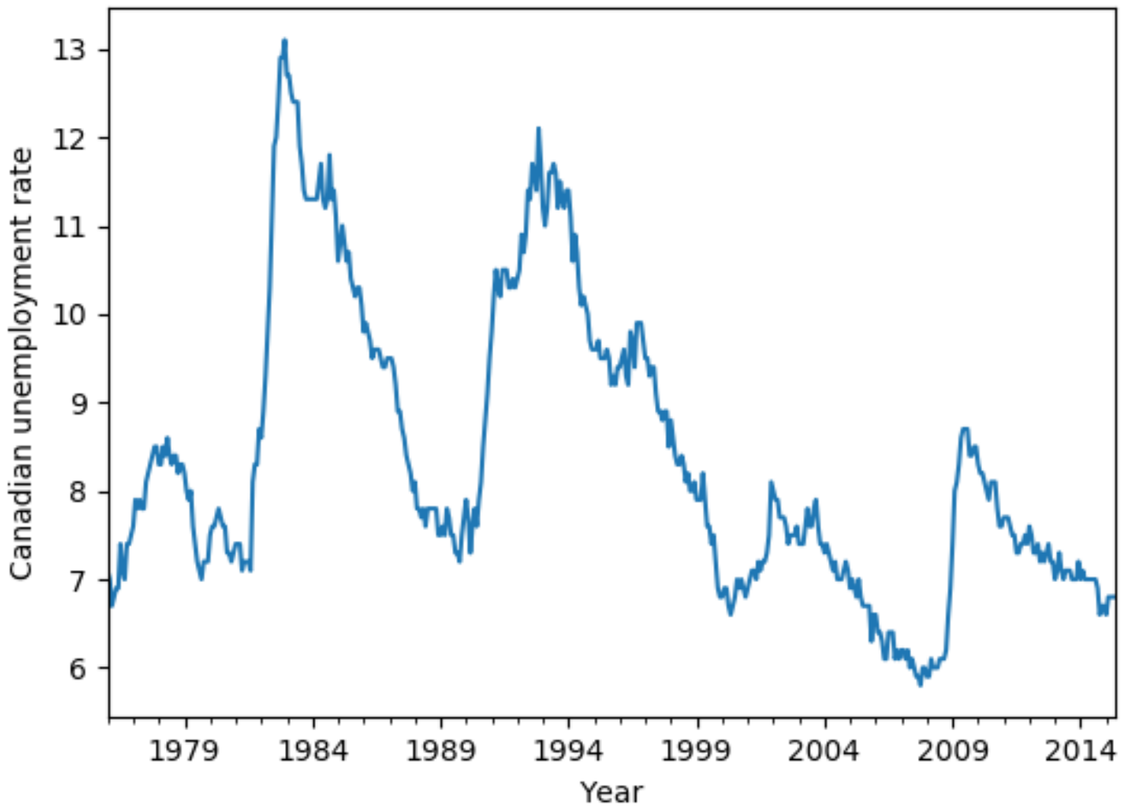
Time series data

A series of data points sequenced by time

- Stock prices
- Gas prices
- Unemployment rates
- Heart rate
- CO2 levels
- Height of ocean tides

