

What is machine learning?

UNDERSTANDING MACHINE LEARNING



Lis Sulmont

Curriculum Manager, DataCamp

AlphaZero beat humans at Chess and StarCraft, now it's working with quantum computers

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AI Blood Test Predicts Neurodegenerative Disease Progression, Severity

Machine Learning Gives Rise to Better Lung Disease Models from Stem Cells

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Amazon is injecting Alexa with more artificial intelligence than ever

How Google Maps uses machine learning to predict bus traffic delays in real time

Machine Learning Gives Rise to Better Lung Disease Models from Stem Cells

This A.I. Bot Writes Such Convincing Ads, Chase Just 'Hired' It to Write Marketing Copy

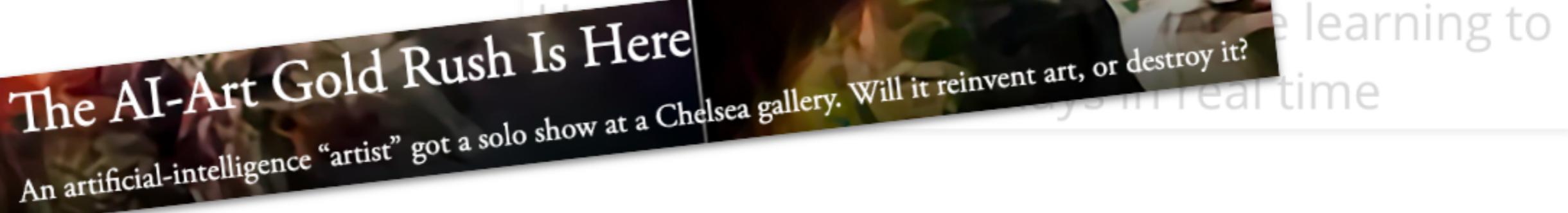
During a trial run, JPMorgan Chase found ads written by the machine learning platform got far more clicks than ads written by humans.

Disease Progression, Severity

Amazon is injecting more artificial intelligence than ever

A.I. is transforming the job interview—and everything after

The AI-Art Gold Rush Is Here

An artificial-intelligence “artist” got a solo show at a Chelsea gallery. Will it reinvent art, or destroy it? 

Waymo's Self-Driving Technology Gets Smarter, Recognizes Billions of Objects Thanks To Content Search

New machine learning algorithm produces "near-perfect" fake human faces

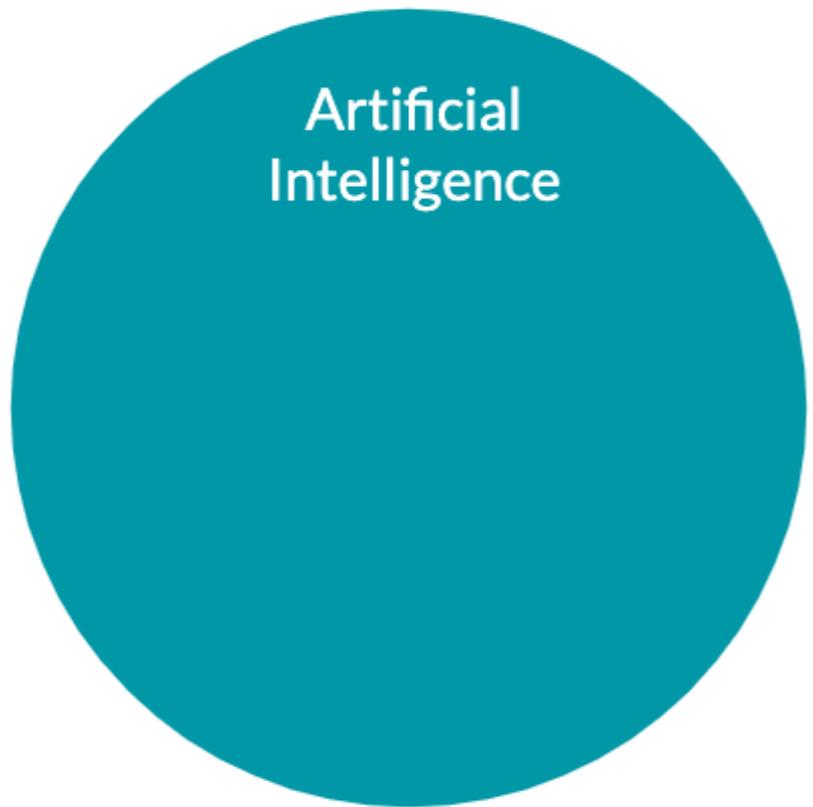
The AI-Art Gold Rush Is Here

An artificial-intelligence "artist" got a solo show at a Chelsea gallery. Will it reinvent art, or destroy it?

White House reportedly aims to double AI research budget to \$2B

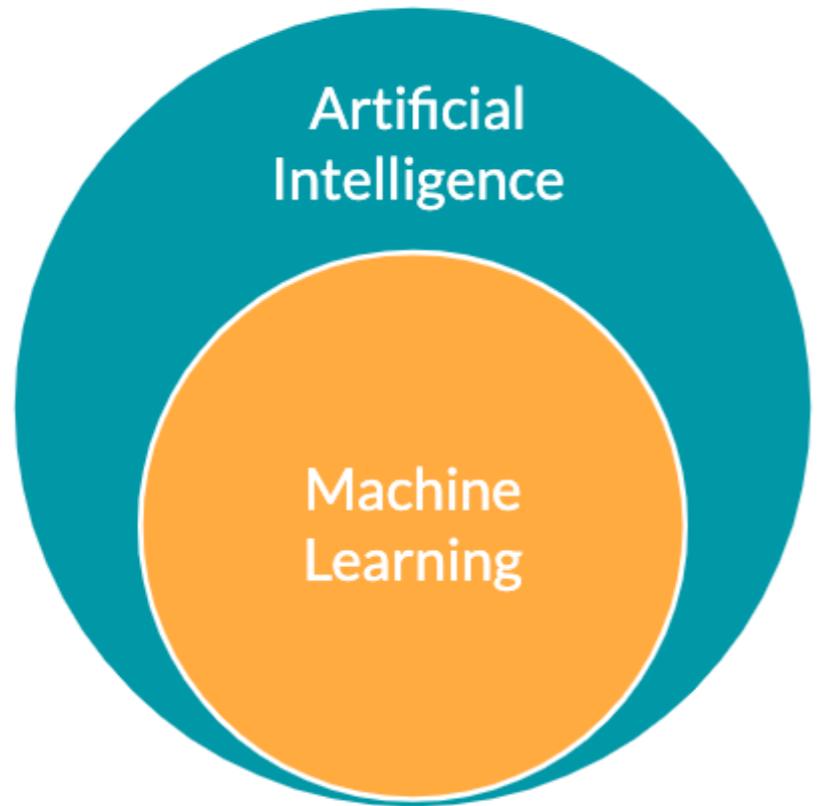
Finland seeks to teach 1% of all Europeans basics on AI

Artificial intelligence (AI)



A huge set of tools for making computers
behave intelligently

Artificial intelligence (AI)

