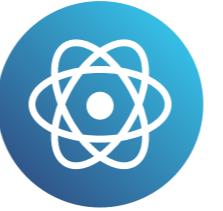


A/B Testing

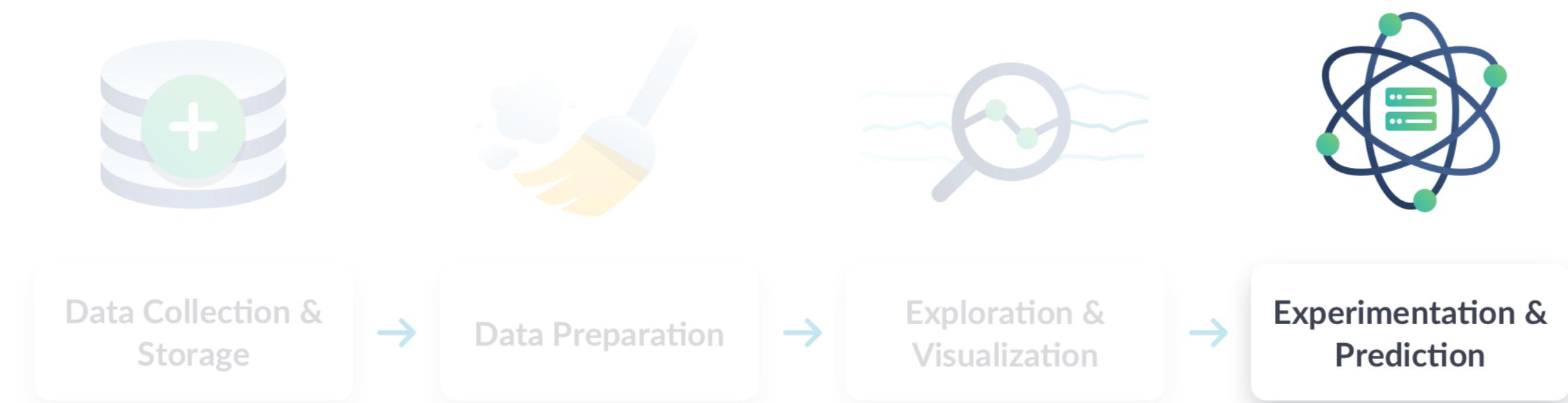
DATA SCIENCE FOR EVERYONE



Lis Sulmont

Curriculum Manager, DataCamp

Data science workflow



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

A

Become an
expert Data
Scientist with
this one weird
trick!



B

You won't
believe these
tips for
becoming a
Data Scientist!



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!

A

Become an
expert Data
Scientist with
this one weird
trick!



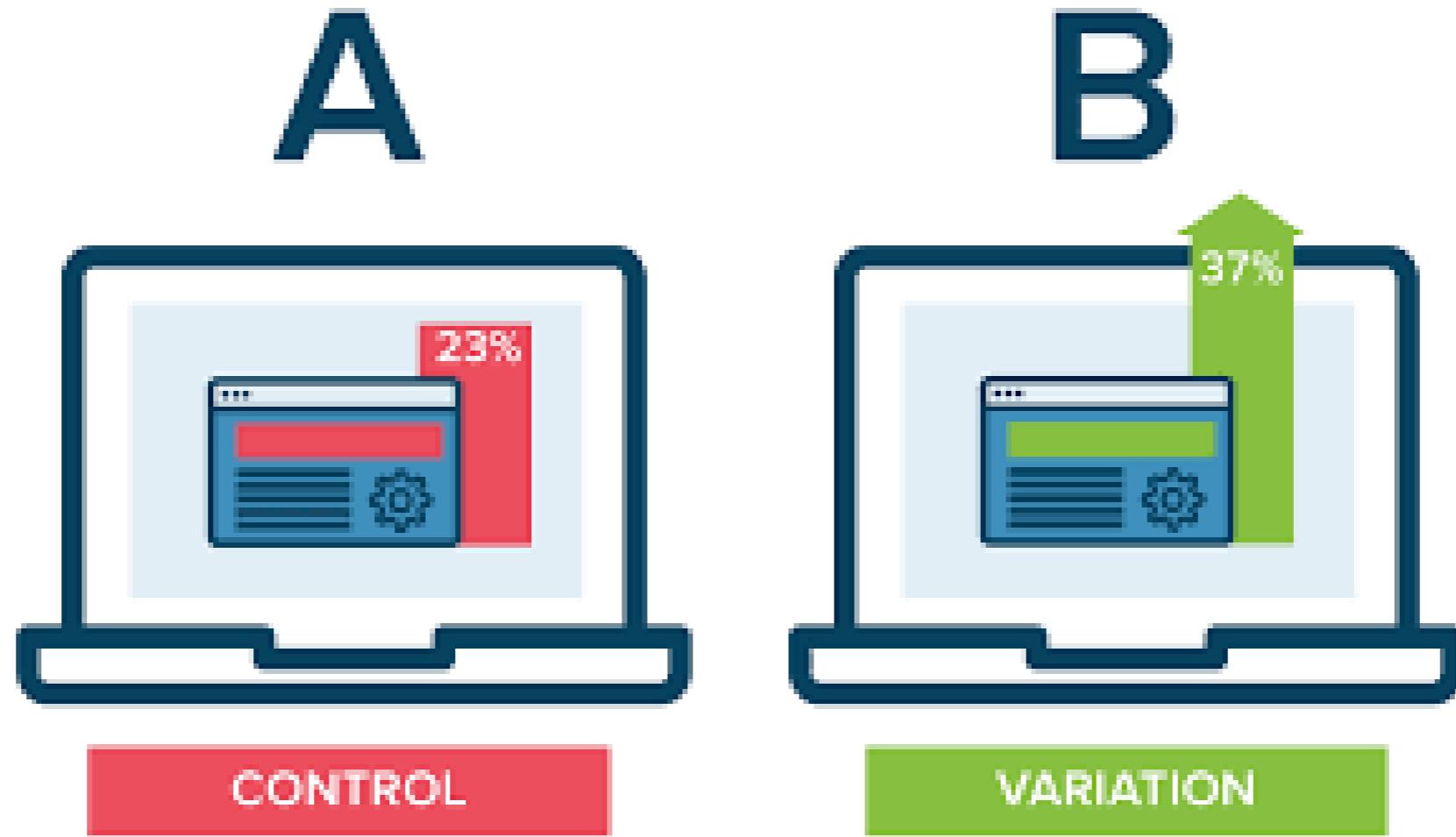
B

You won't
believe these
tips for
becoming a
Data Scientist!



What is A/B Testing?

AKA Champion/Challenger Testing



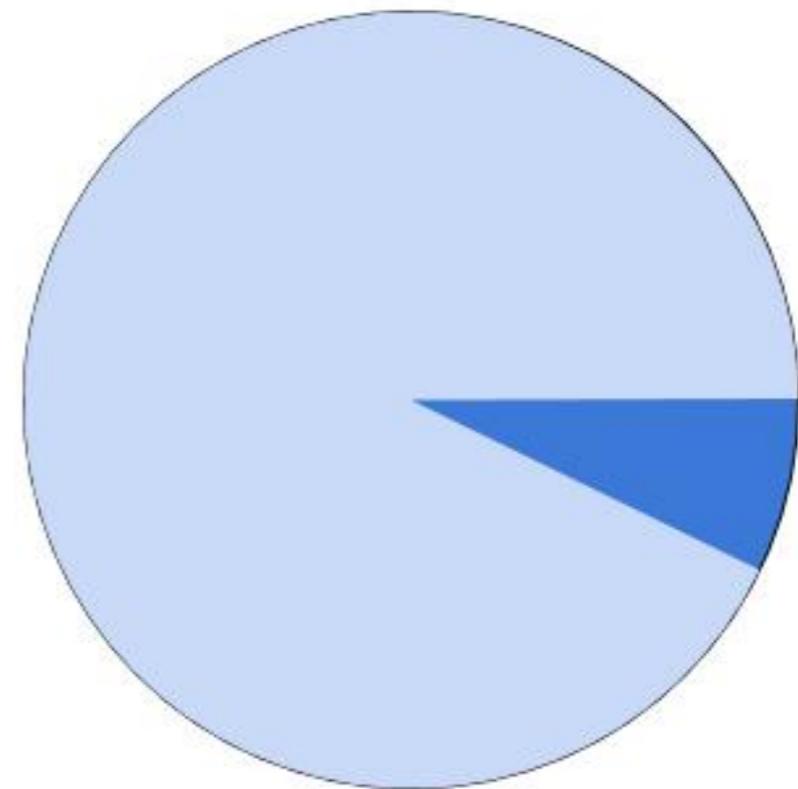
Terminology Review

- **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

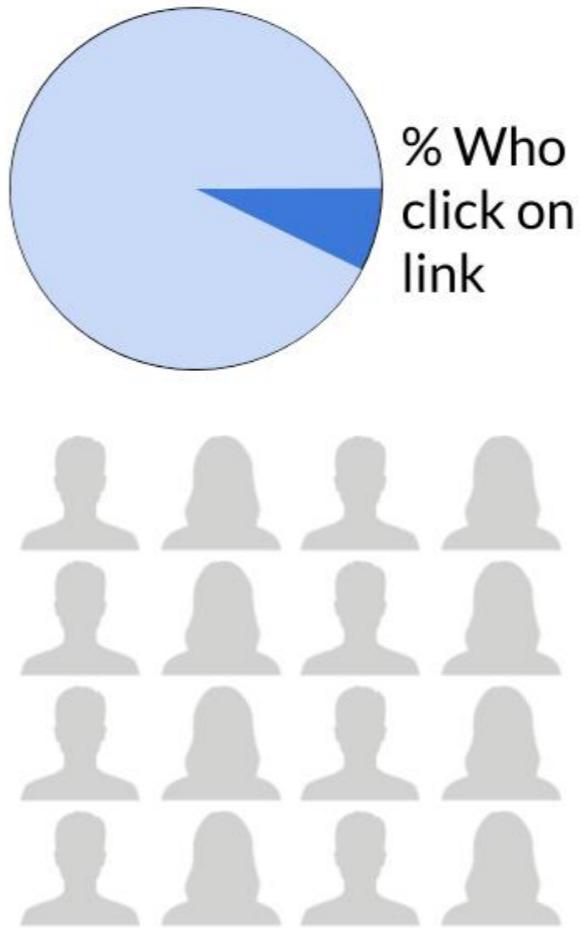
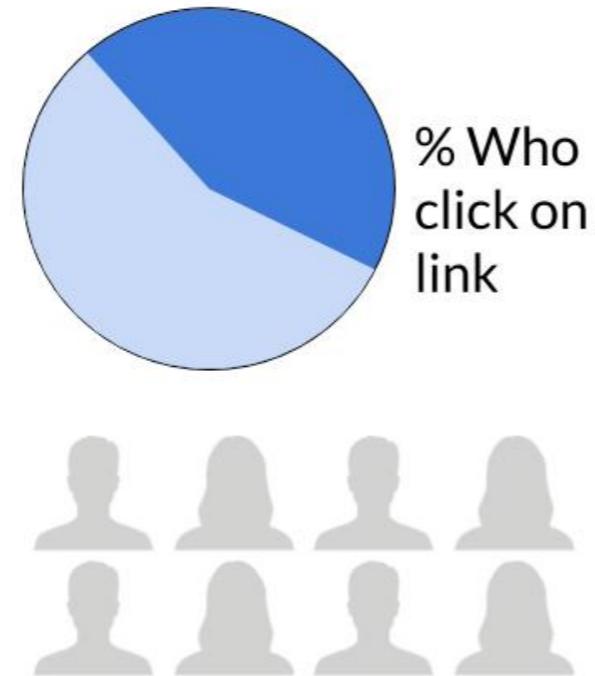
A/B Testing Steps

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

Pick a metric to track: click-through rate

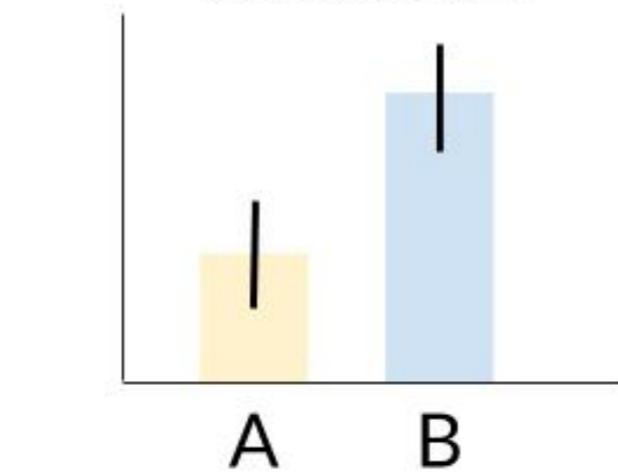


% Who
click on
link

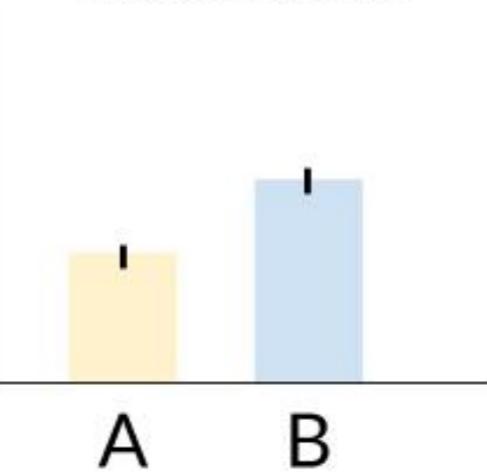


- Baseline metric to gauge any changes
 - *How often people generally click on a link to our blogs*
- If the rate is much larger or smaller than 50%, we need a large sample size
 - Click rate is typically small (<3%)