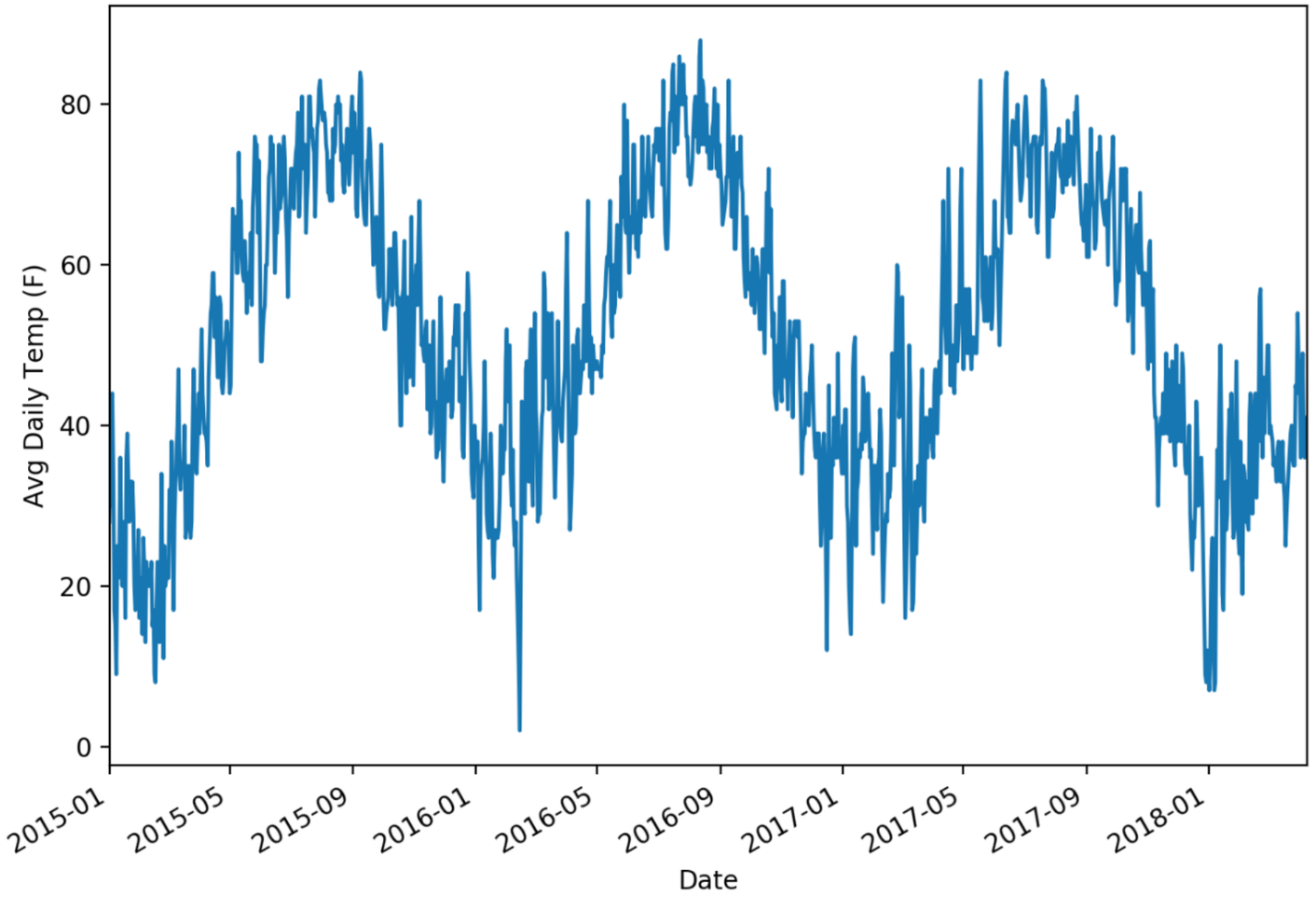


Plotting time series data

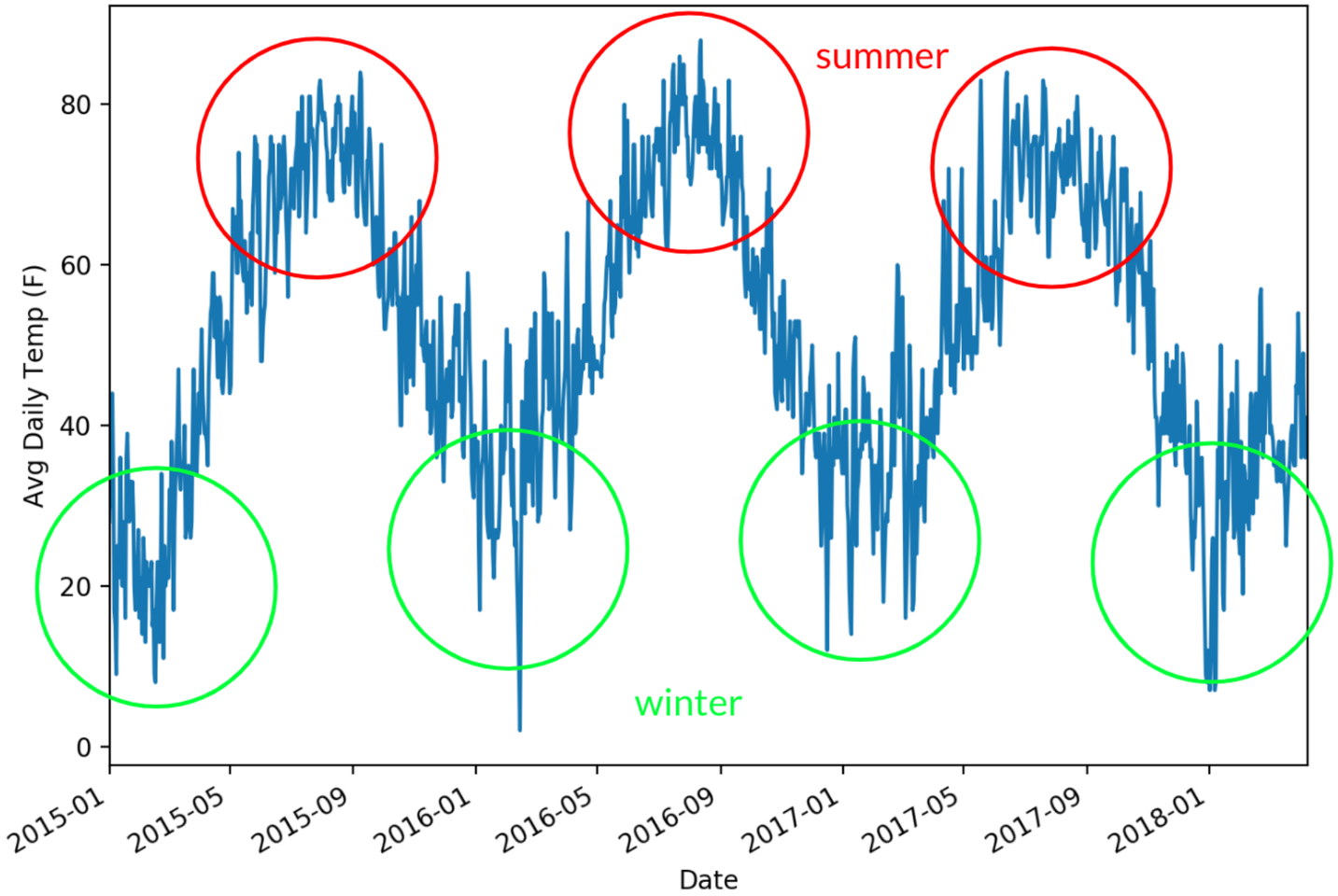


Date	Rate
1976-01-01	7.1
1976-02-01	7
...	
1991-01-01	10.3
...	
2015-04-01	6.8
2015-05-01	6.8