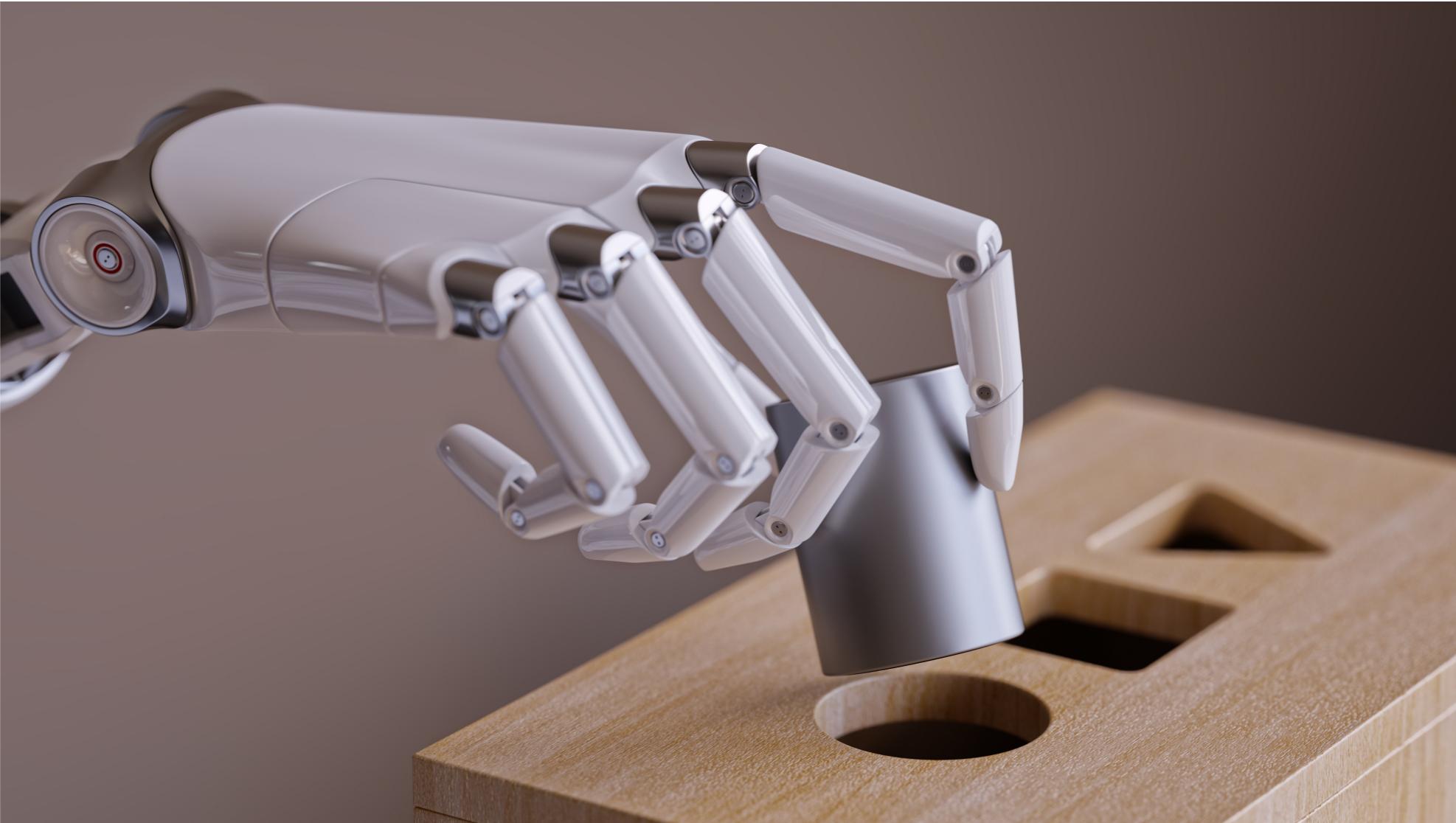


A huge set of tools for making computers behave intelligently

Machine learning is the most prevalent subset of AI

Defining machine learning:

A set of tools for making inferences and predictions from data



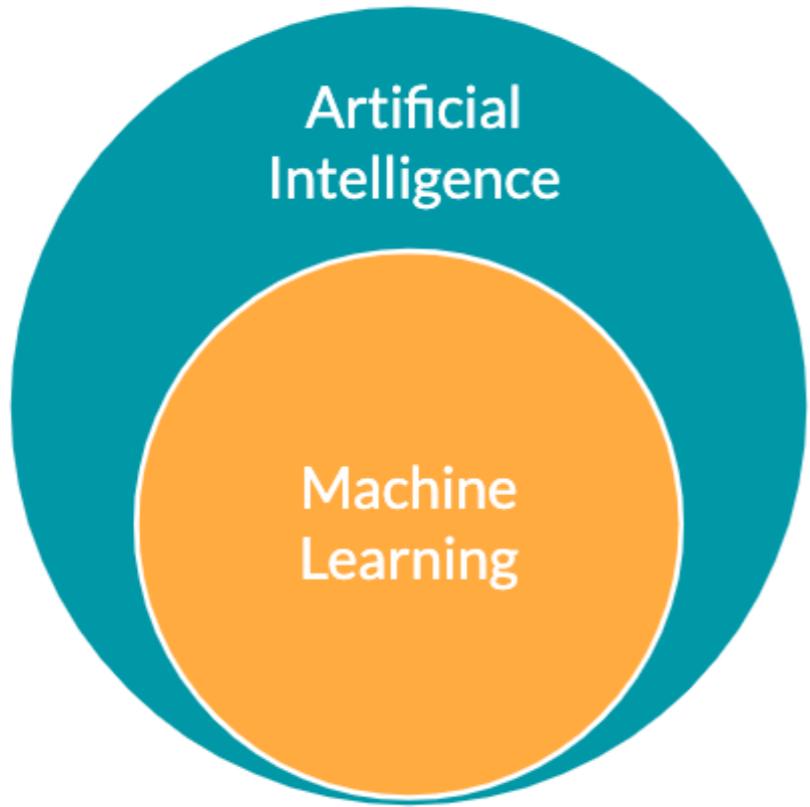
Defining machine learning: what can it do?

- Predict future events
 - *Will it rain tomorrow?*
 - Yes (75% probability)
- Infer the causes of events and behaviors
 - *Why does it rain?*
 - Time of the year, humidity levels, temperature, location, etc
- Infer patterns
 - *What are the different types of weather conditions?*
 - Rain, sunny, overcast, fog, etc

Defining machine learning: how does it work?

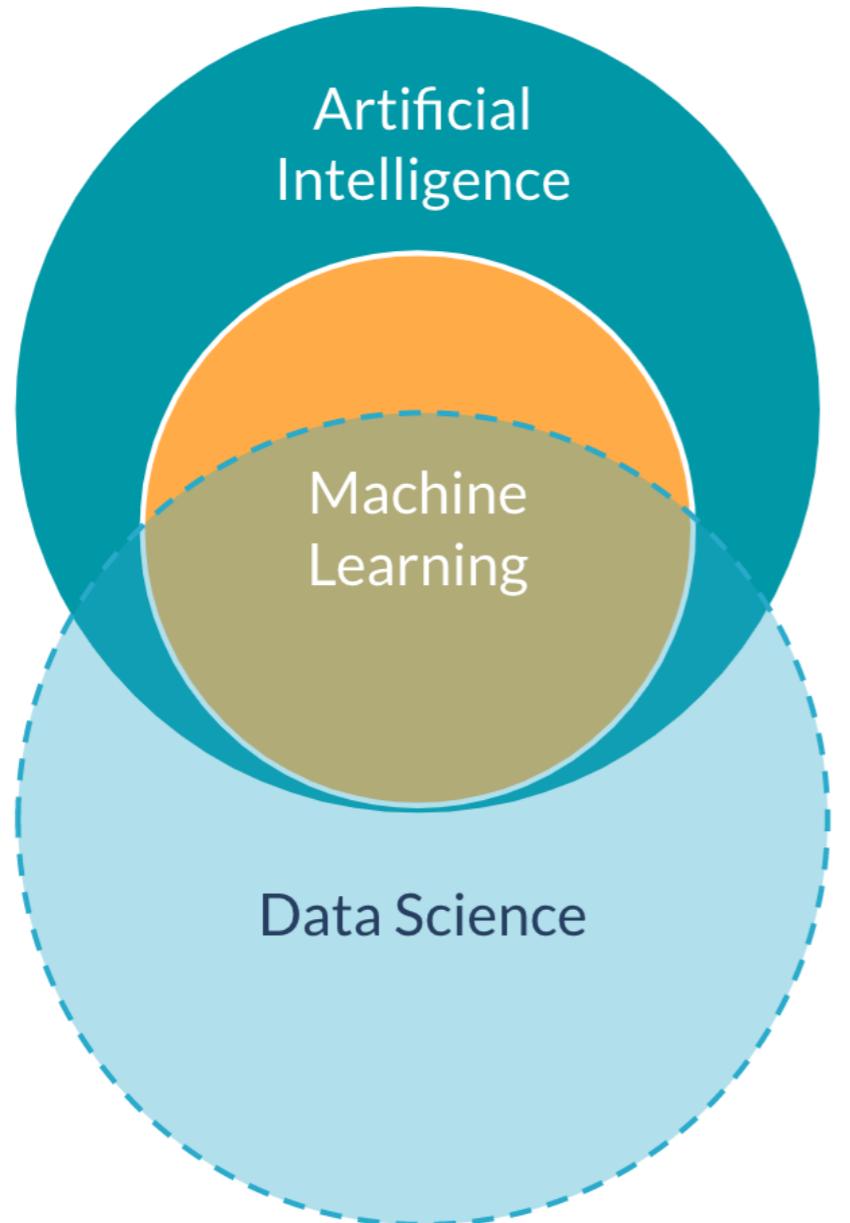
- Interdisciplinary mix of statistics and computer science
- Ability to learn without being explicitly programmed
- Learn patterns from existing data and applies it to new data
- Relies on high-quality data
- ... more to come throughout the course!