Low sensitivity, detects
large differences



High sensitivity, detects
small differences



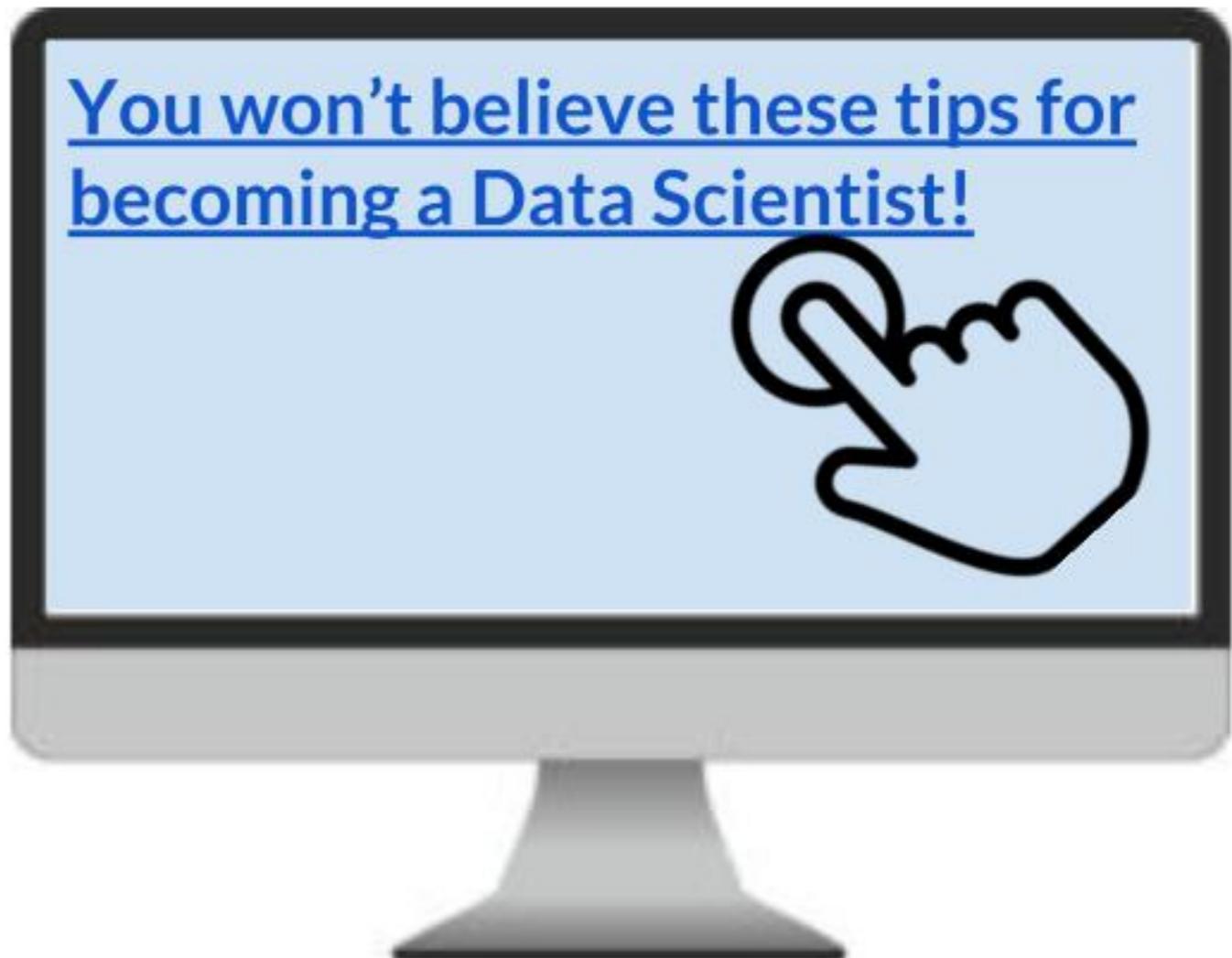
Larger sample sizes allow us to detect smaller changes

Run your experiment

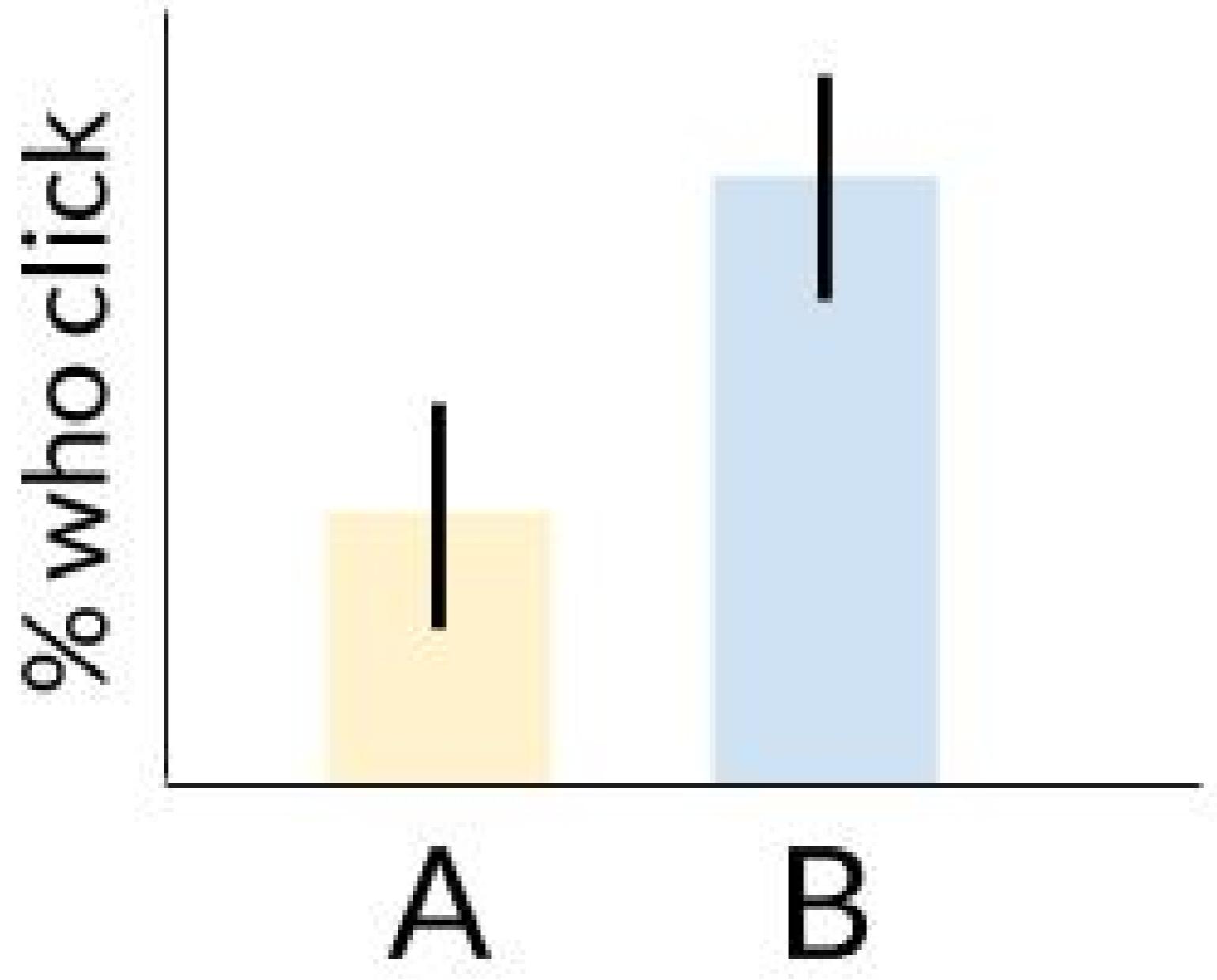
A



B



Check for significance



What if the results aren't significant?

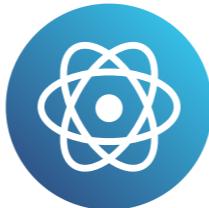
- Difference is smaller than the threshold we chose
- Running our test longer won't help
- Still might be a difference; it's just small and insignificant to us

Let's practice!

DATA SCIENCE FOR EVERYONE

Time series forecasting

DATA SCIENCE FOR EVERYONE



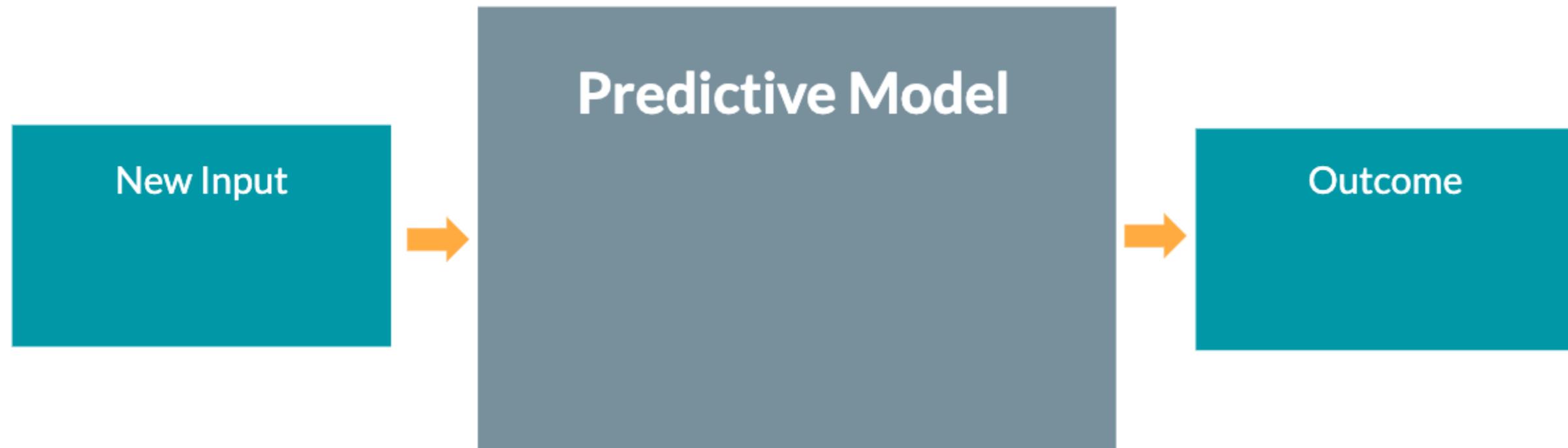
Lis Sulmont
Curriculum Manager

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



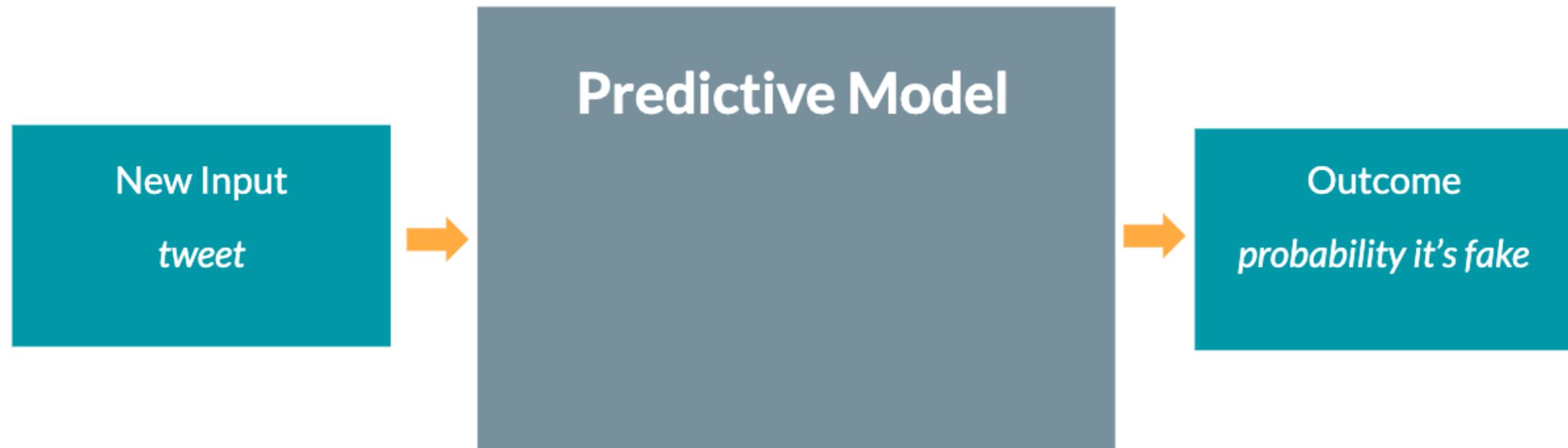
- Enter new input(s) and model predicts an outcome