Seasonality in time series

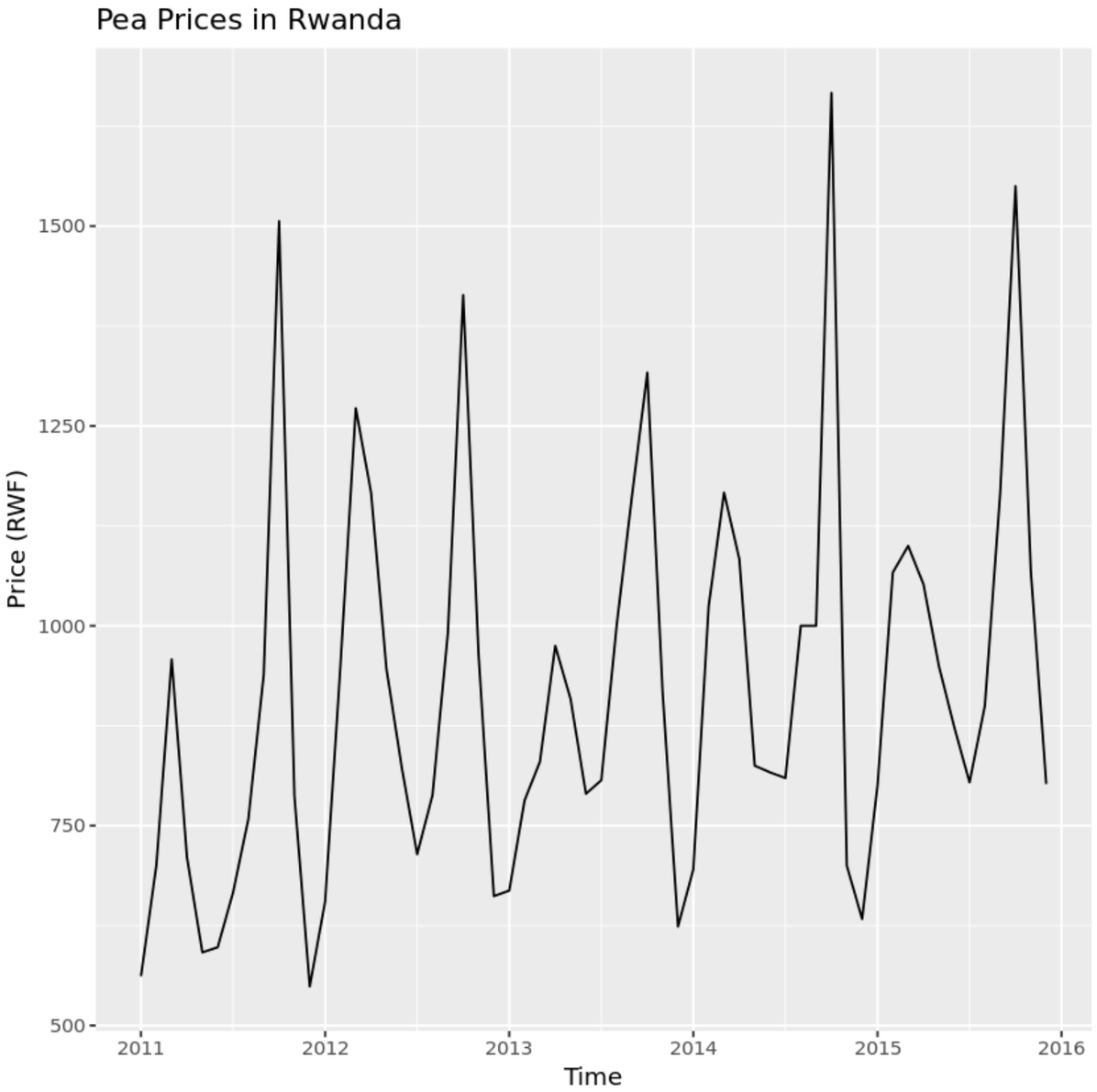


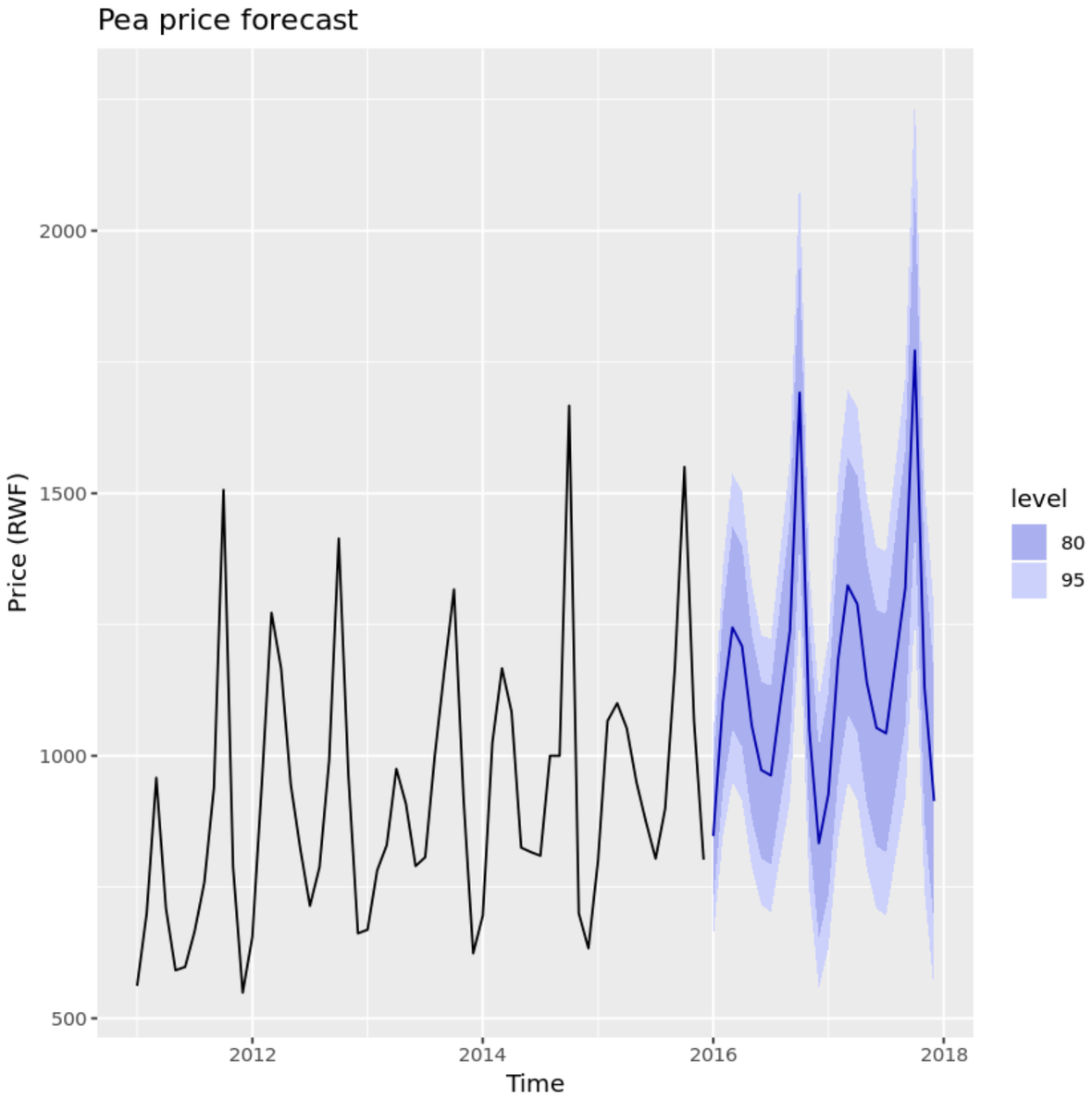
Seasonality in time series



Forecasting time series

- *Examples:*
  - How much rainfall will we get next month?
  - Will traffic ease up in the next half hour?
  - How will the stock market move in the next six hours?
  - What will be earth's population in 20 years?
- Derive a model from historical data to generate predictions
- Modeling methods use a combination of statistical and machine learning methods


Pea Prices in Rwanda
Price (RWF)
1500
1250
1000
750
500
2011
2012
2013
2014
2015
2016
Time



Confidence intervals

Model is **X%** sure that the true value will fall in this area

Let's practice!

DATA SCIENCE FOR EVERYONE

Supervised machine learning

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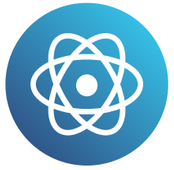