Data science



Data science is about discovering and communicating insights from data

Data science

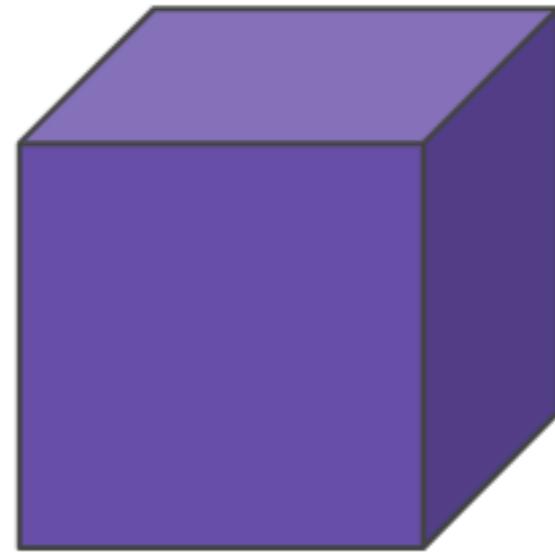


Data science is about making discoveries and creating insights from data

Machine learning is often an important tool for data science work

Machine learning model

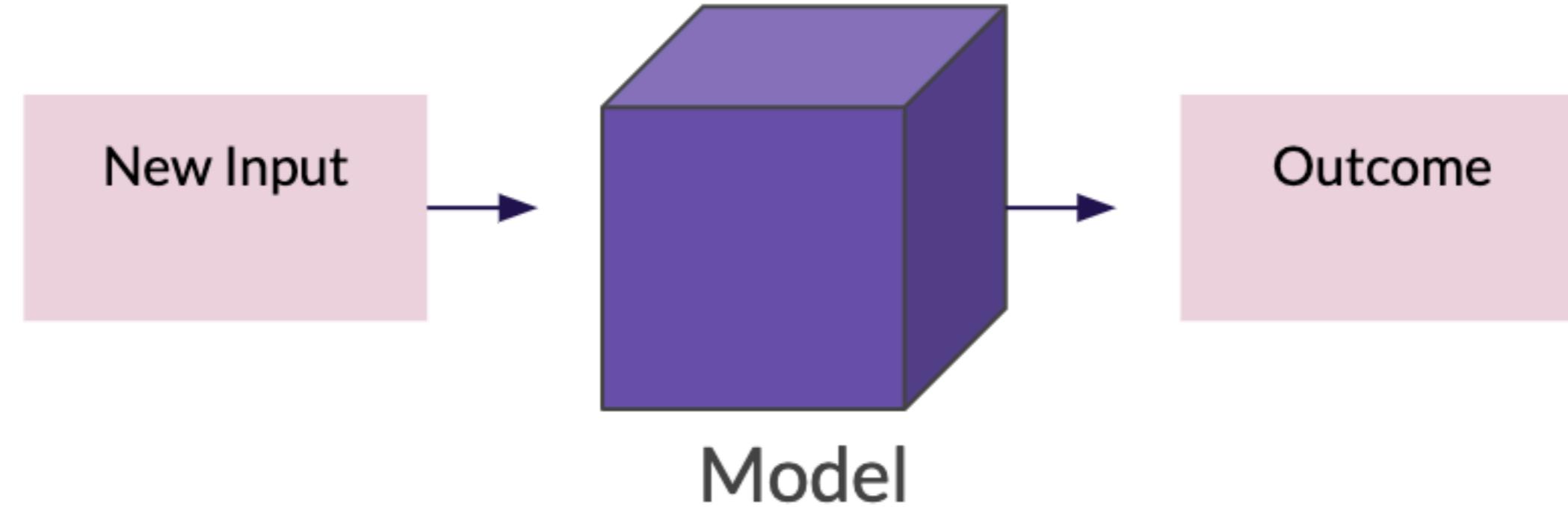
A statistical representation of a real-world process based on data