Predictive modeling



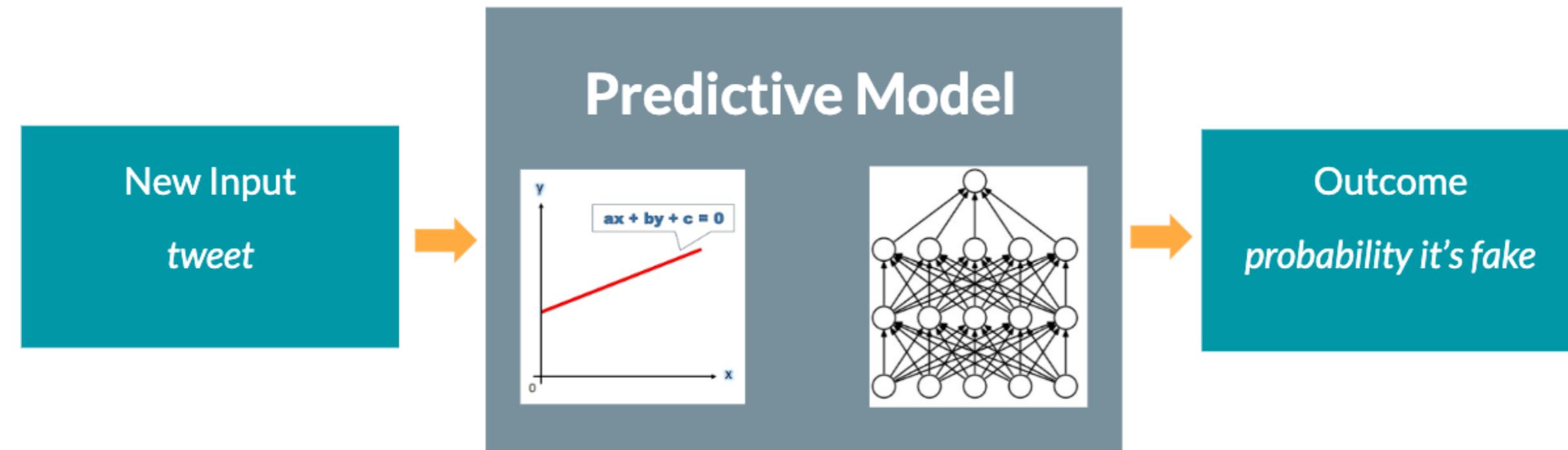
- Enter new input(s) and model predicts an outcome

Predictive modeling



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

Predictive modeling

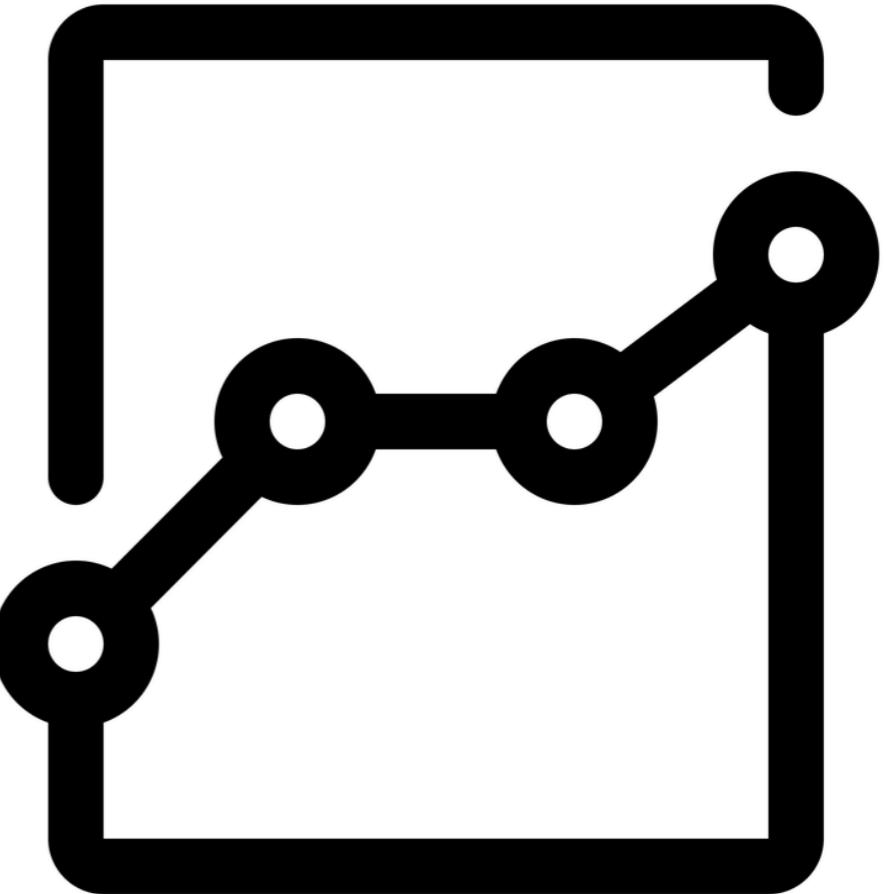


- Enter new input(s) and model predicts an outcome
 - Probability of an outcome
- Ranges in complexity, from a linear equation to a deep learning algorithm