Lis Sulmont
Curriculum Manager, DataCamp

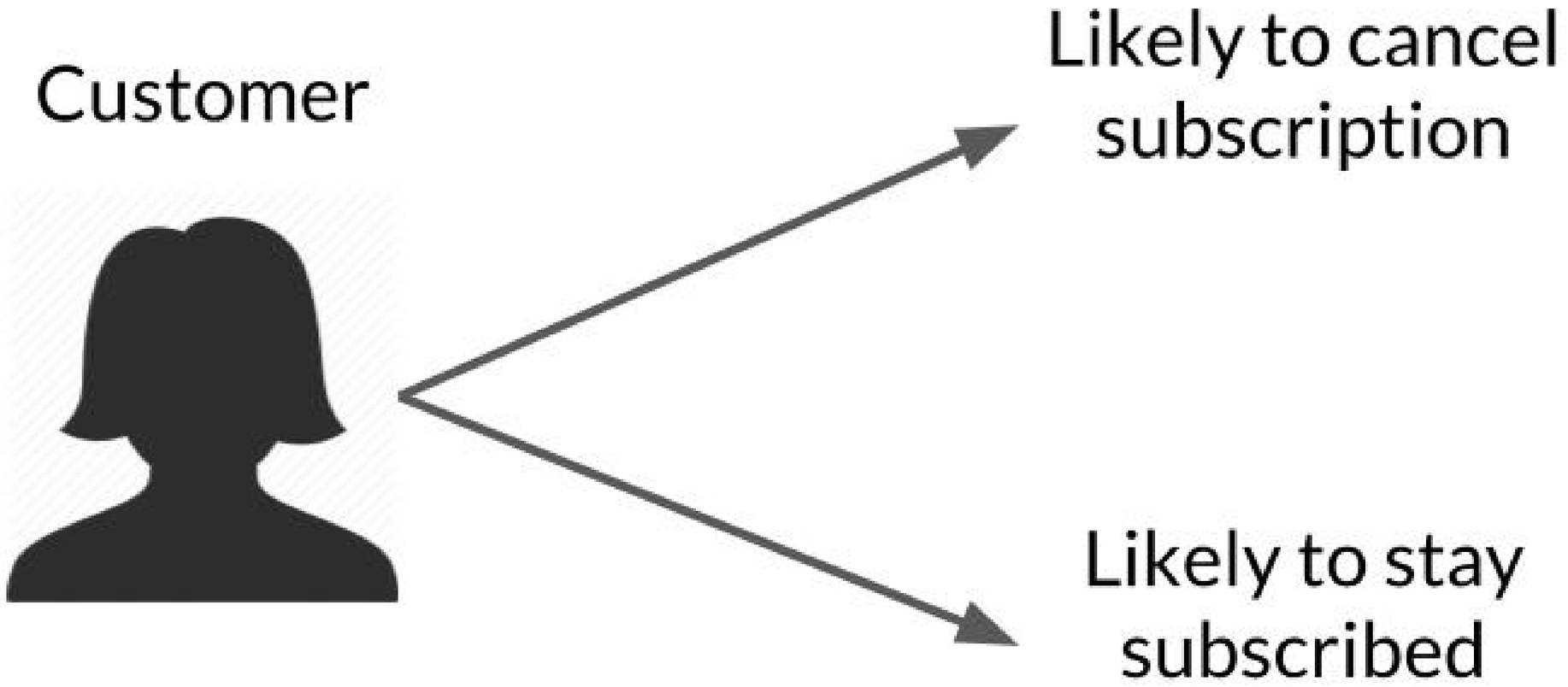
Data science workflow

Data Collection & Storage → Data Preparation → Exploration & Visualization → **Experimentation & Prediction**

What is supervised machine learning?

- **Machine learning**: Predictions from data
- ***Supervised machine* learning**: Predictions from data with *labels* and *features*
  - Recommendation systems
  - Diagnosing biomedical images
  - Recognizing hand-written digits
  - Predicting customer churn