Model

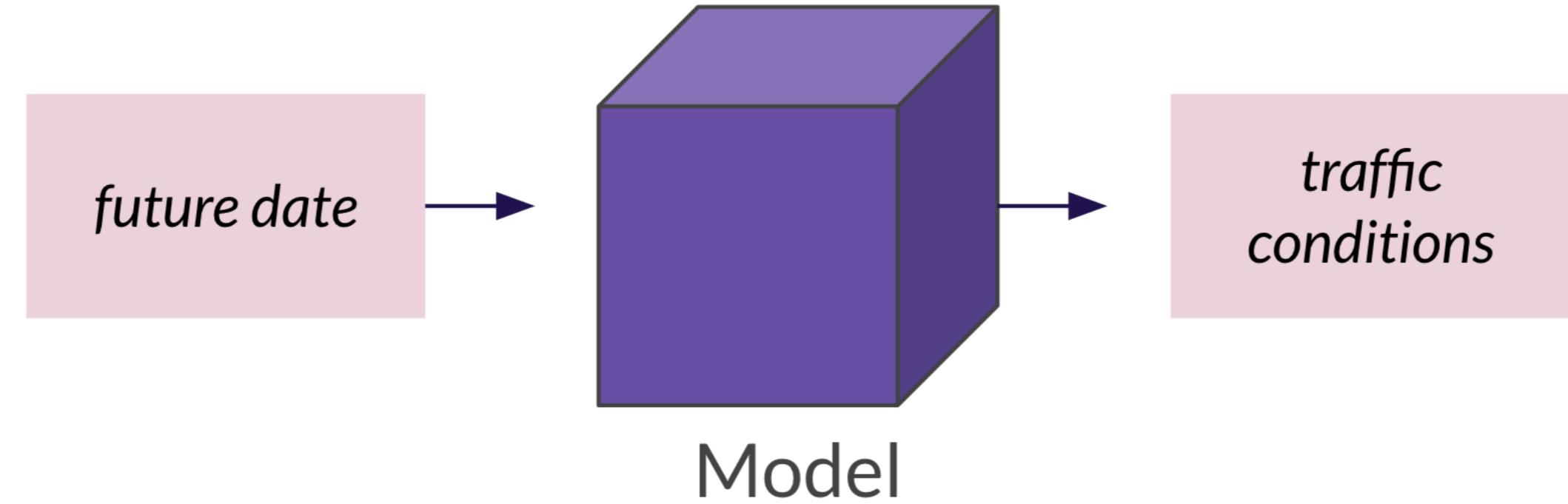
Machine learning model

A statistical representation of a real-world process based on data



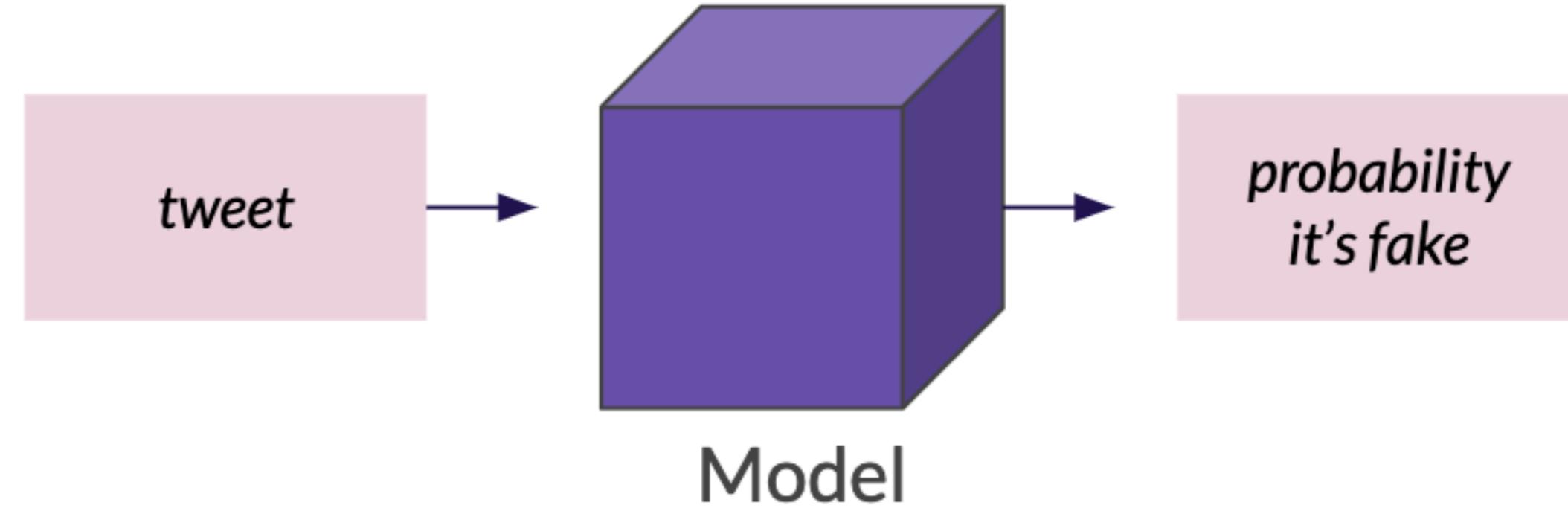
Machine learning model

A statistical representation of a real-world process based on data



Machine learning model

A statistical representation of a real-world process based on data



Let's practice!

UNDERSTANDING MACHINE LEARNING

Machine learning concepts

UNDERSTANDING MACHINE LEARNING



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Three types of machine learning

- 1) Reinforcement learning**
- 2) Supervised learning**
- 3) Unsupervised learning**

Training data

- **Training data:** existing data to learn from
- **Training a model:** when a model is being built from training data
 - Can take nanoseconds to weeks

Supervised learning training data

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
55	M	221	5	True	typical angina	118	True
50	F	196	0	False	non-anginal pain	98	False
53	F	215	0	True	asymptomatic	110	True
62	M	245	3	False	typical angina	126	True
48	M	190	0	True	non-anginal pain	99	False
70	M	201	0	True	typical angina	105	False

Supervised learning training data

Target Variable

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
55	M	221	5	True	typical angina	118	True
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Supervised learning training data

Target Variable

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
55	M	221	5	True	typical angina	118	True Labels
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Supervised learning training data

Observations or Examples	Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
→	55	M	221	5	True	typical angina	118	True
→	50	F	196	0	False	non-anginal pain	98	False
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Supervised learning training data

Features

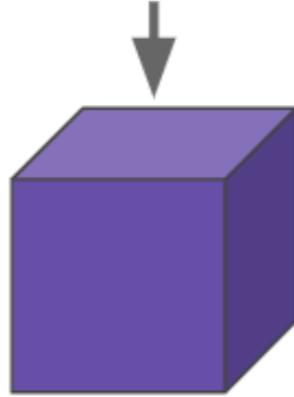
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After training (supervised learning)

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
65	F	208	2	False	typical angina	105	???

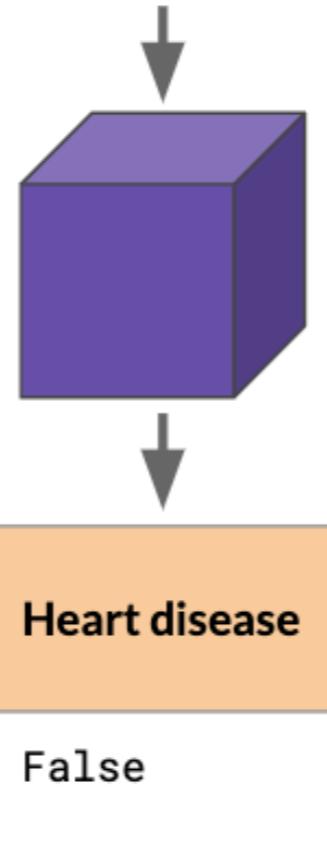
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After training (supervised learning)

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
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Supervised vs unsupervised learning

- **Supervised learning**
 - Training data is "labeled"
- **Unsupervised learning**
 - Training data only has features
 - Useful for:
 - Anomaly detection
 - Clustering, e.g., *dividing data into groups*

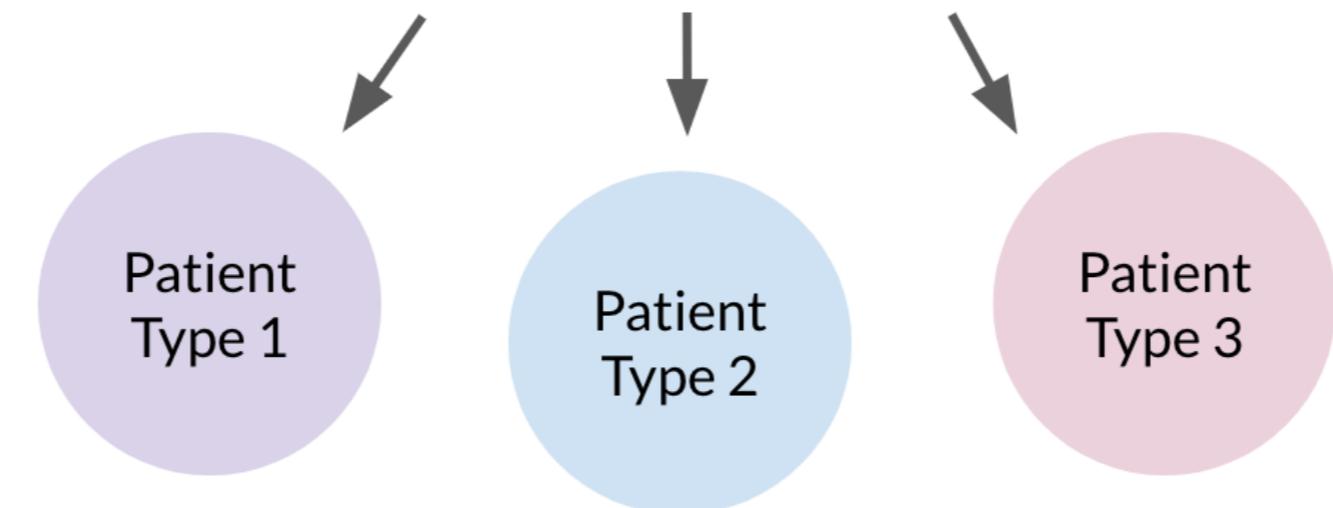
Target Variable	
Blood sugar	Heart disease
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98	False
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Unsupervised learning training data

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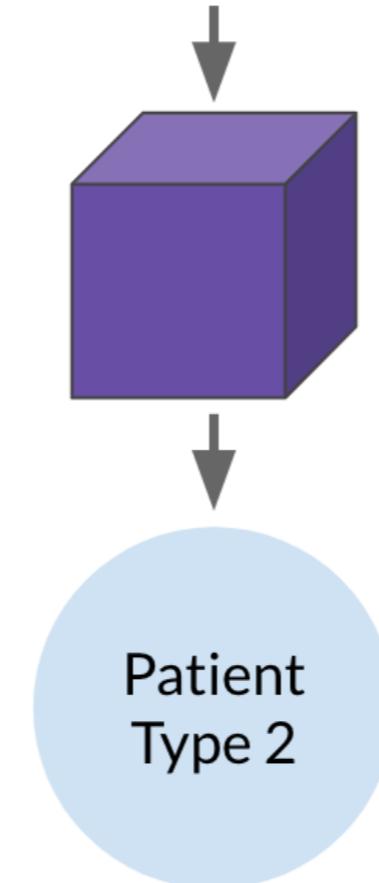
Unsupervised learning training data

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After training (unsupervised learning)

Age	Sex	Cholesterol	Cigarettes per day	Family history of heart disease	Chest pain type	Blood sugar	Heart disease
65	F	208	2	False	typical angina	105	True



Unsupervised Learning

- In reality, data doesn't always come with labels
 - Requires manual labor to label
 - Labels are unknown
- No labels: model is unsupervised and finds its own patterns

Let's practice!