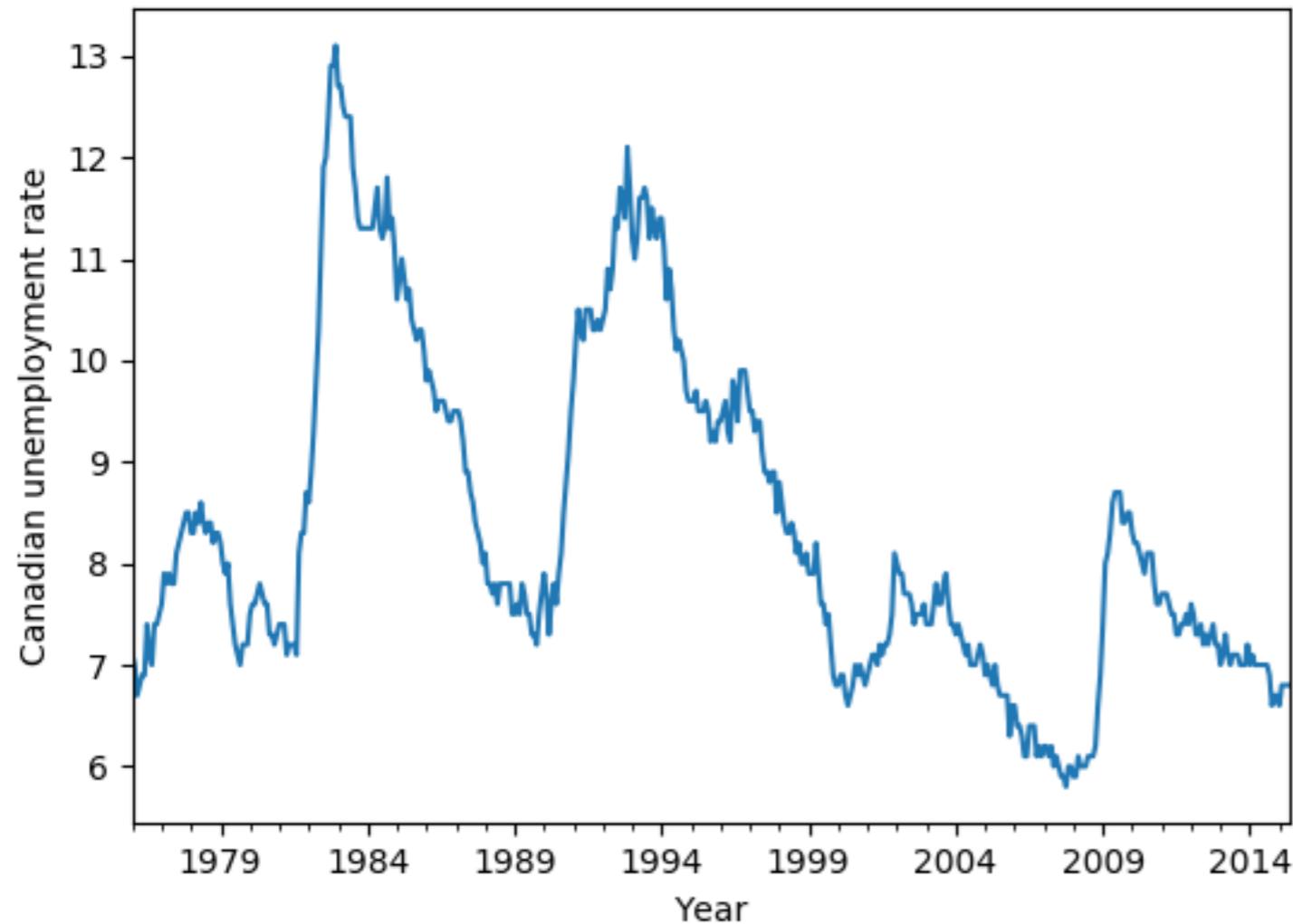
Time series data

A series of data points sequenced by time

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

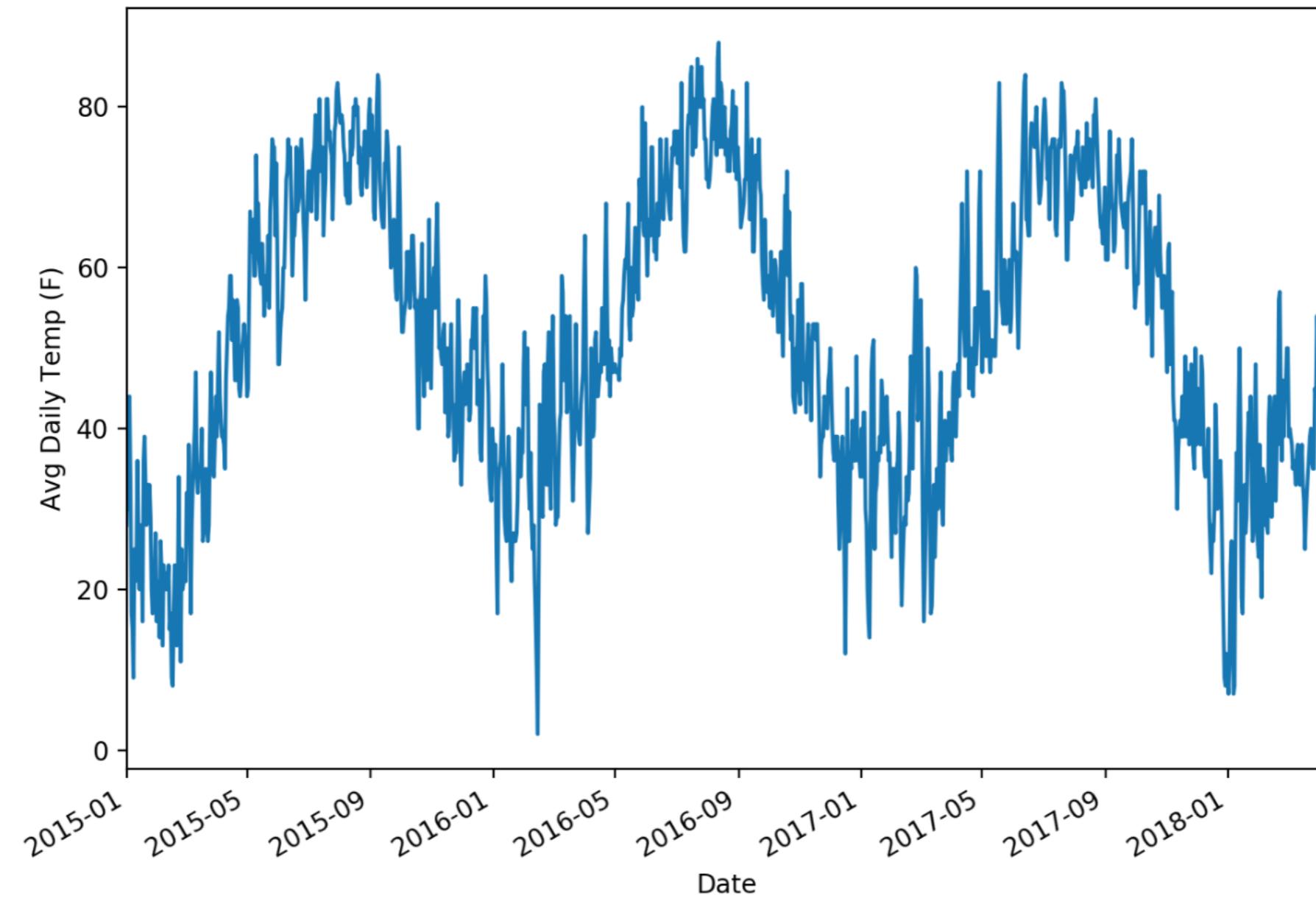


Plotting time series data

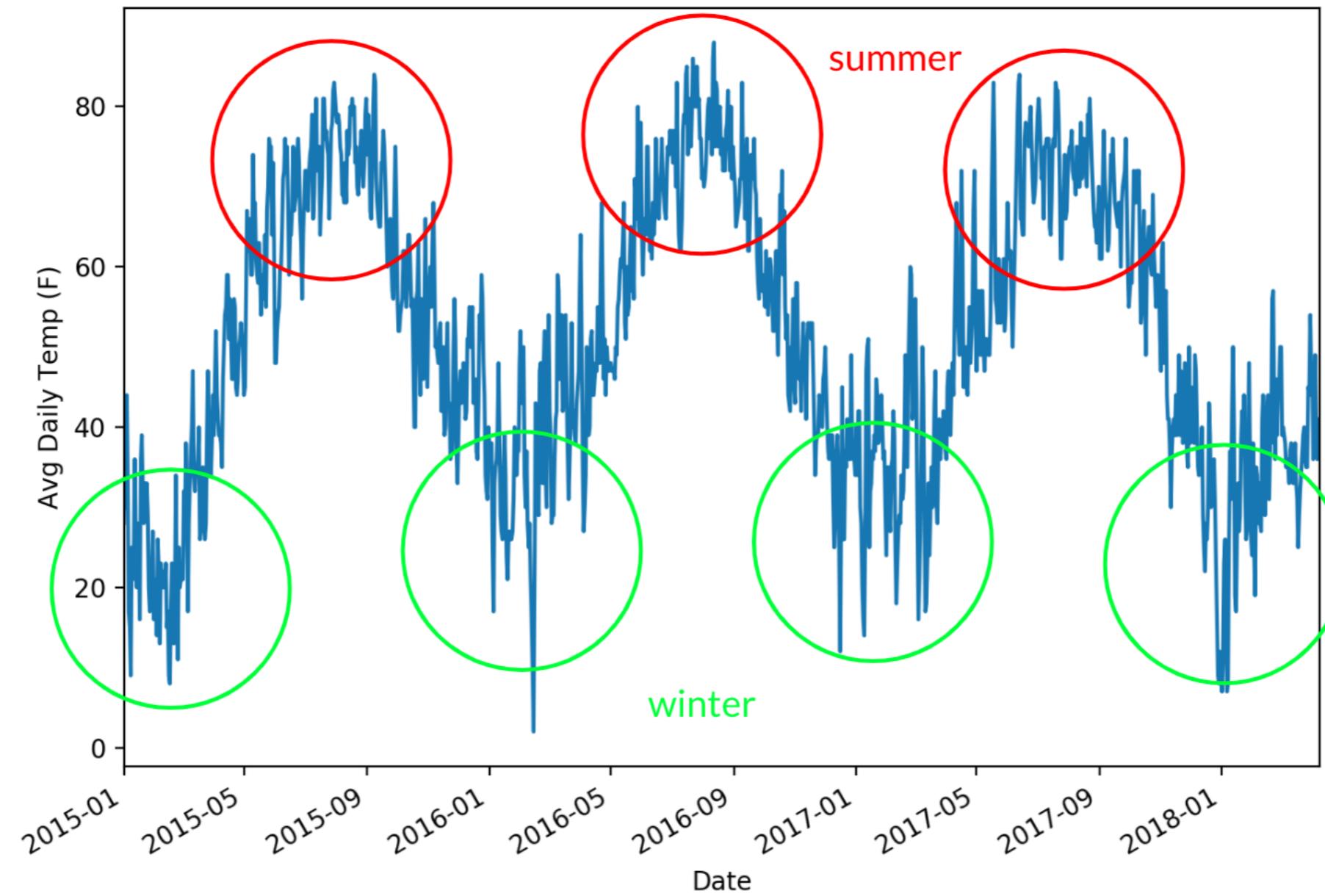


Date	Rate
1976-01-01	7.1
1976-02-01	7
...	
1991-01-01	10.3
...	
2015-04-01	6.8
2015-05-01	6.8

Seasonality in time series



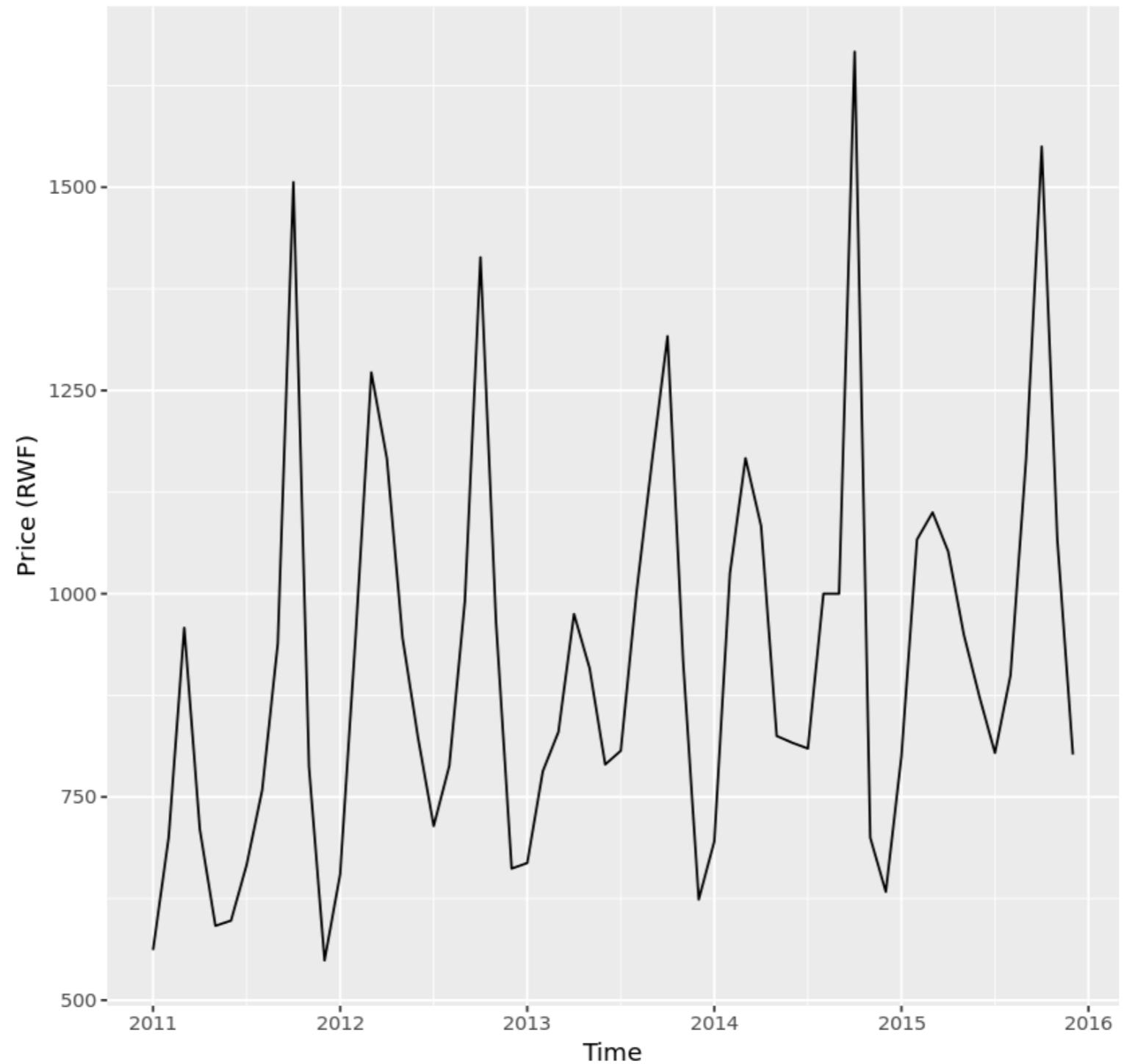
Seasonality in time series



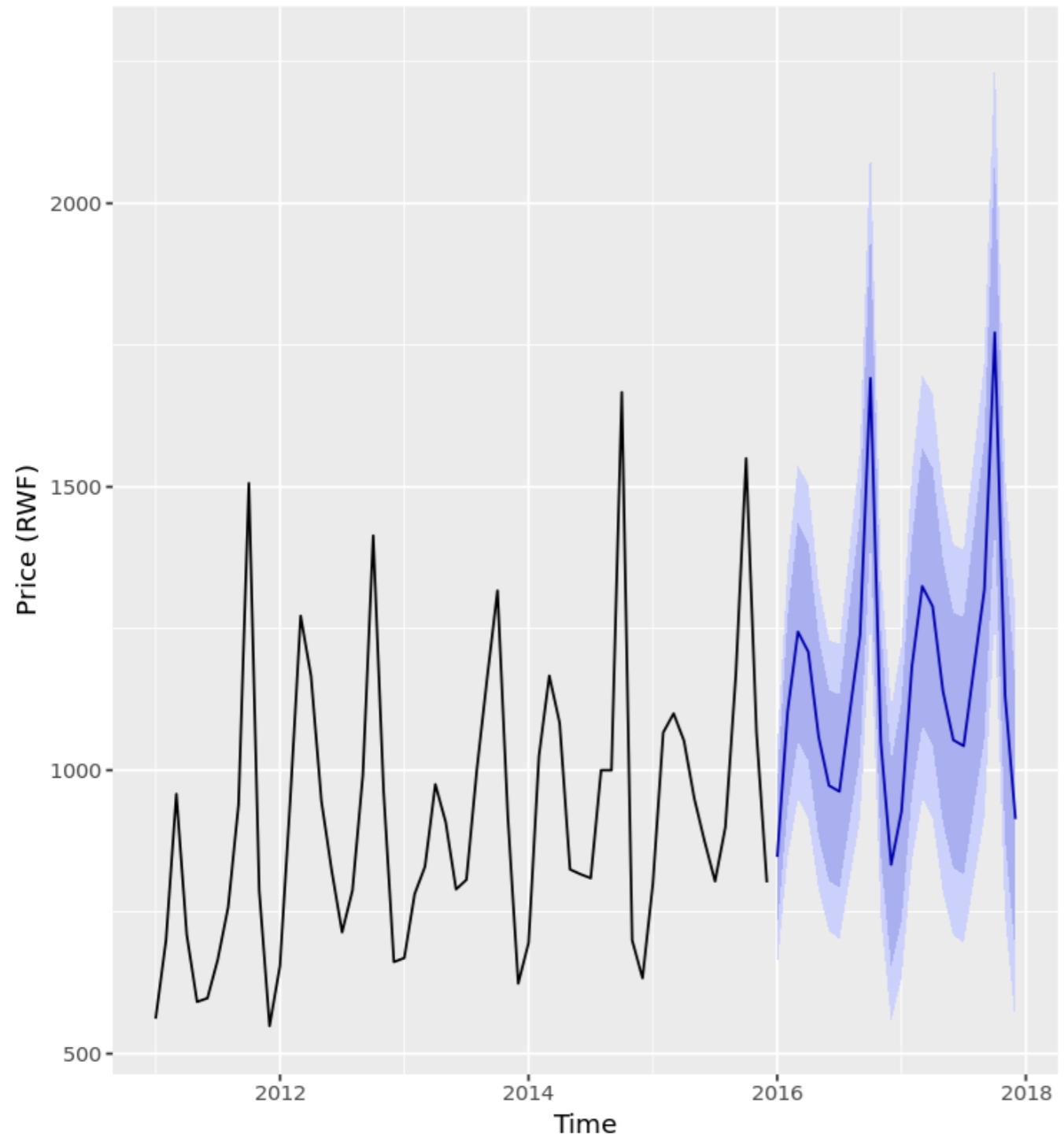
Forecasting time series

- *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

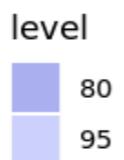


Pea price forecast



Confidence intervals

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

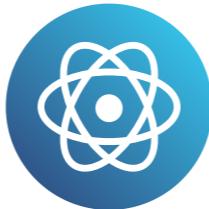


Let's practice!

