Introduction to machine learning

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Outline

- What is machine learning?
- Examples of machine learning
- Types of machine learning
- Introducing the basics, machine learning pipeline

What is machine learning?

Definition 1

Improve the performance of a software system, based on previous experience.

Definition 2

Set of methods that can automatically detect patterns in data, and then use the uncovered patterns to predict future data, or to perform other kinds of decision making under uncertainty. - Kevin P. Murphy

Machine learning everywhere

Figure: Document classification and email spam filtering

Machine learning everywhere

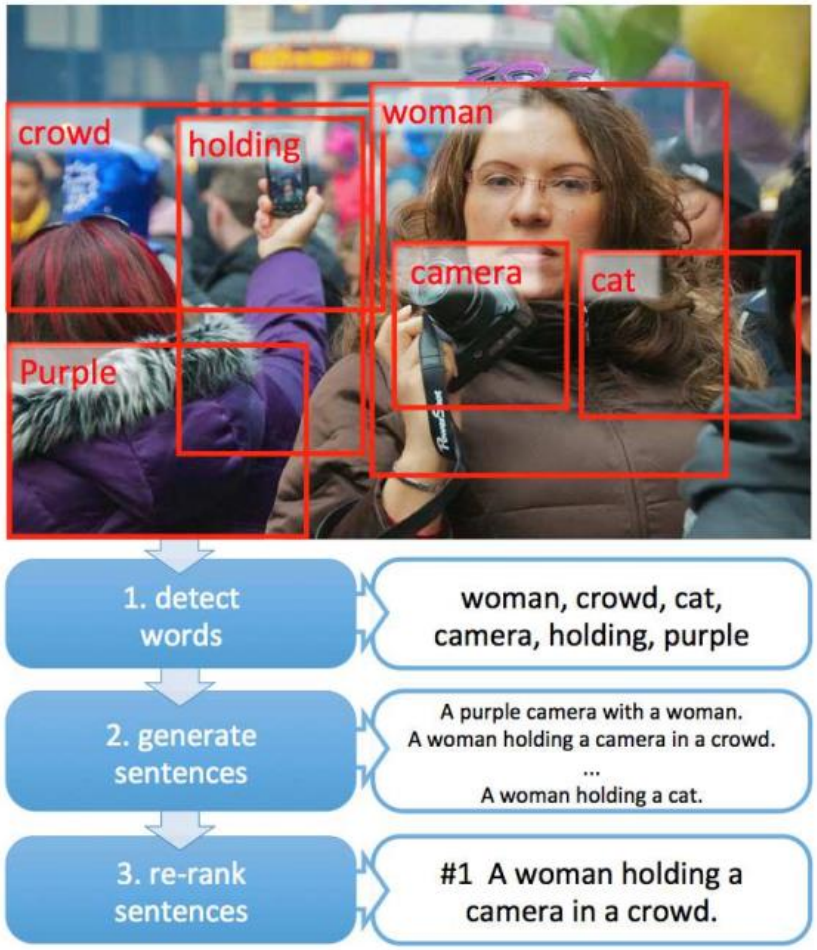

Figure: Image classification

Machine learning everywhere

Figure: Style transfer

Machine learning everywhere

Figure: Skype translator

Machine learning everywhere

This person does not exist!!