Case study: churn prediction



Case study: churn prediction

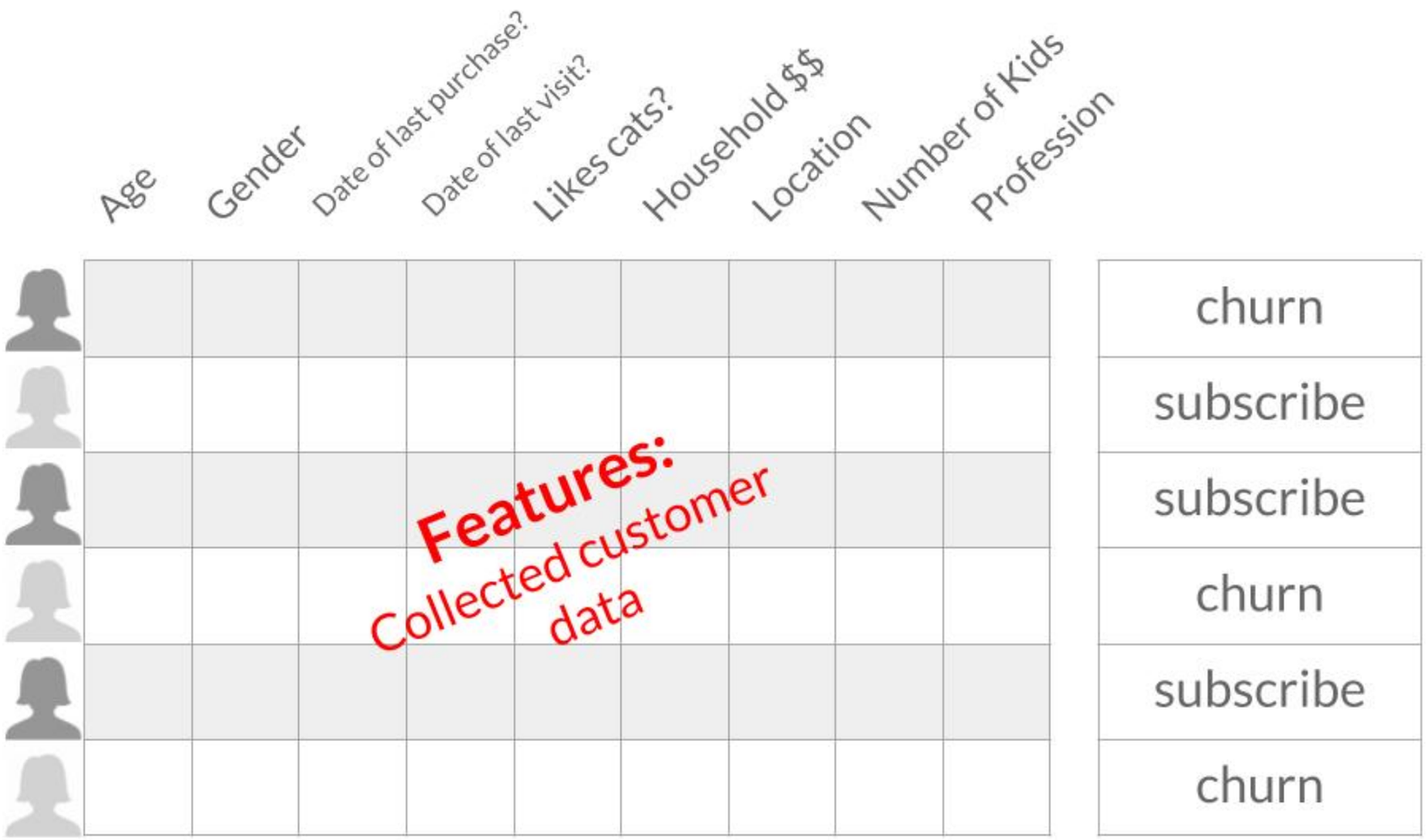
Training Data:
Customers

Case study: churn prediction

Labels
Customer outcomes

churn
subscribe
subscribe
churn
subscribe
churn

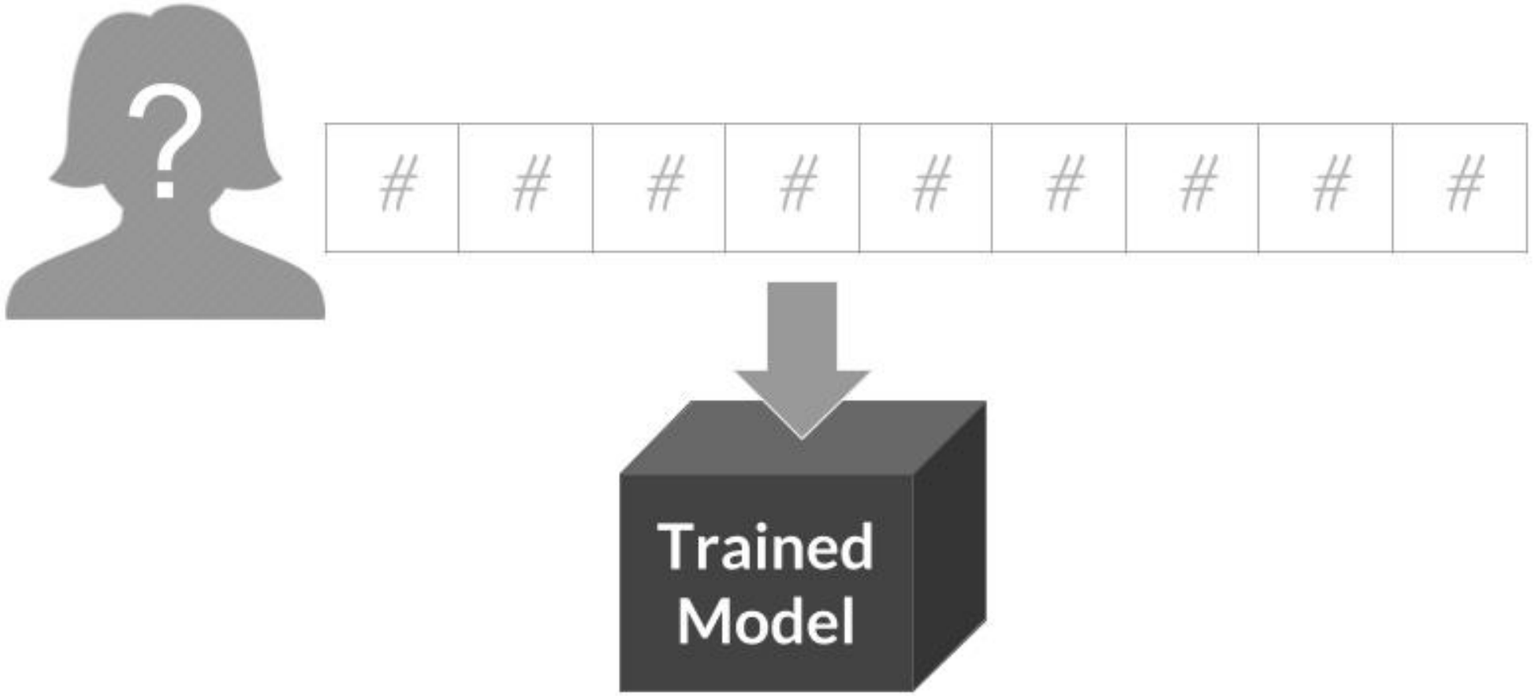
Case study: churn prediction



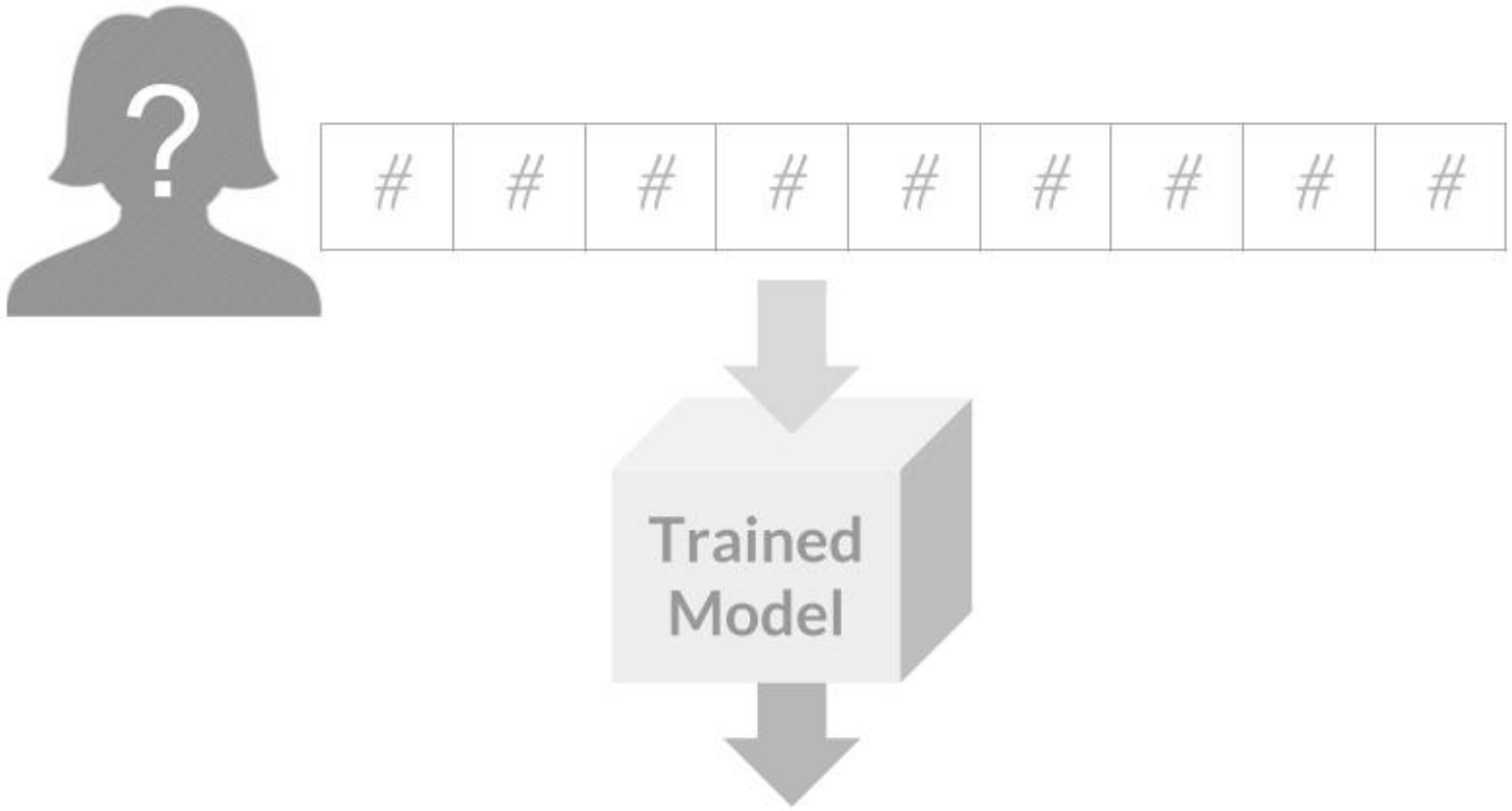
Case study: churn prediction

#	#	#	#	#	#	#	#	#

Case study: churn prediction



Case study: churn prediction

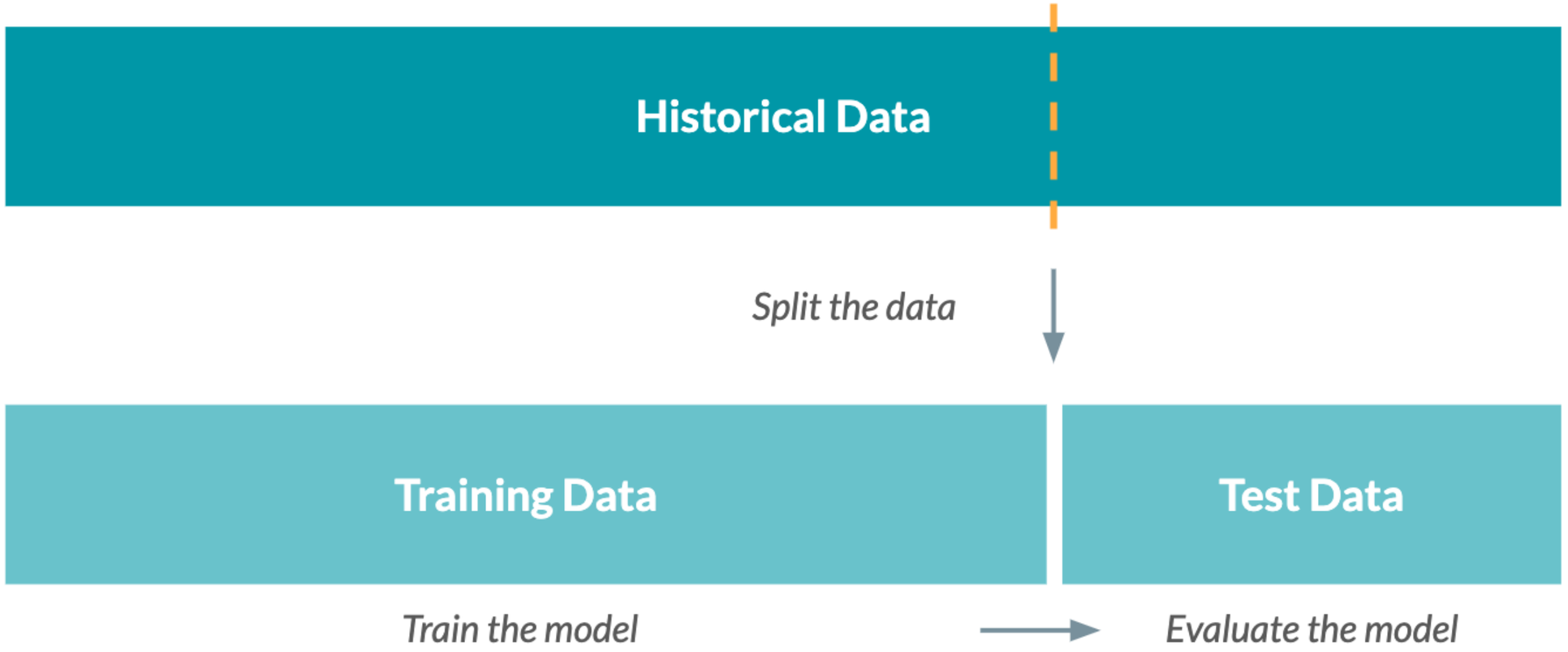


Supervised machine learning recap

- Make a prediction based on data
- Data has *features* and *labels*
  - Label: what we want to predict
  - Features: data that might predict the label
- Trained model can make predictions

Model evaluation

Split historical data into training and testing sets



Model Evaluation

Possible Labels	True Labels	Model Prediction	Model Accuracy