UNDERSTANDING MACHINE LEARNING

Machine learning workflow

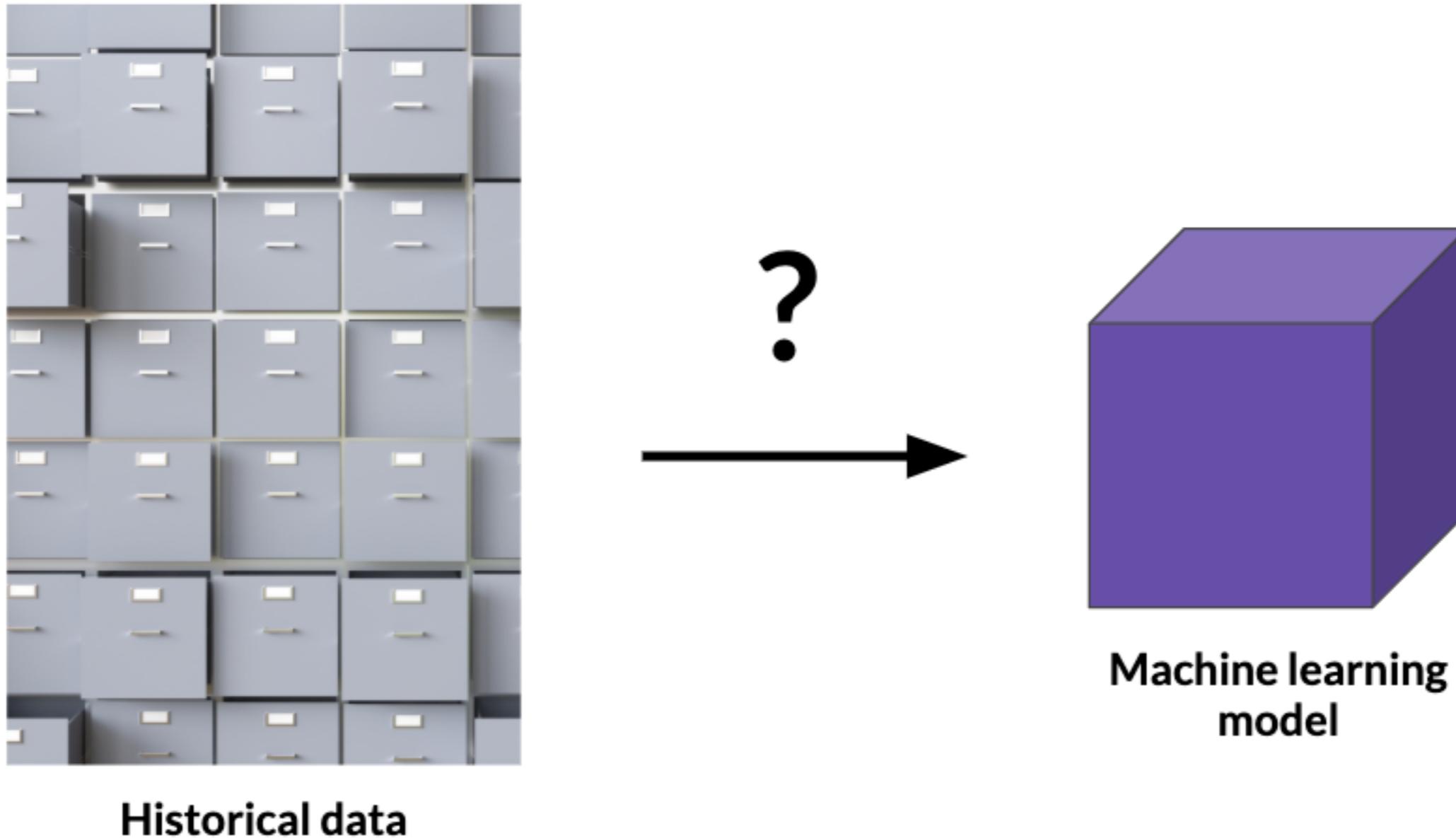
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Machine learning workflow



Our scenario



Our dataset: NYC property sales from 2015-2019

Includes:

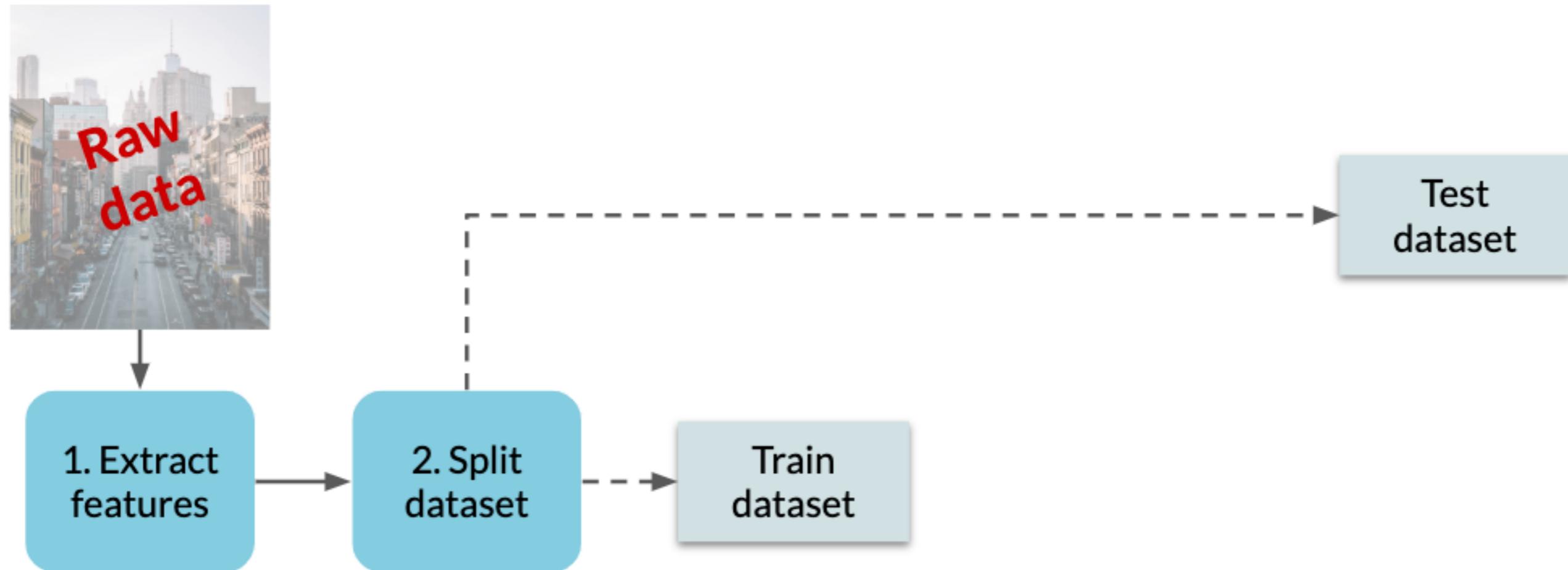
- Square feet
- Neighborhood
- Year built
- Sale price
- And more!