Figure: Image Synthesis

Machine learning everywhere

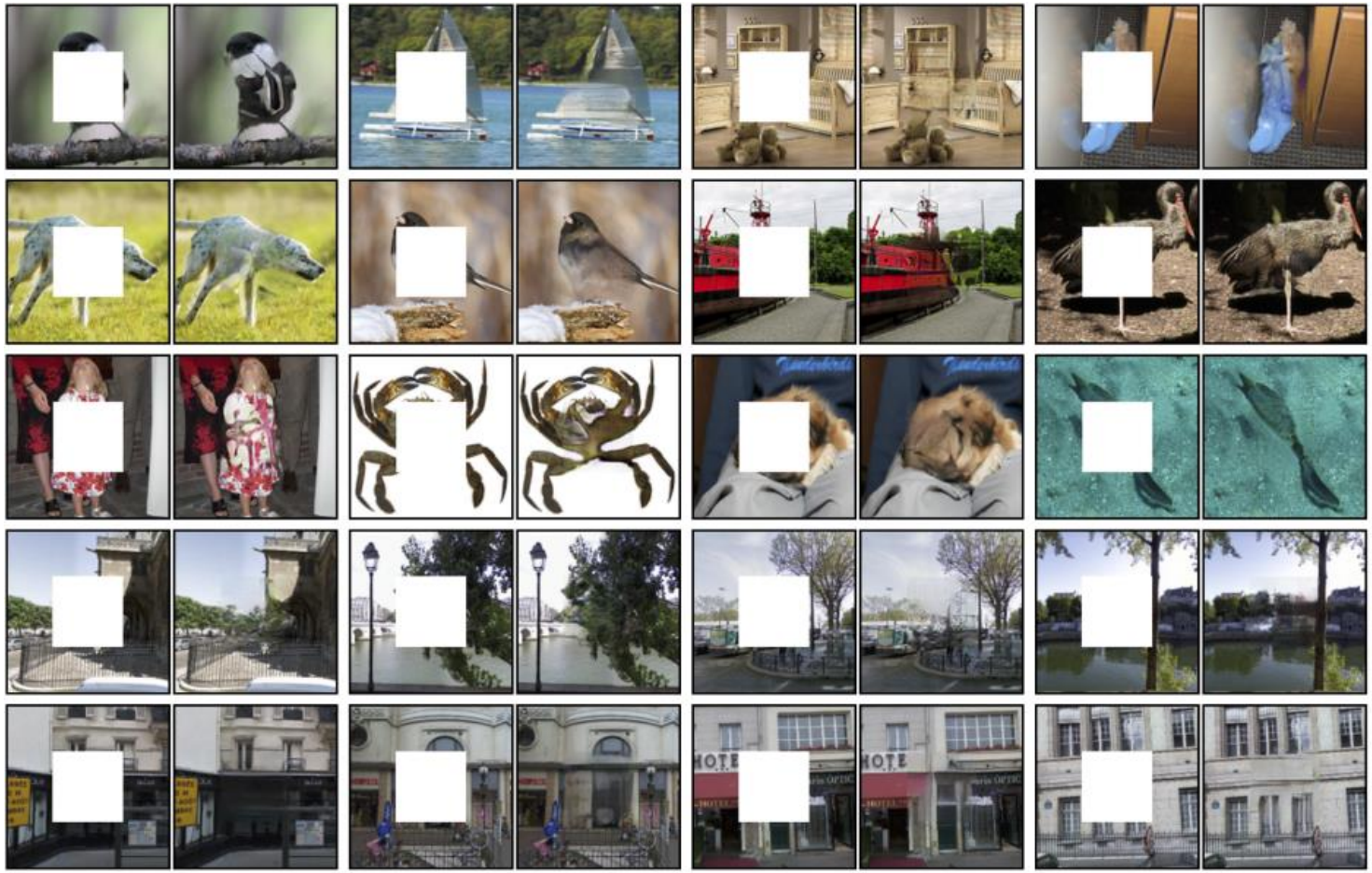

Figure: Image impainting

Machine learning everywhere

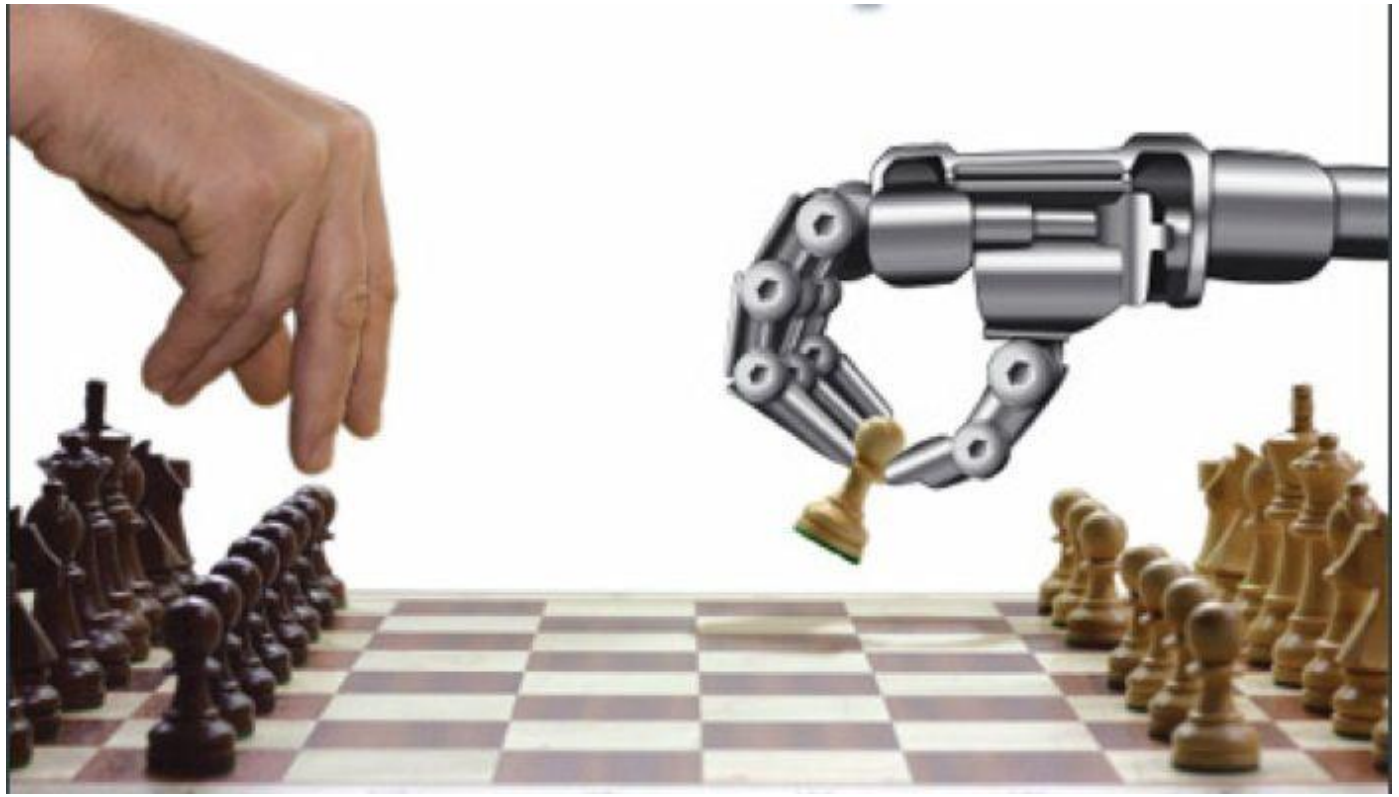

Figure: Playing chess

Key elements for machine learning

Machine learning is used when

- There is a pattern
- We can not pin it down mathematically
- We have data on it

Which is the most important of the three?