Customer remains	970		
Customer churns	30		

Model Evaluation

Possible Labels	True Labels	Model Prediction	Model Accuracy
Customer remains	970	1000	
Customer churns	30	0	

Model Evaluation

Possible Labels	True Labels	Model Prediction	Model Accuracy
Customer remains	970	1000	# of correct predictions / # of predictions = 970/1000 = **97%**
Customer churns	30	0	

- Checking both outcomes is important for rare events
- Model has 0% accuracy at predicting an actual churn outcome

Let's practice!

DATA SCIENCE FOR EVERYONE

Clustering

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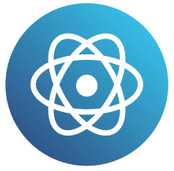
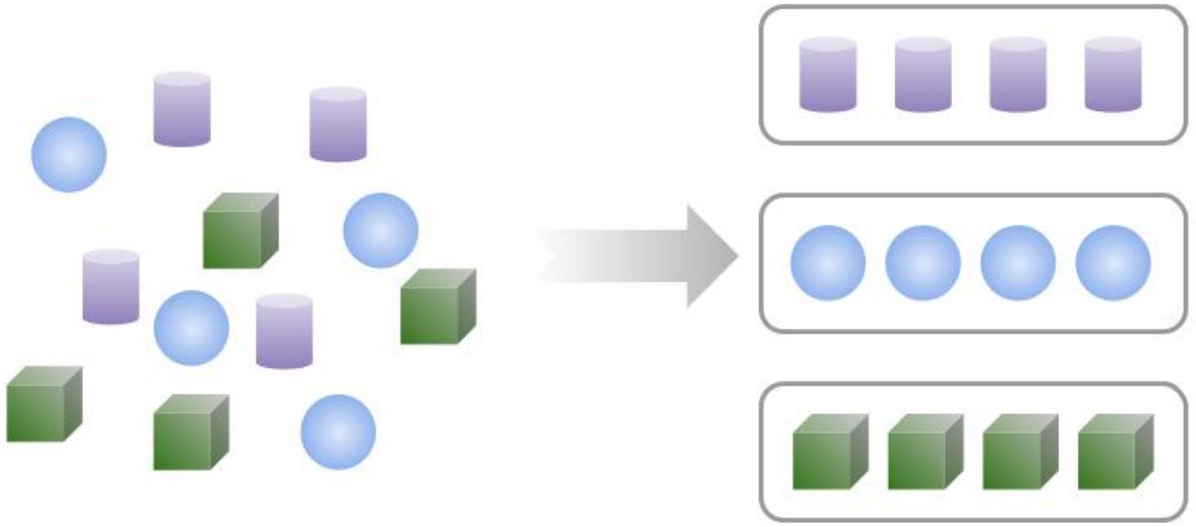


Lis Sulmont
Curriculum Manager, DataCamp

What is clustering?



- Divide data into categories
- Use cases
  - Customer segmentation
  - Image segmentation
  - Anomaly detection