DATA SCIENCE FOR EVERYONE

Supervised machine learning

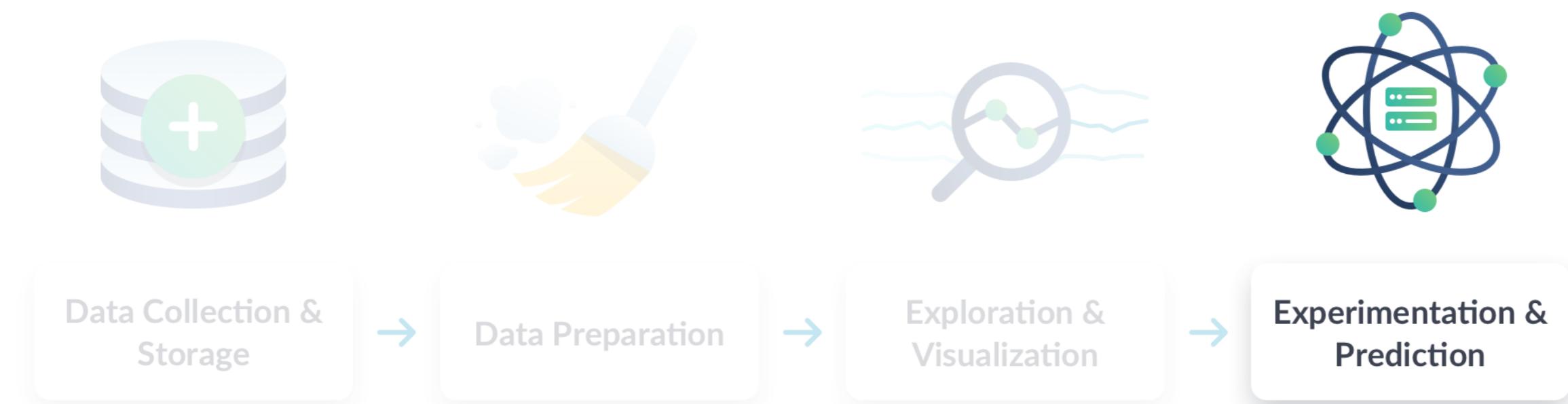
DATA SCIENCE FOR EVERYONE



Lis Sulmont

Curriculum Manager, DataCamp

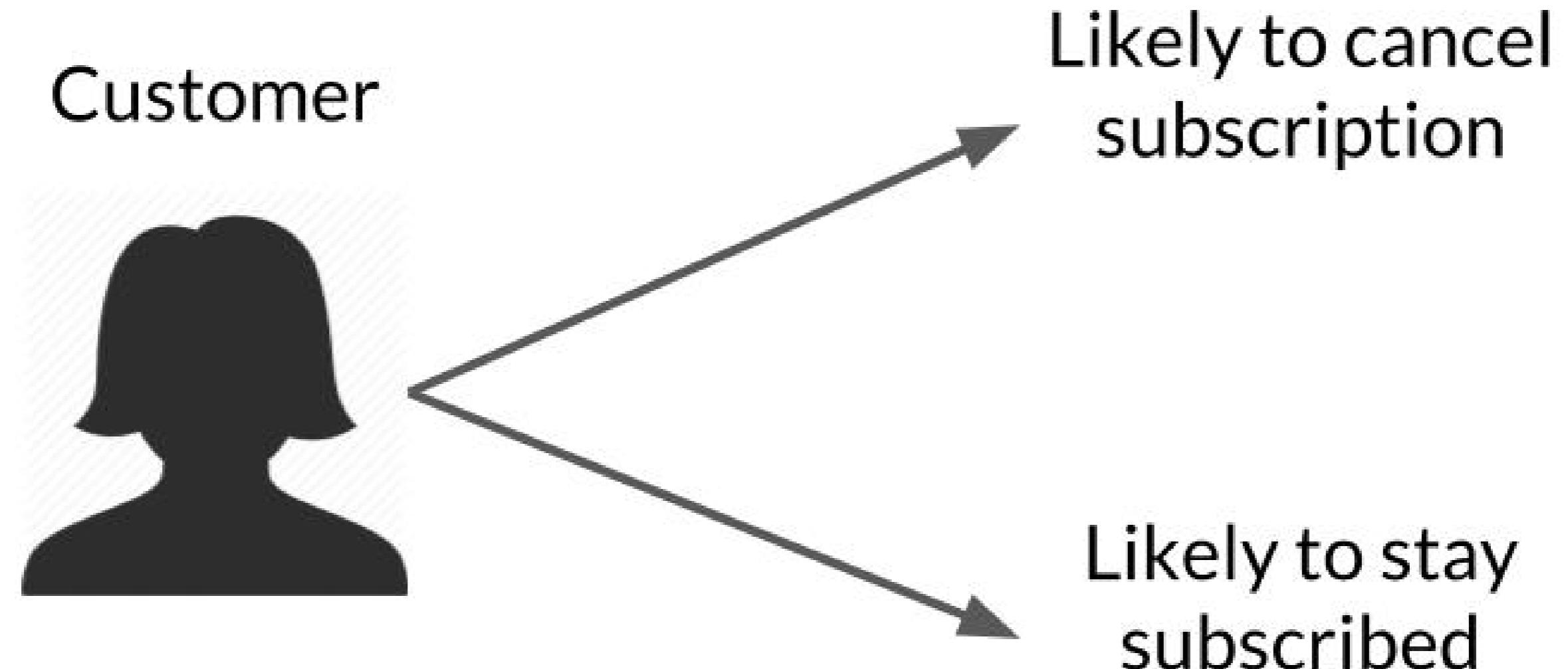
Data science workflow



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



Case study: churn prediction

	Age	Gender	Date of last purchase?	Date of last visit?	Likes cats?	Household \$\$	Location	Number of Kids	Profession	
										churn
										subscribe
										subscribe
										churn
										subscribe
										churn