Our target: Sale price

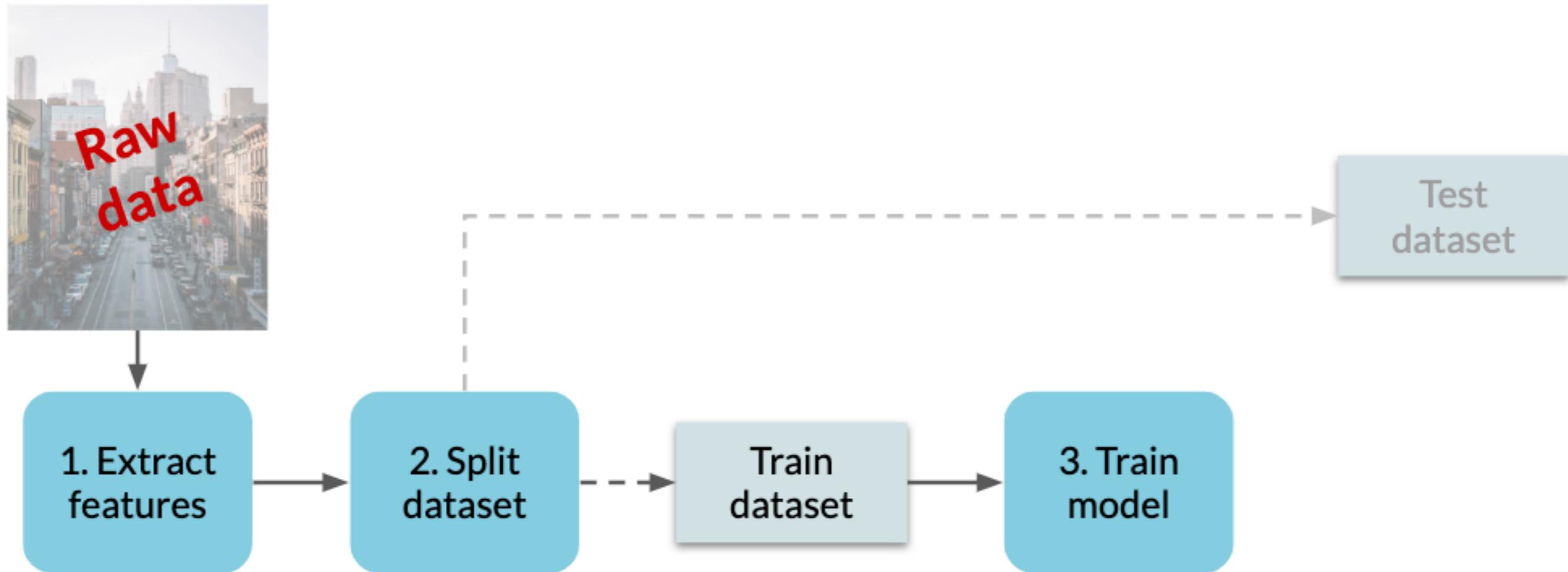
Step 1: Extract features



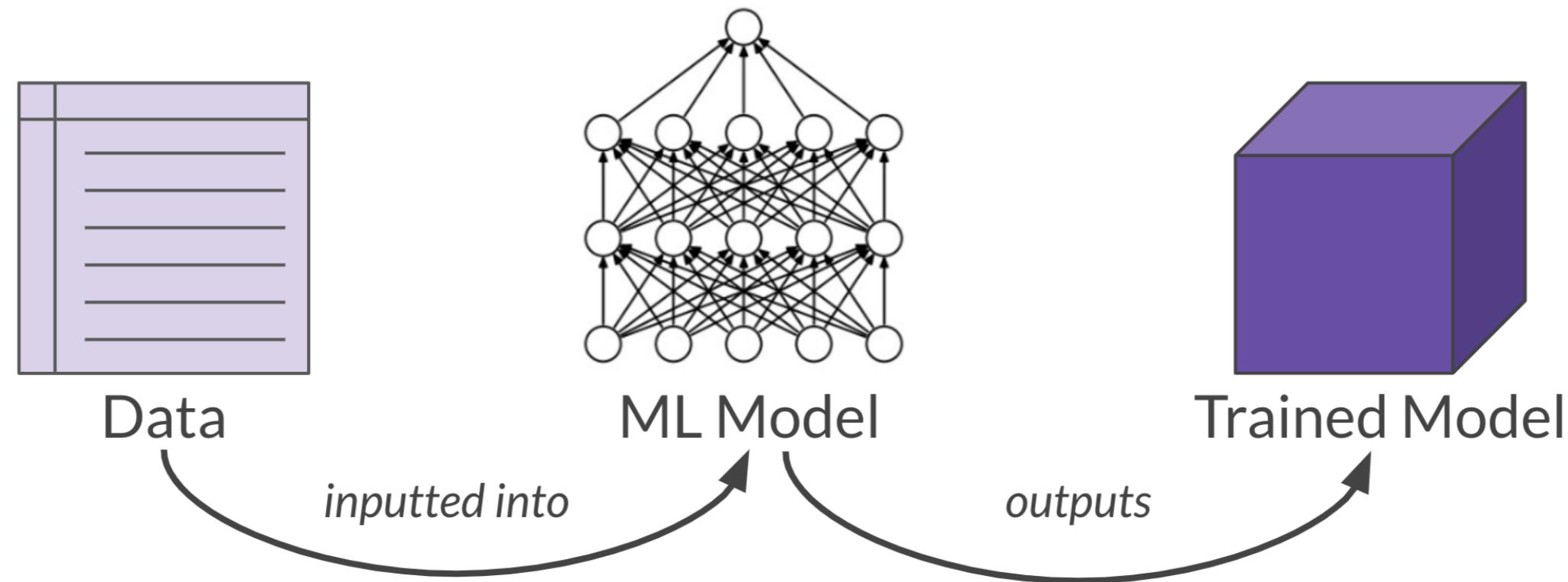
Step 2: Split dataset



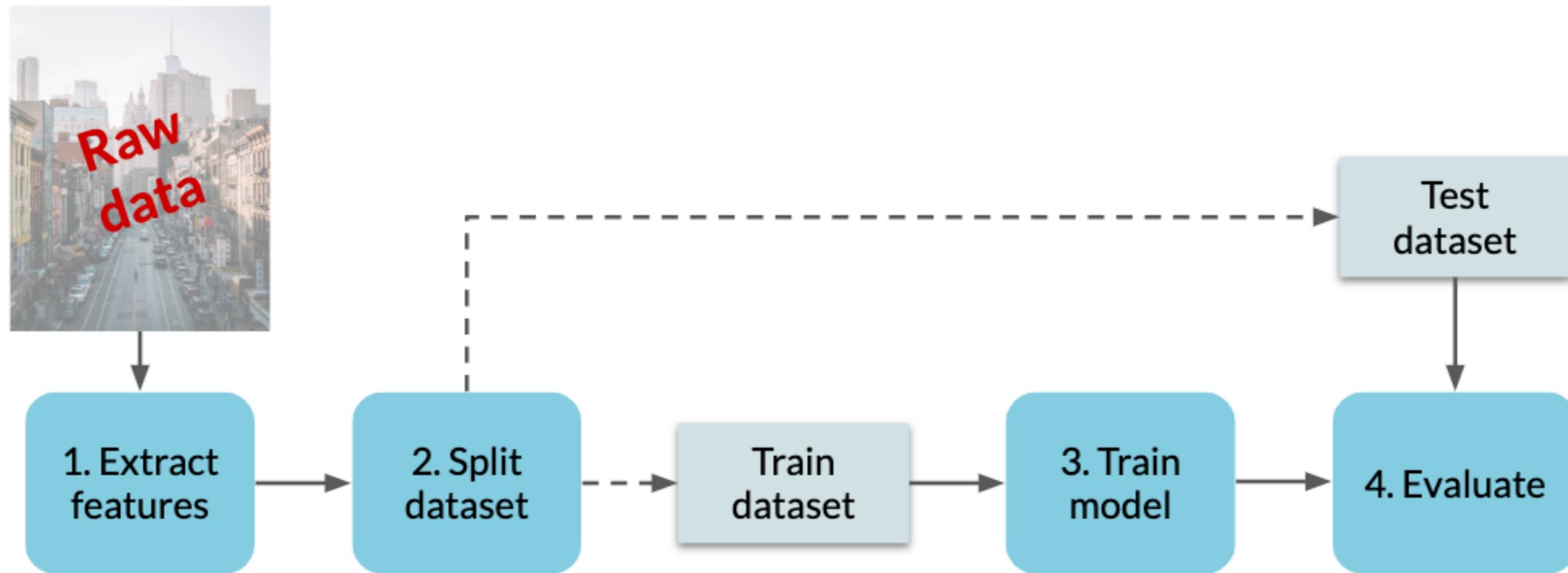
Step 3: Train model



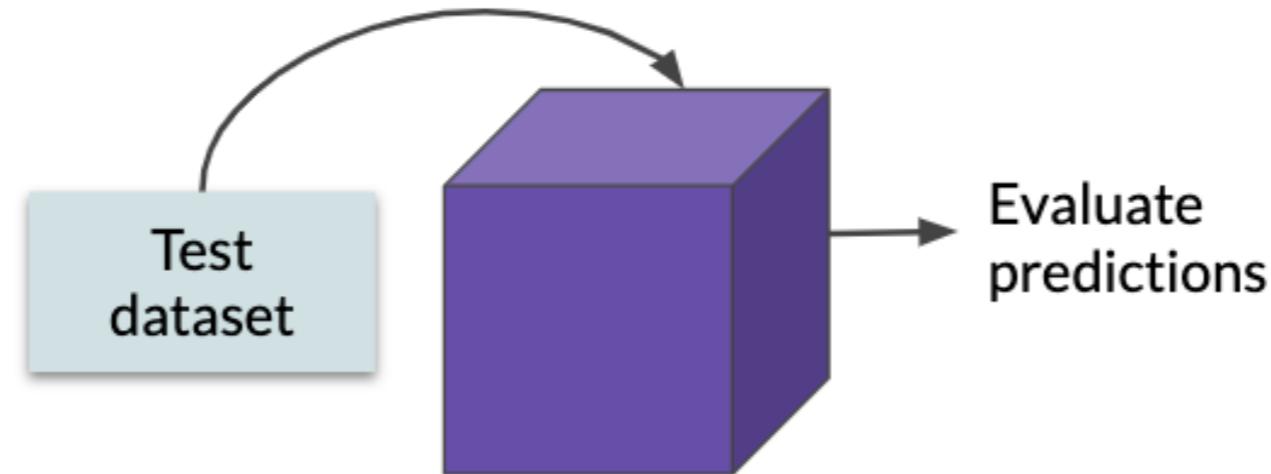
Step 3: Train model



Step 4: Evaluate