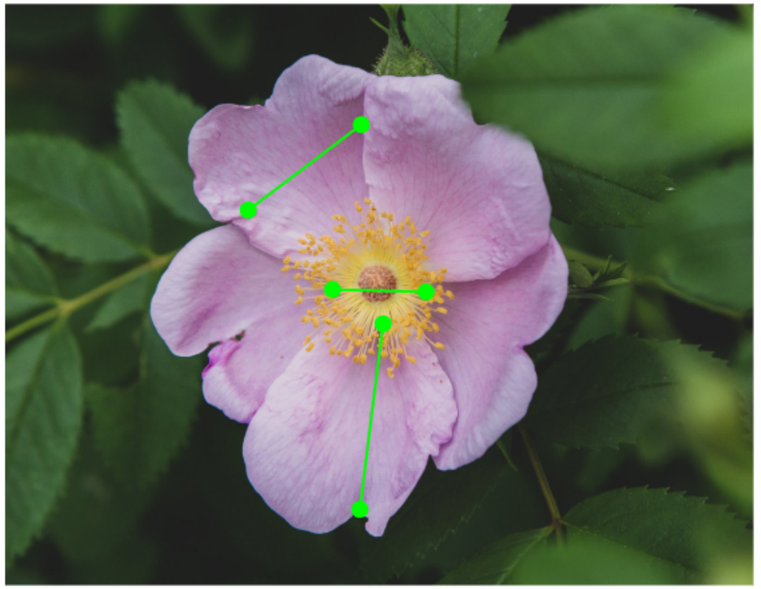
Supervised Machine Learning

Unsupervised Machine Learning

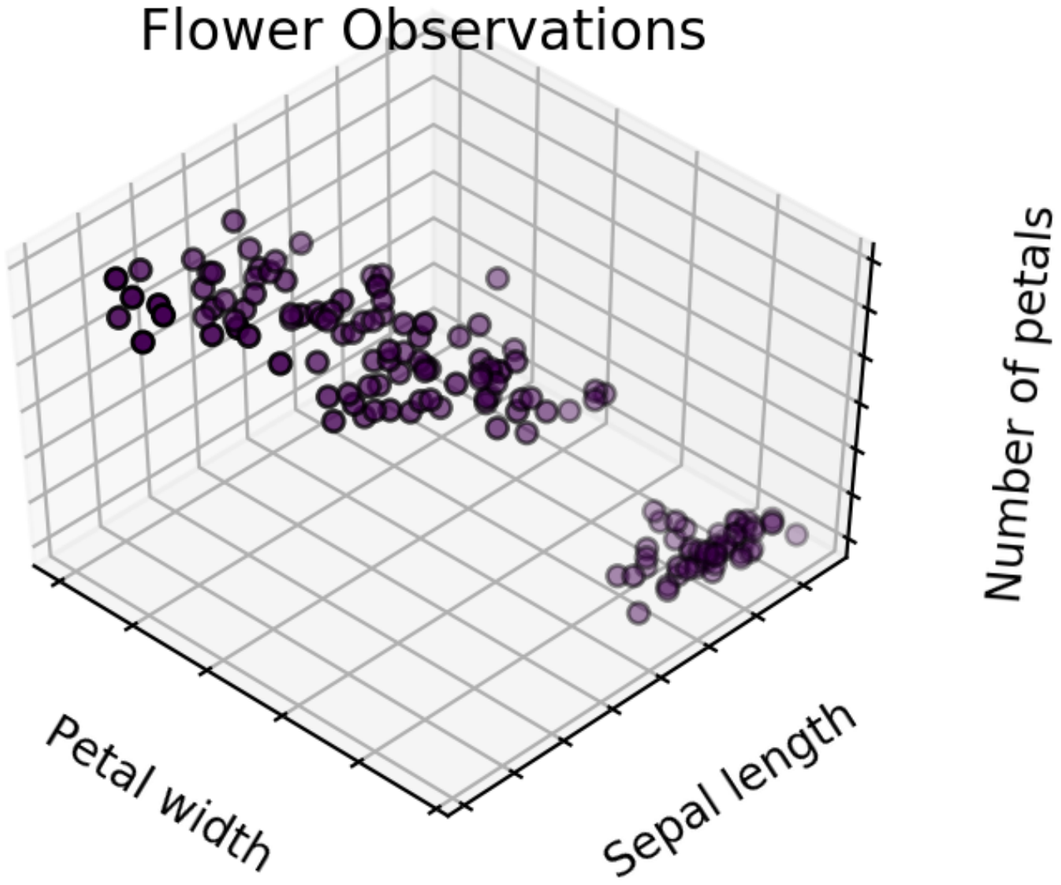
Case study: discovering new species

Defining features

- Flower colors
- Petal length and width
- Sepal length and width
- Number of petals

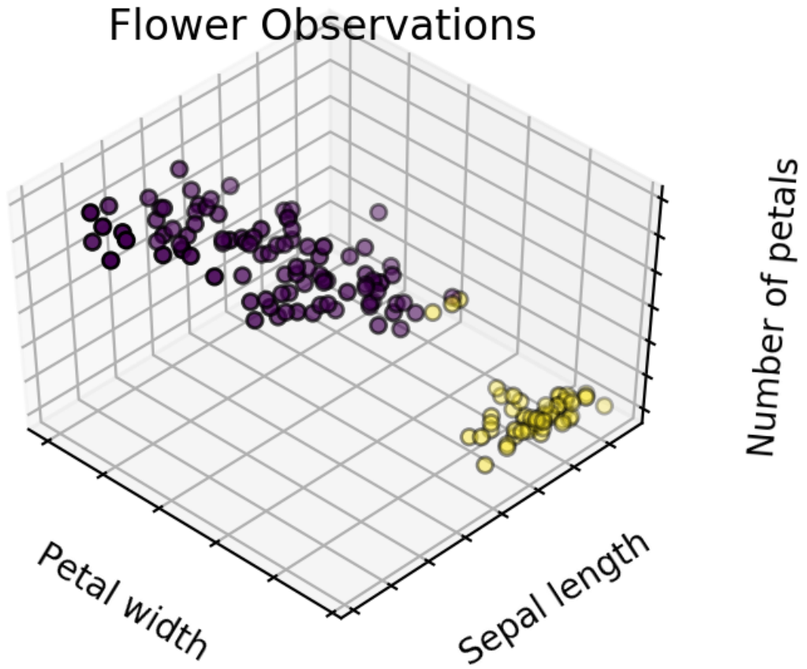


Defining number of clusters

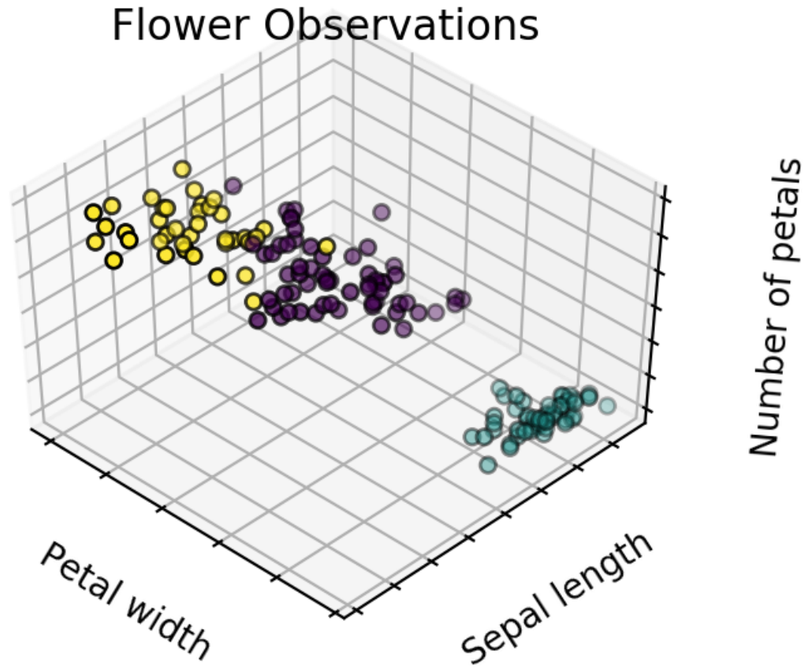


Comparing number of clusters

Two clusters:

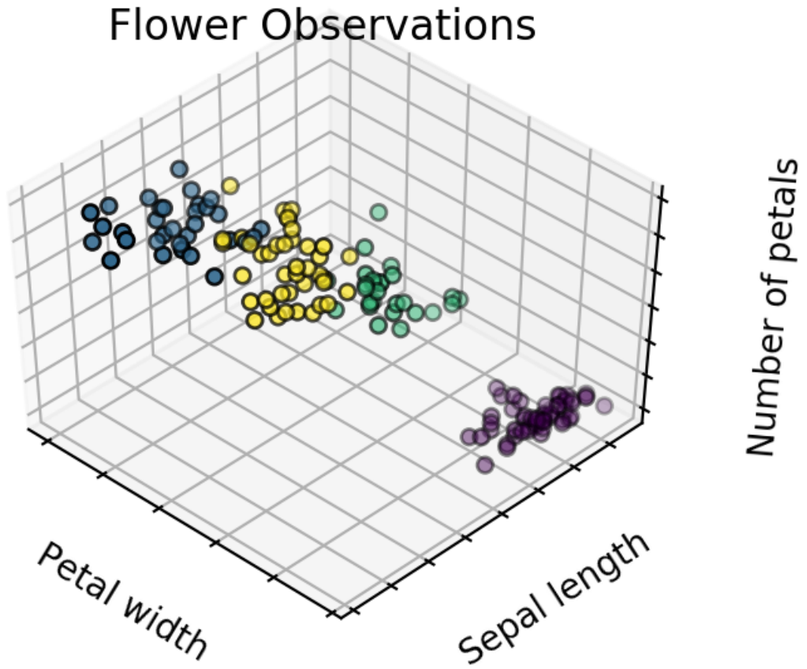


Three clusters:

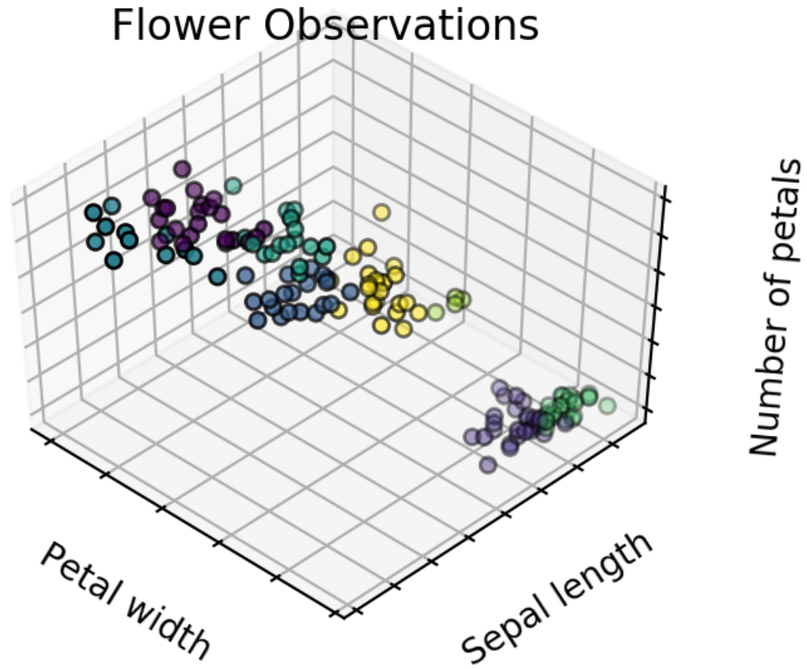


Comparing number of clusters

Four clusters:



Eight clusters:



Comparing number of clusters

- Up to you to decide on final number of clusters
- Use domain knowledge help decide

Clustering review

Definition

- Divide unlabeled dataset into different categories

Steps

- Select features
- Select number of clusters
- Use clusters to solve problems

Let's practice!

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Congratulations!

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Lis Sulmont
Curriculum Manager, DataCamp

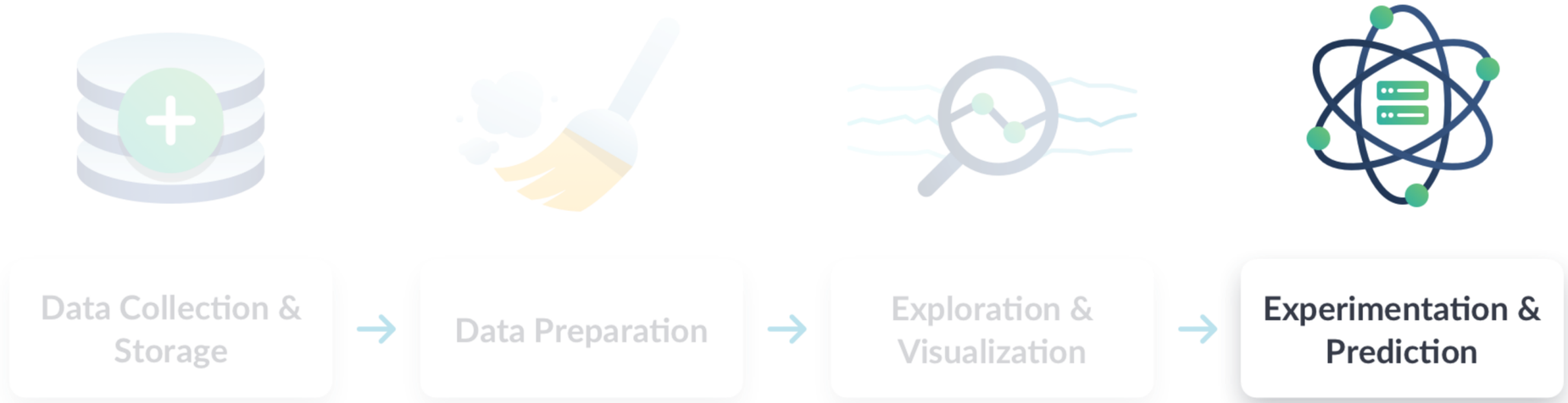
Chap 1: Introduction to Data Science

Chap 2: Data Collection and Storage

Data Collection & Storage → Data Preparation → Exploration & Visualization → Experimentation & Prediction

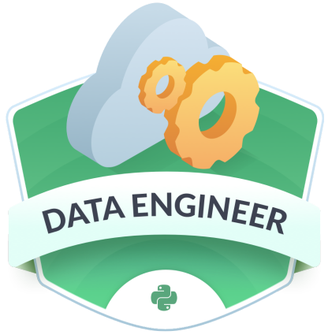
Chap 3: Preparation, Exploration & Visualization

Chap 4: Experimentation and Prediction

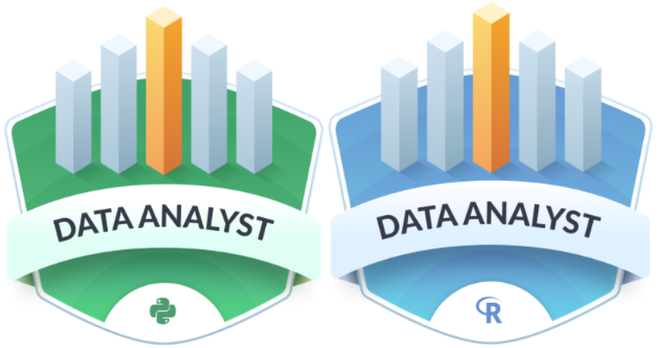


What's next?

Data Engineer

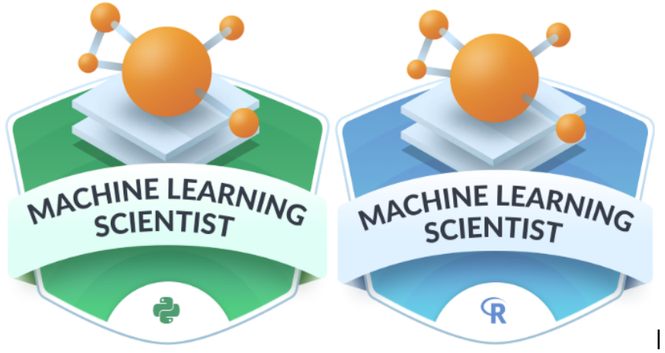


Data Analyst



Data Scientist

Machine Learning Scientist



Let's practice!

DATA SCIENCE FOR EVERYONE