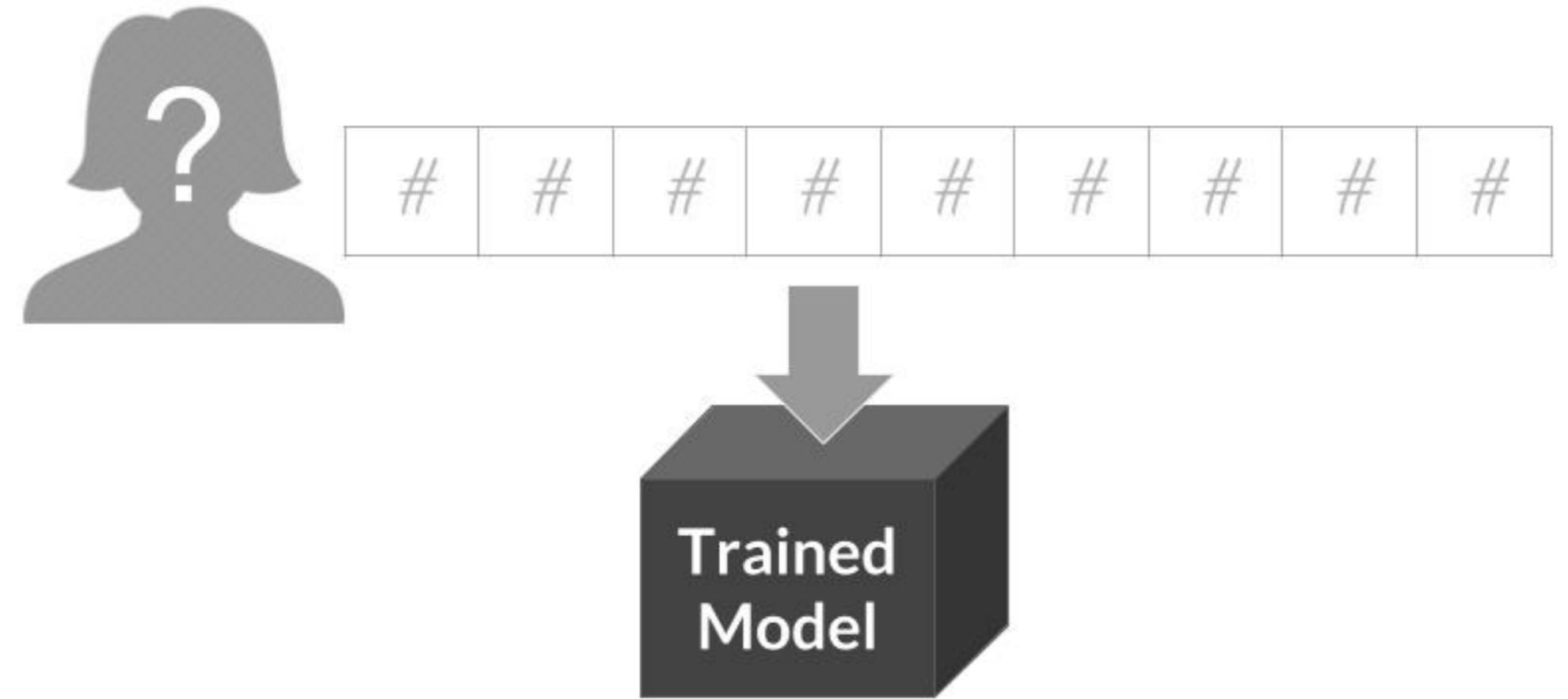
Features:
Collected customer
data

Case study: churn prediction

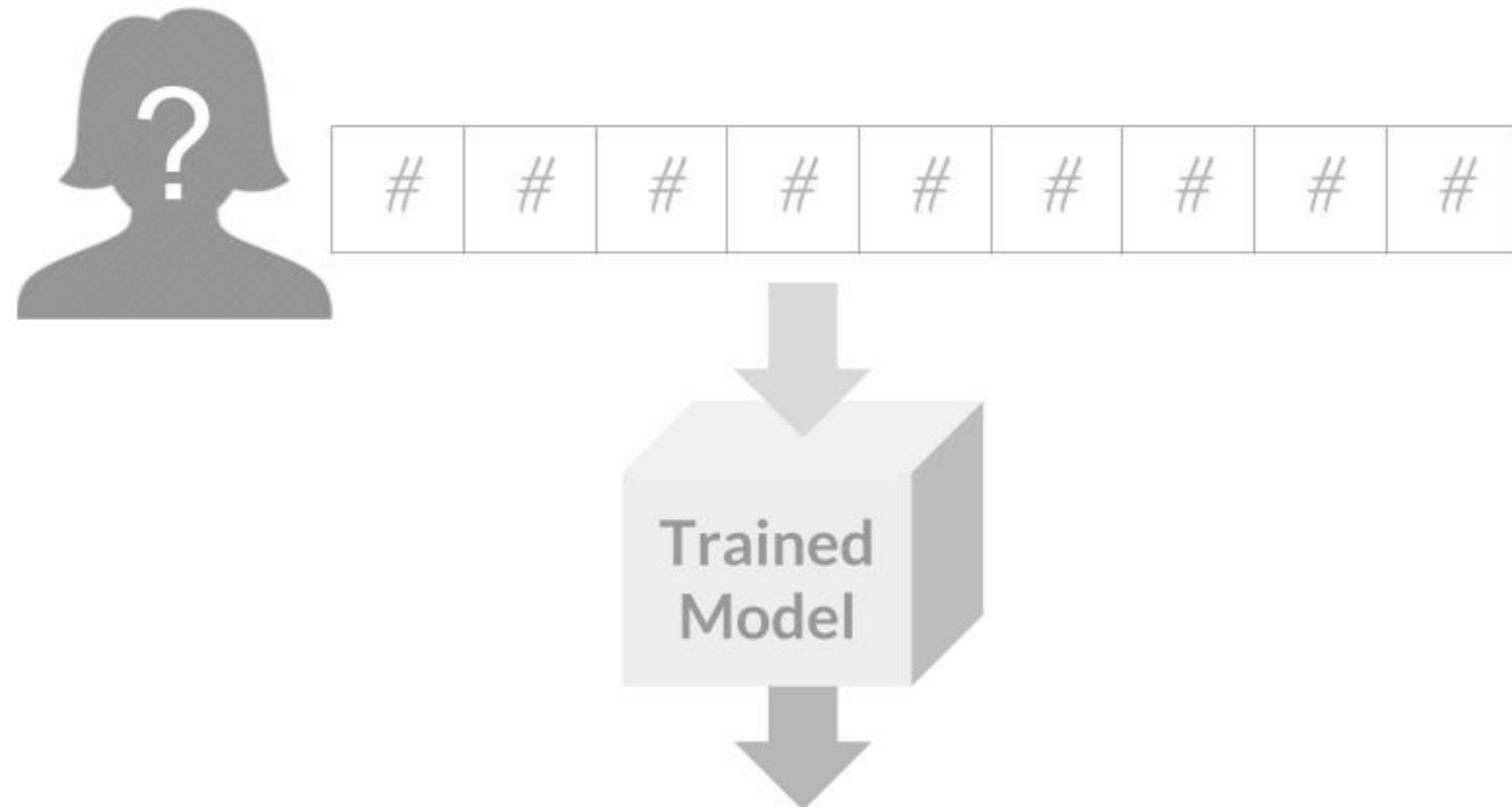


#	#	#	#	#	#	#	#	#
---	---	---	---	---	---	---	---	---

Case study: churn prediction



Case study: churn prediction



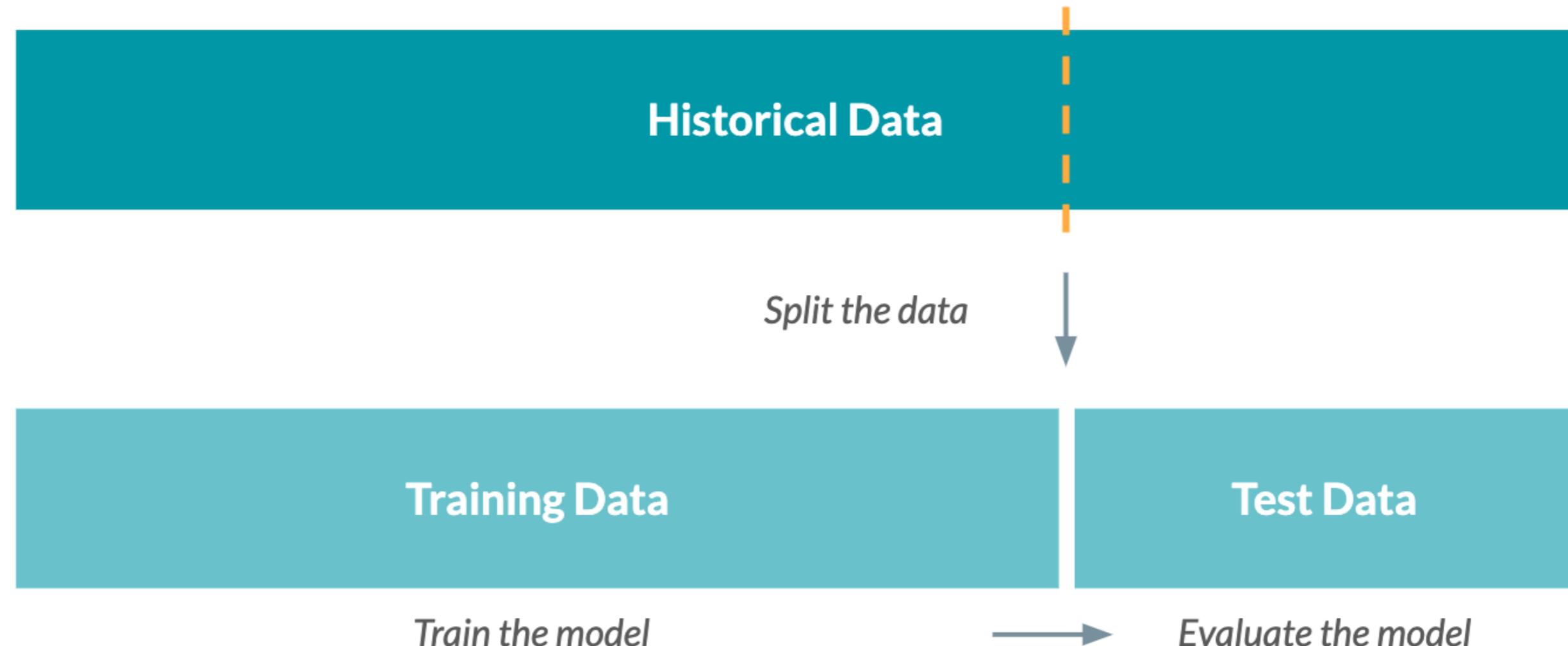
Prediction: Subscribe

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
<i>Customer remains</i>	970		
<i>Customer churns</i>	30		

Model Evaluation

Possible Labels	True Labels	Model Prediction	Model Accuracy
<i>Customer remains</i>	970	1000	
<i>Customer churns</i>	30	0	

Model Evaluation

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

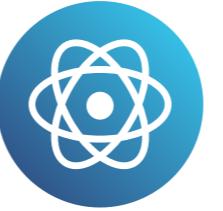
- Checking both outcomes is important for rare events
- Model has 0% accuracy at predicting an actual churn outcome

Let's practice!

DATA SCIENCE FOR EVERYONE

Clustering

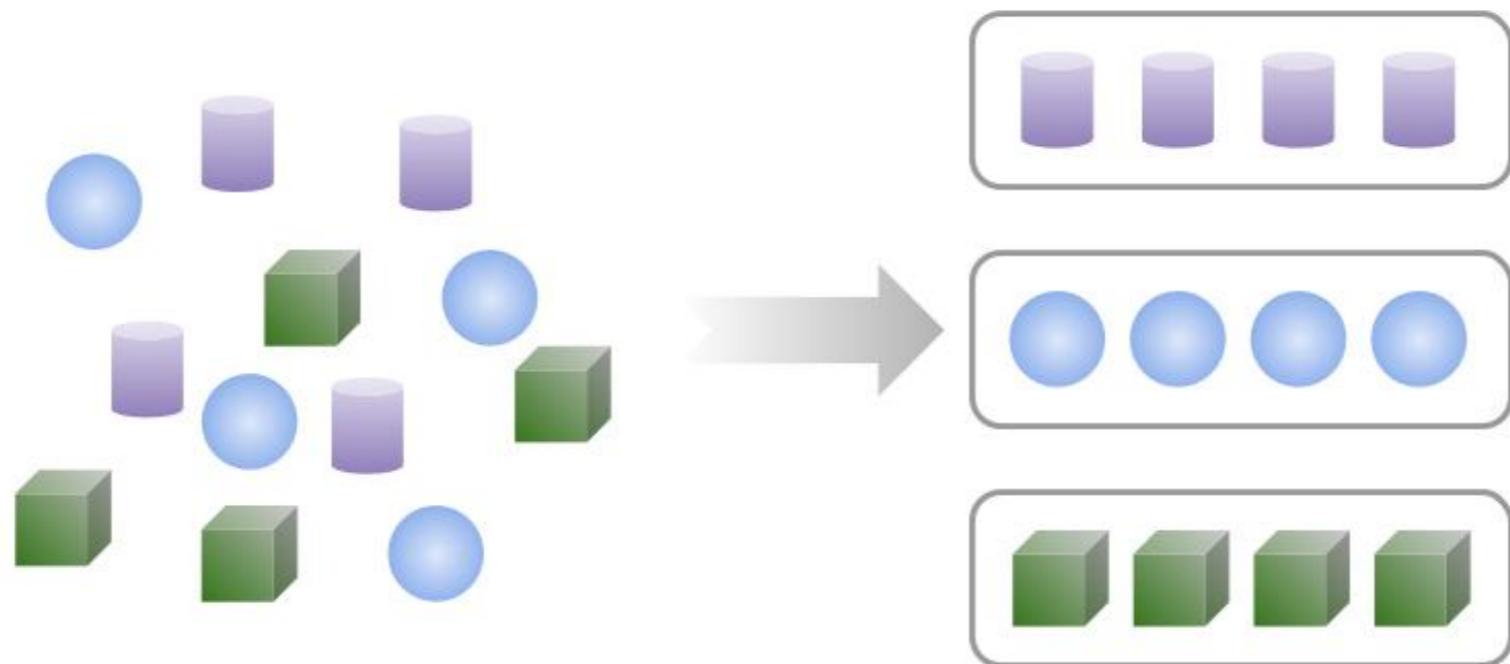
DATA SCIENCE FOR EVERYONE



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

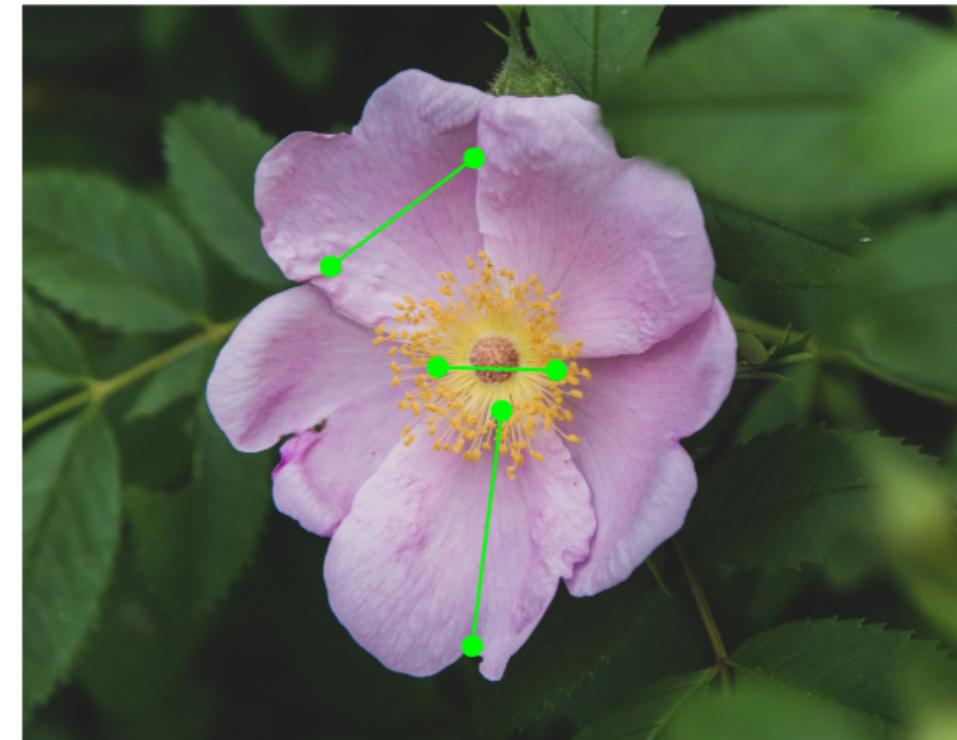
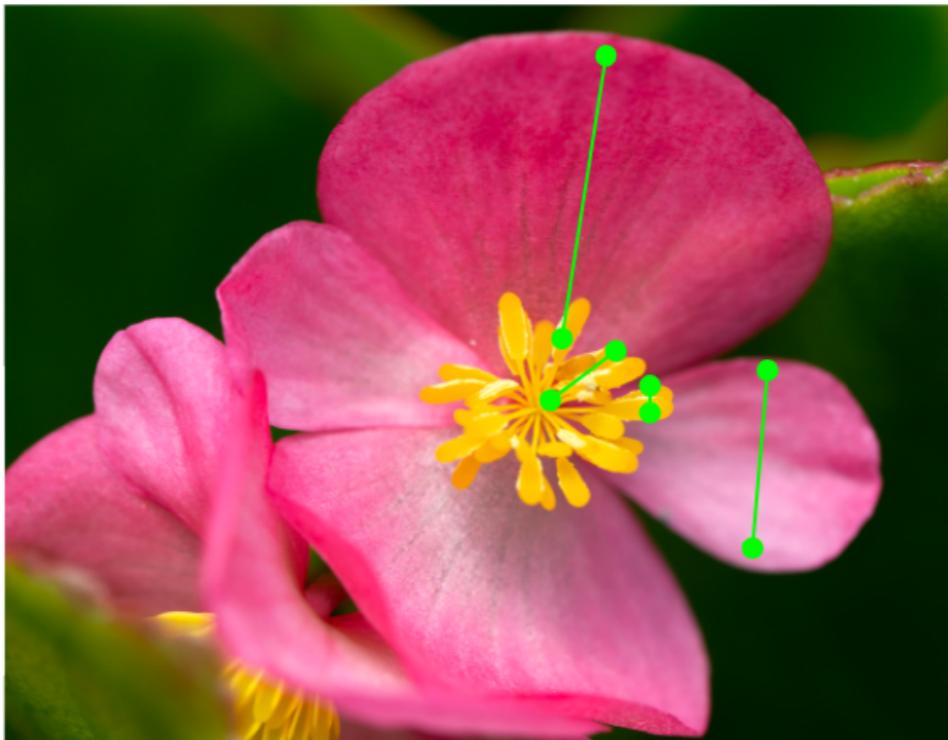