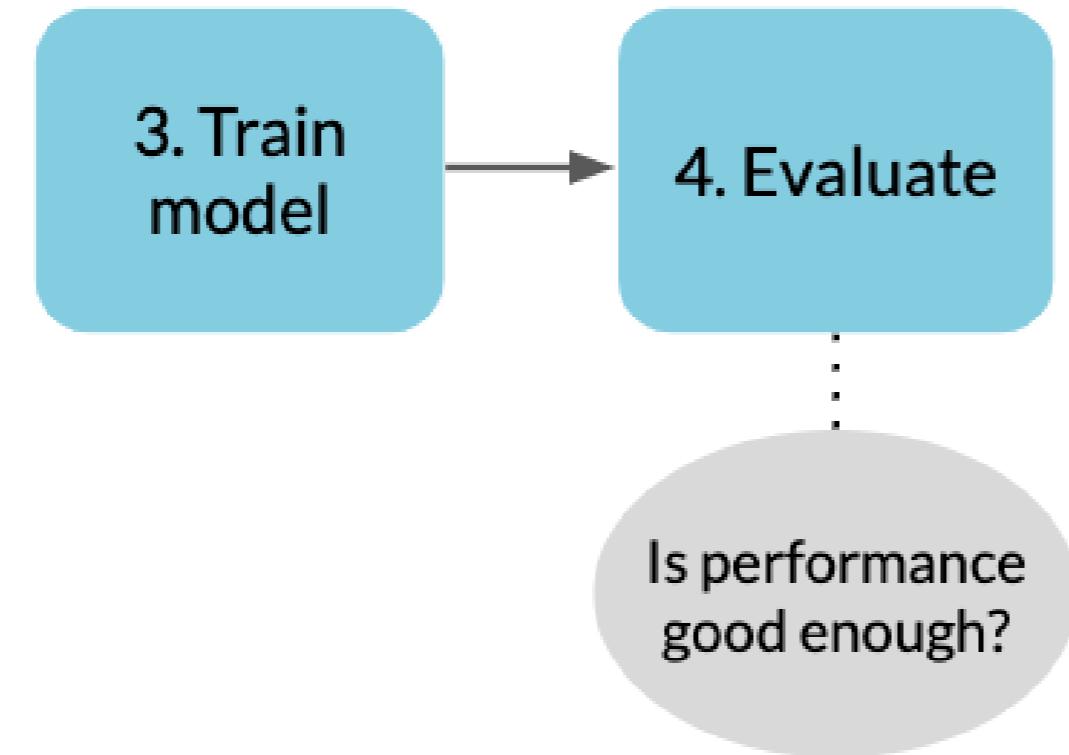


Step 4: Evaluate

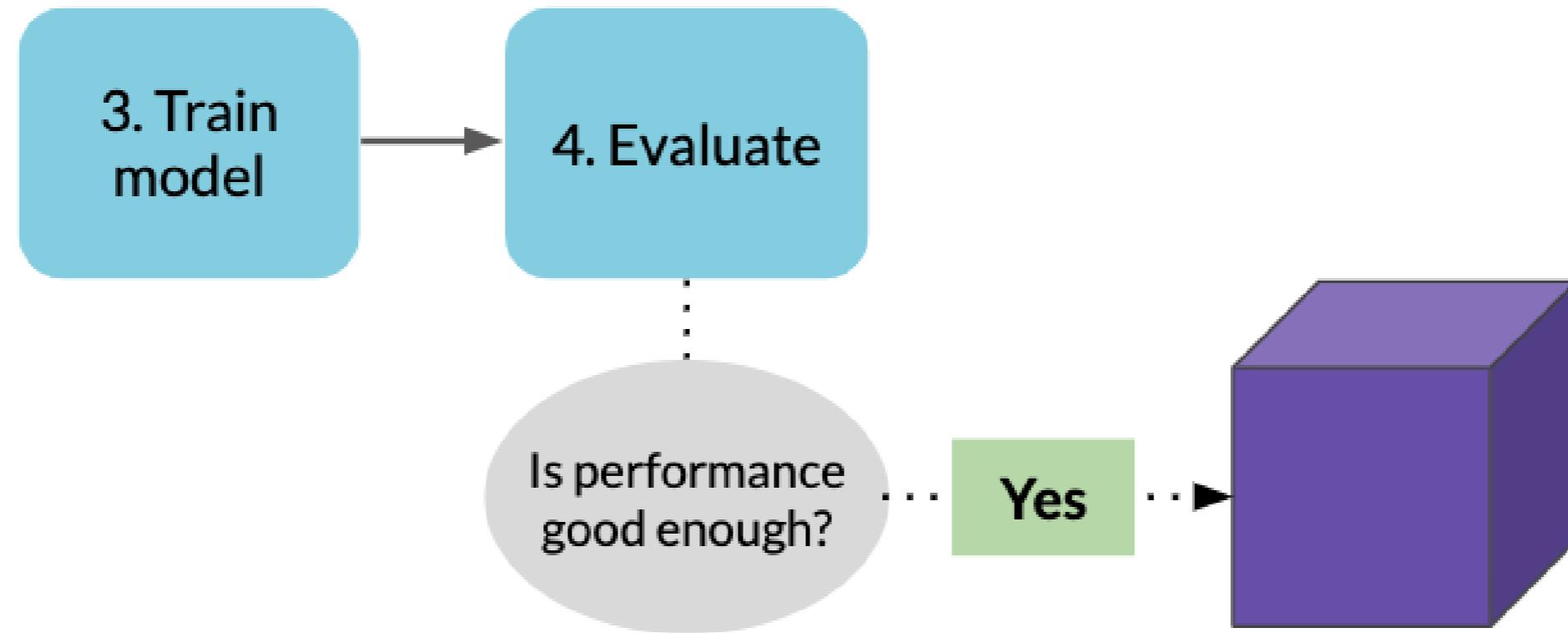


- Test dataset: "unseen" data
- Many ways to evaluate:
 - What is the average error of the predictions?
 - What percent of apartments did the model accurately predict within a 10% margin?