Case study: discovering new species

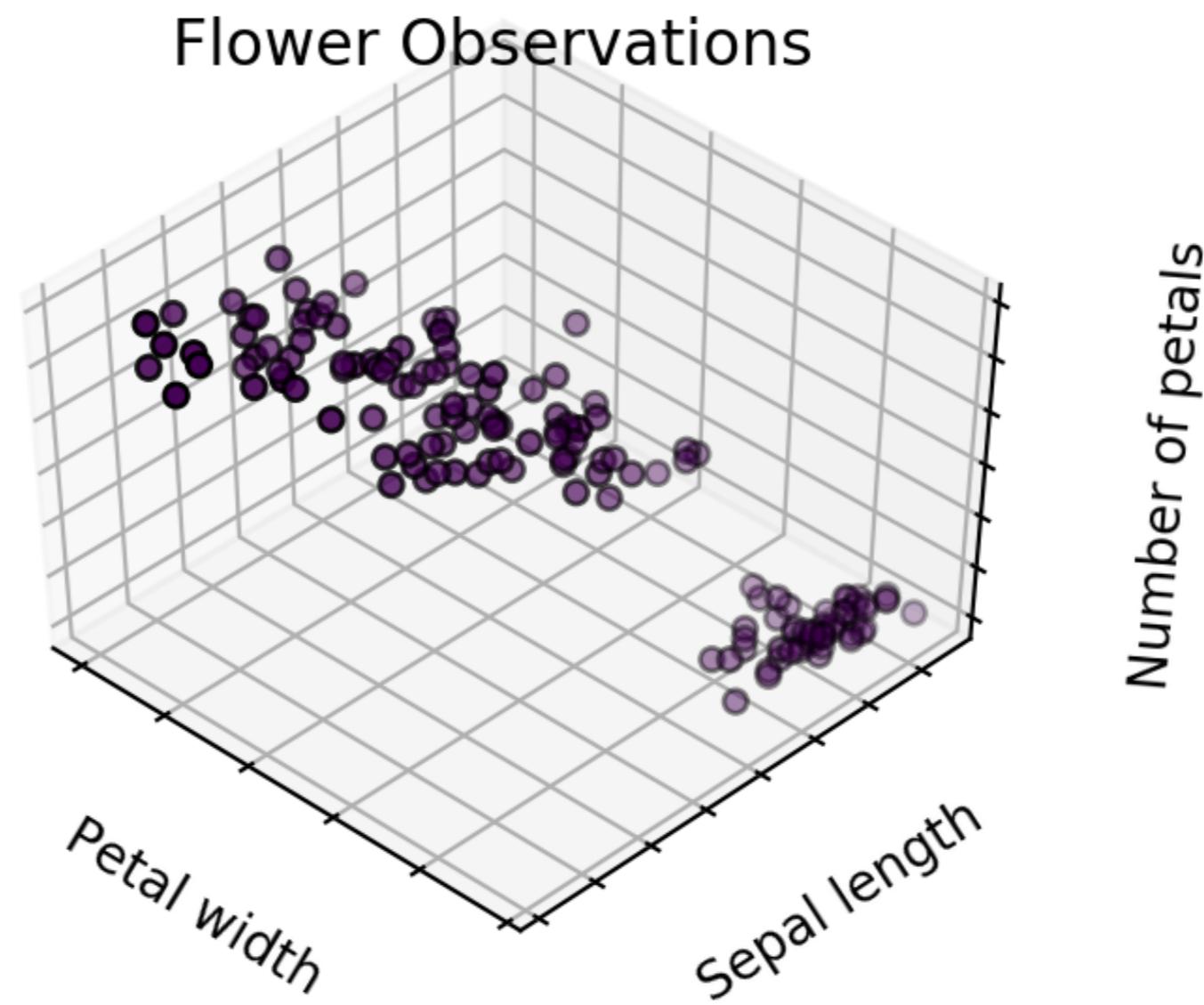


Defining features

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

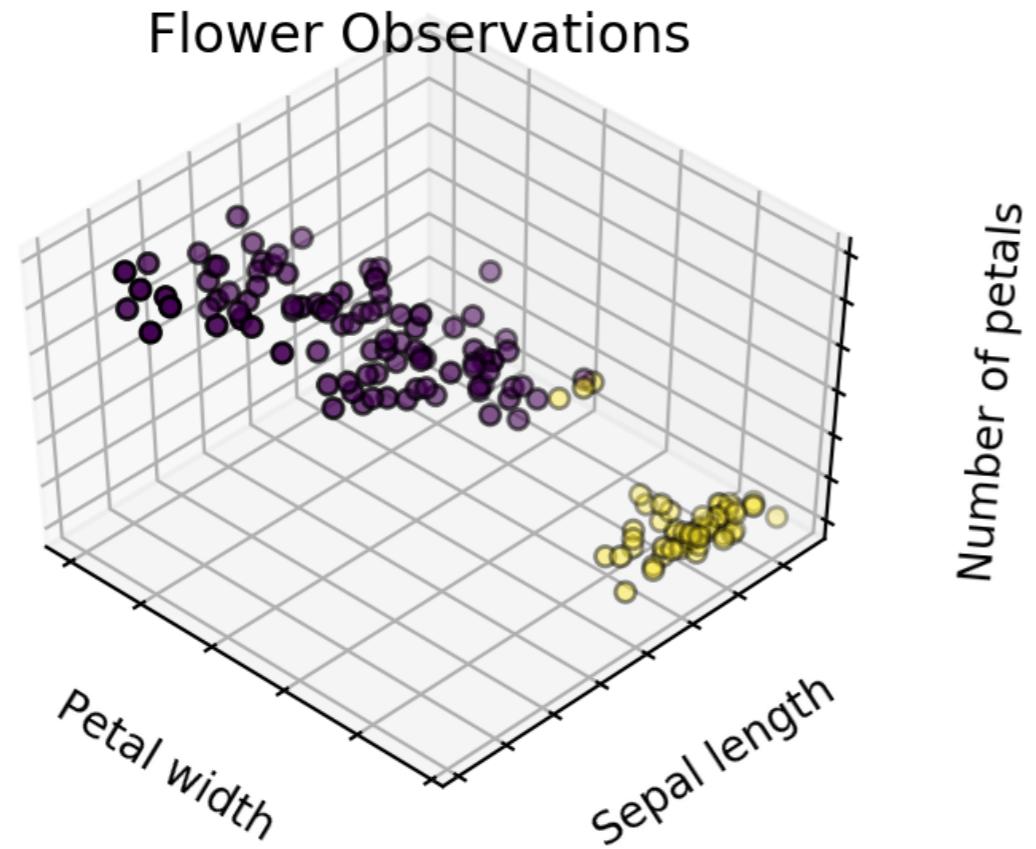


Defining number of clusters

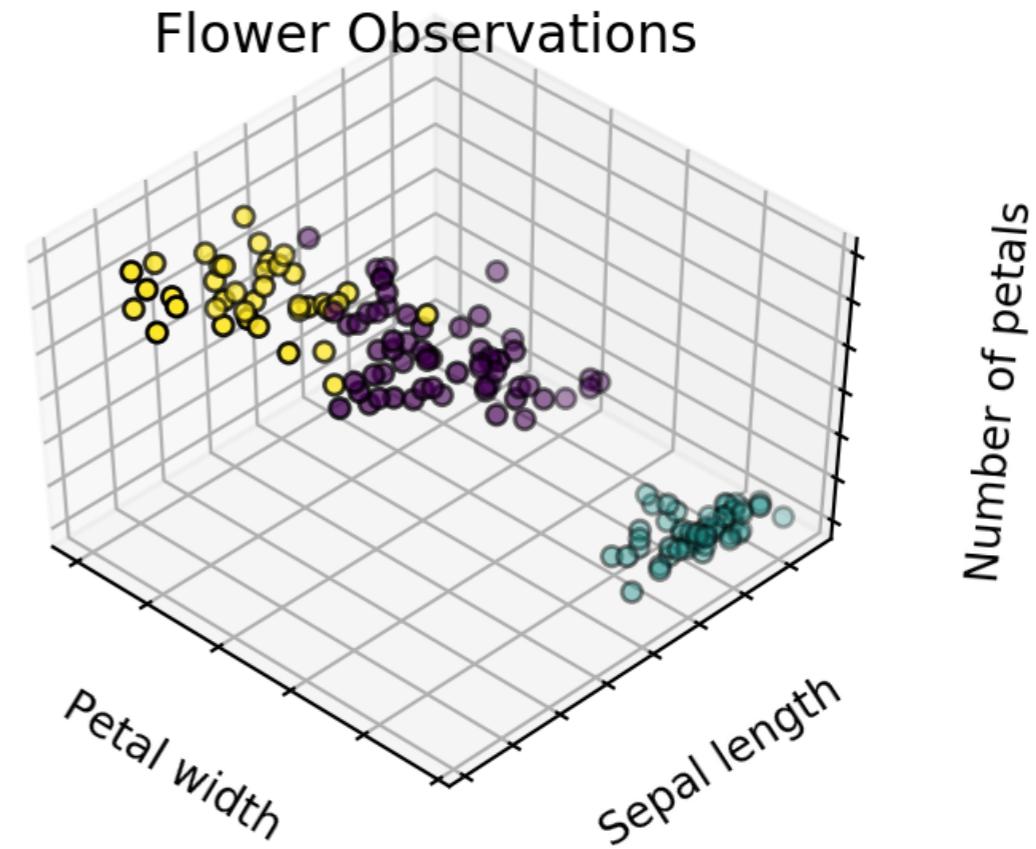


Comparing number of clusters

Two clusters:

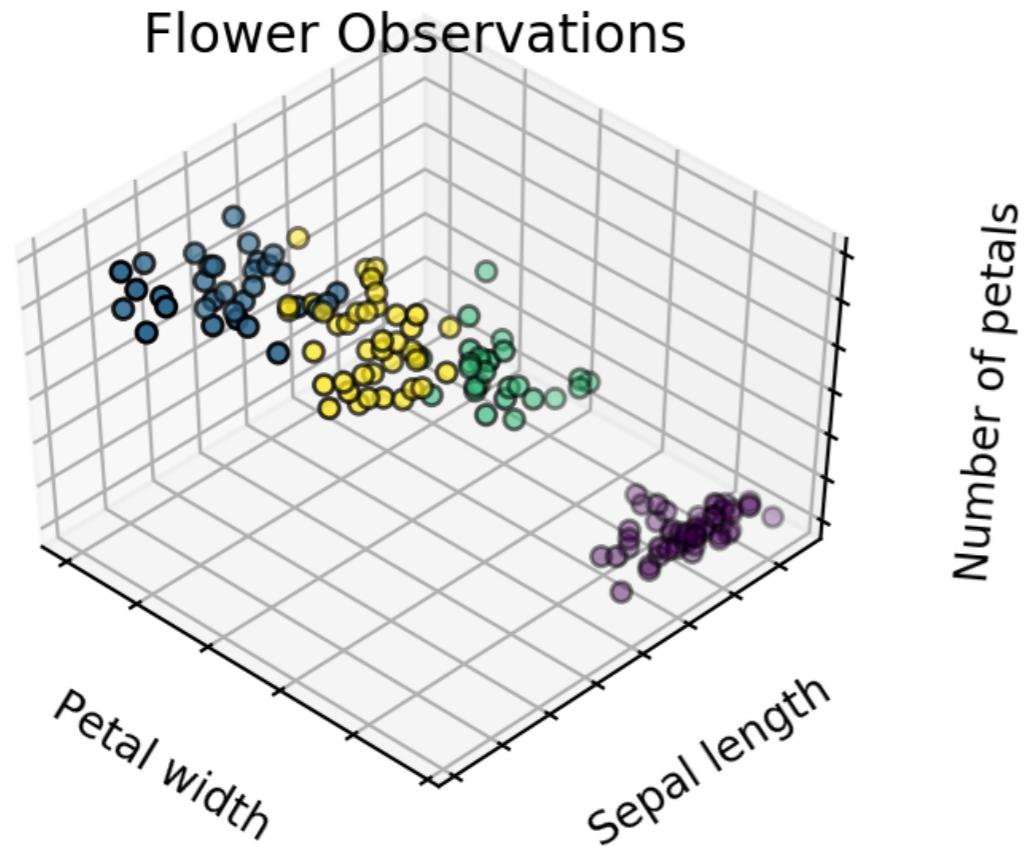


Three clusters:

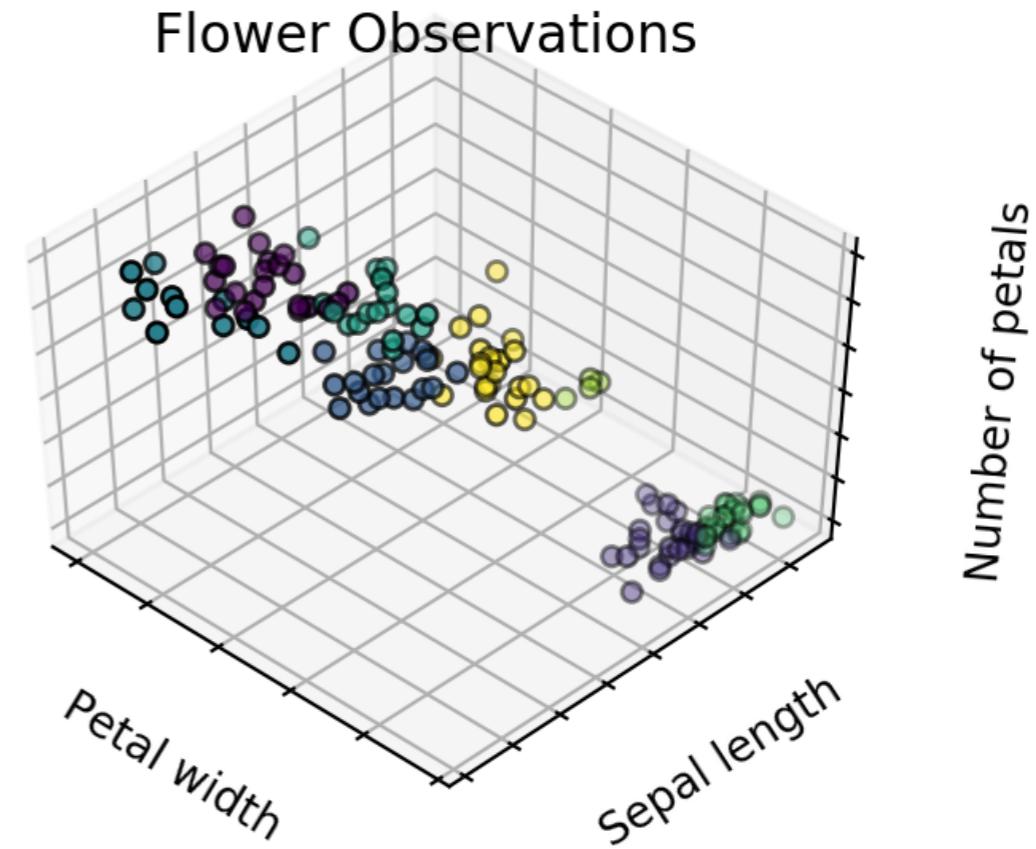


Comparing number of clusters

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

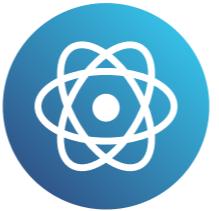
- Select features
- Select number of clusters
- Use clusters to solve problems

Let's practice!

DATA SCIENCE FOR EVERYONE

Congratulations!

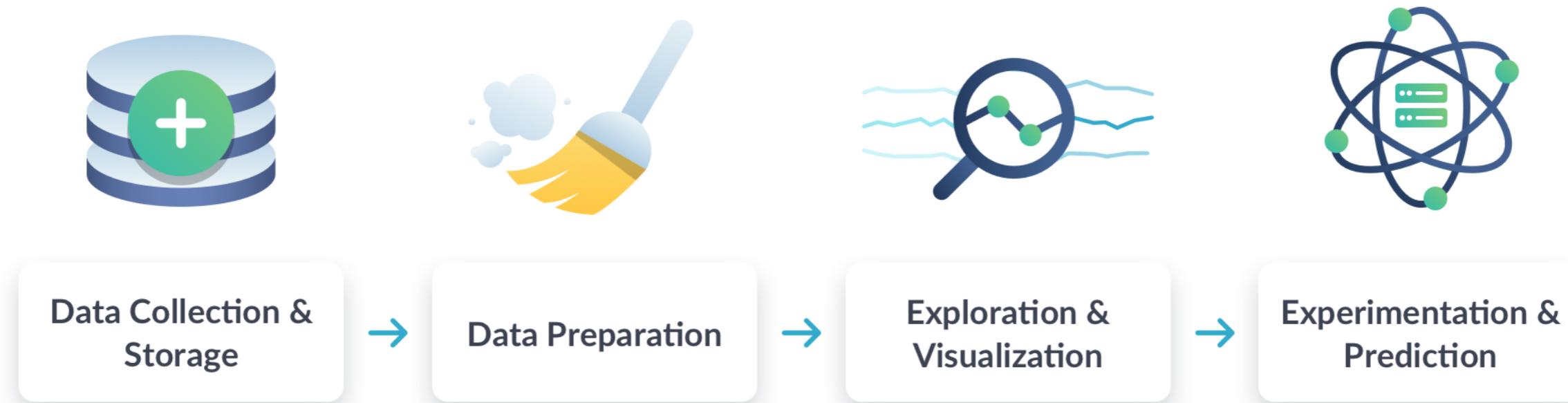
DATA SCIENCE FOR EVERYONE



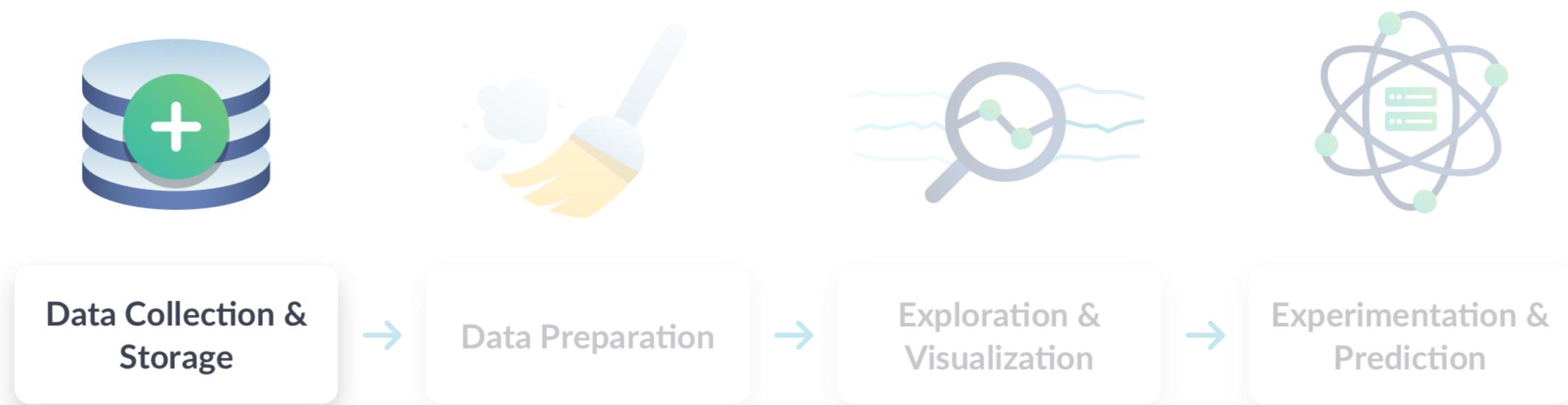
Lis Sulmont

Curriculum Manager, DataCamp

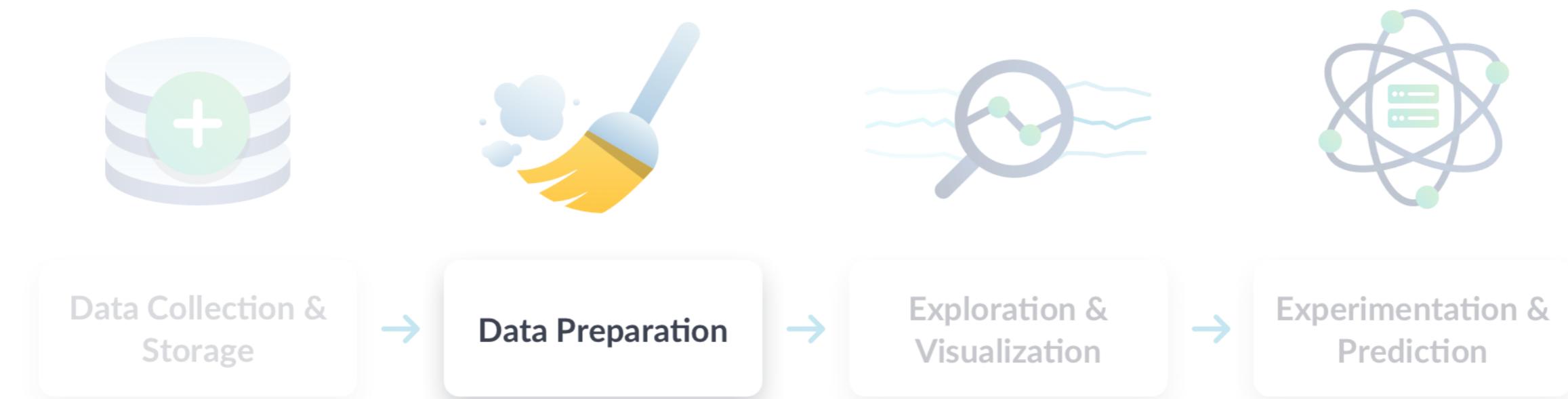
Chap 1: Introduction to Data Science



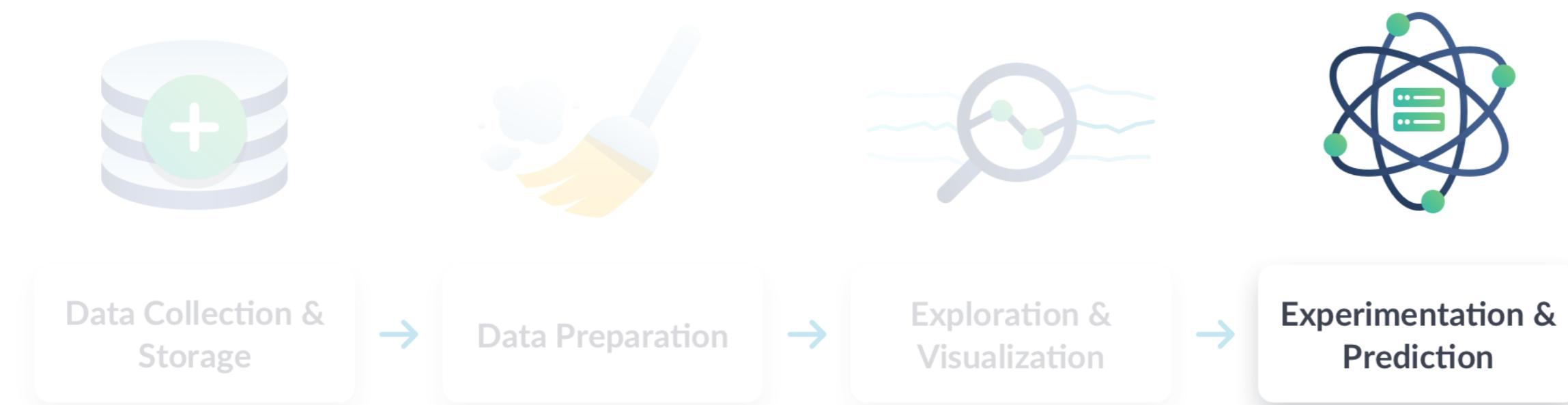
Chap 2: Data Collection and Storage



Chap 3: Preparation, Exploration & Visualization

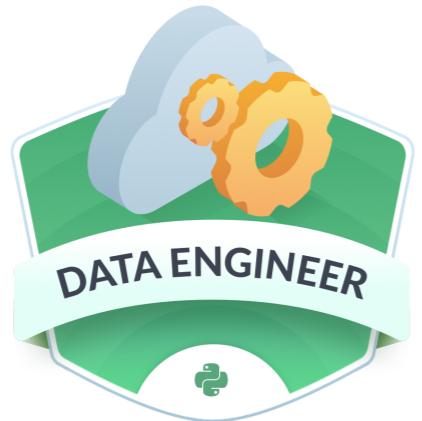


Chap 4: Experimentation and Prediction



What's next?

Data Engineer



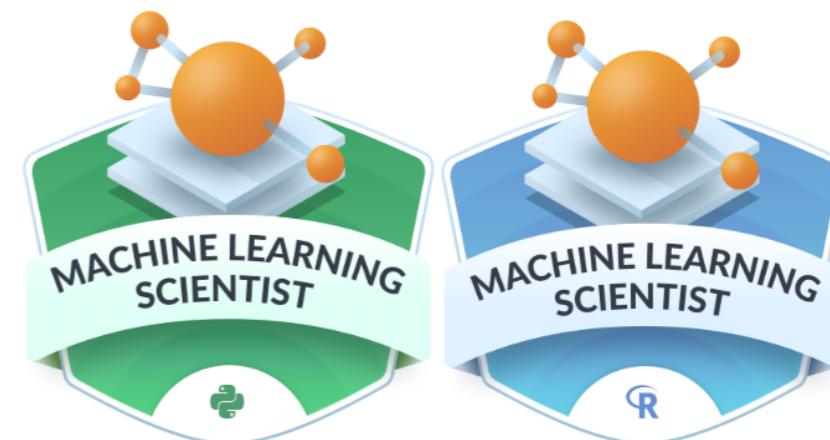
Data Analyst



Data Scientist



Machine Learning Scientist



Let's practice!

DATA SCIENCE FOR EVERYONE