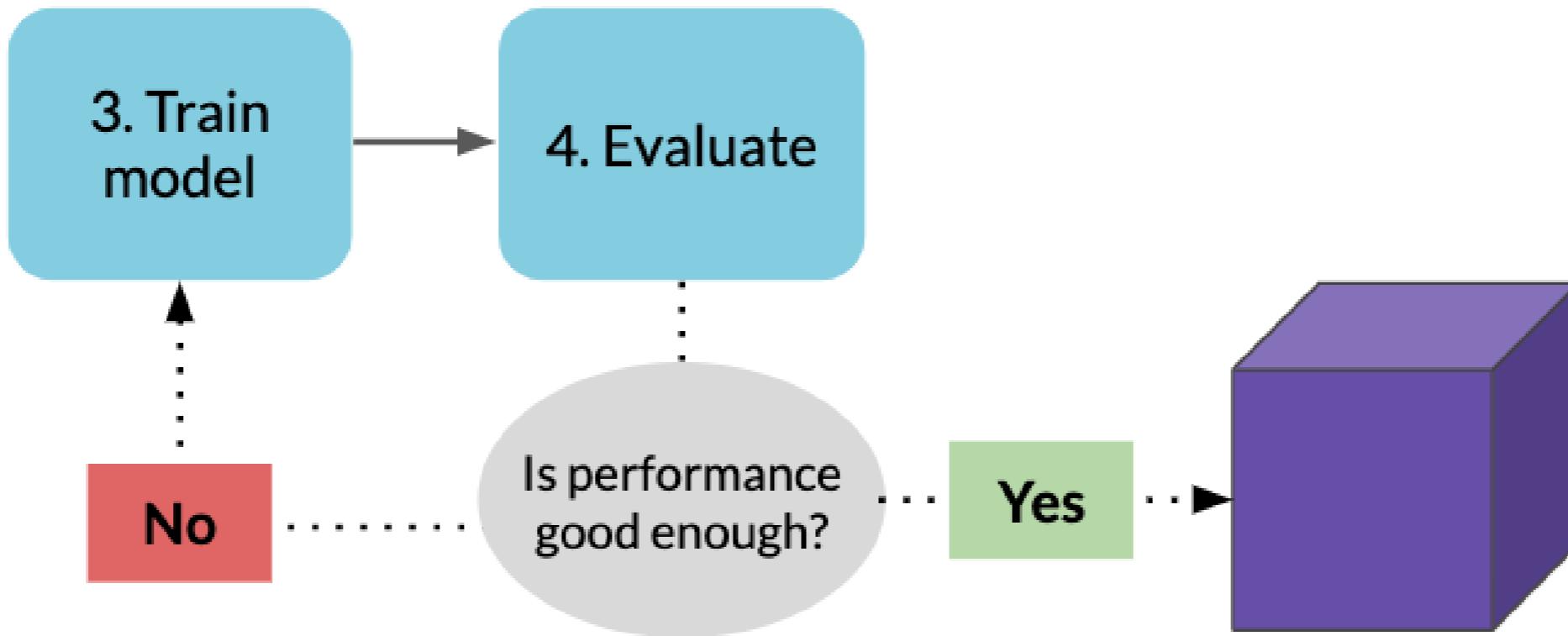
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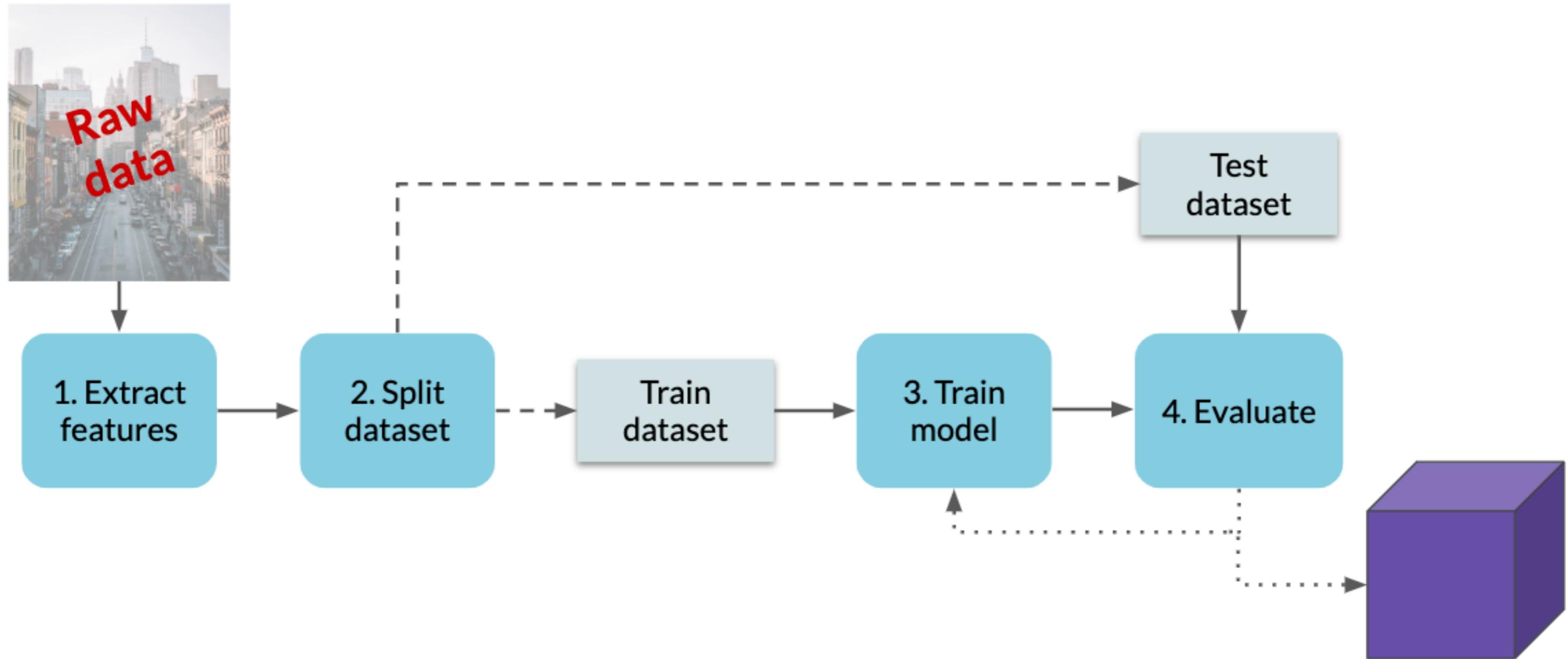


Step 4: Evaluate



- If not, tune the model and re-train it:
 - e.g., change the model's options, add/remove features

Machine learning workflow



Summary of steps

1. Extract features
 - Choosing features and manipulating the dataset
2. Split dataset
 - Train and test dataset
3. Train model
 - Input train dataset into a machine learning model
4. Evaluate
 - *If desired performance isn't reached:* tune the model and repeat Step 3

Let's practice!

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