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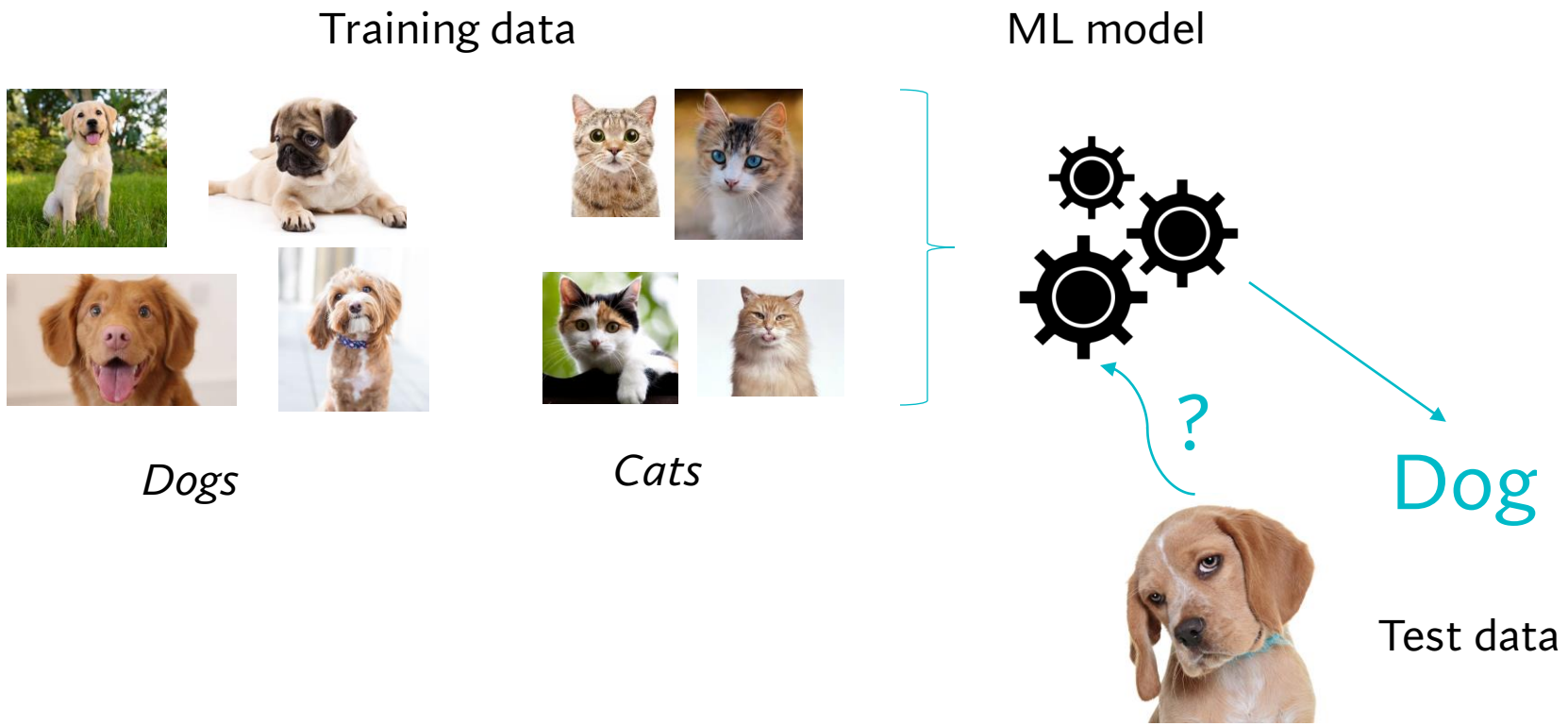
Which is the most important of the three? That's why we also call it data science

Types of machine learning

- **Supervised learning:** Given some data x, we want to learn a target y. Regression and classification.

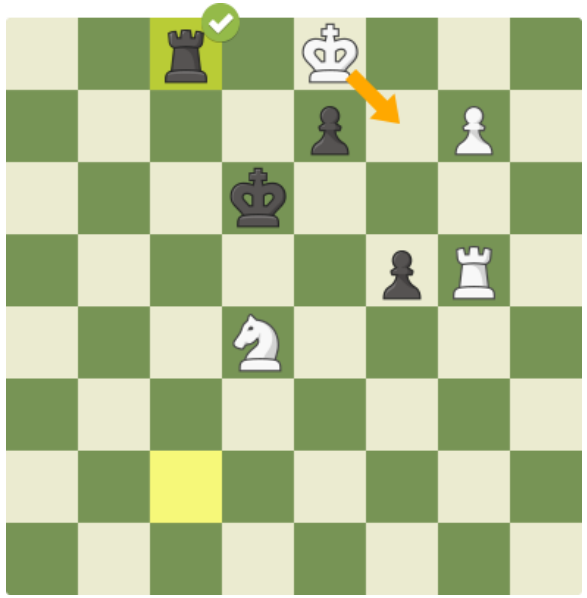


Types of machine learning

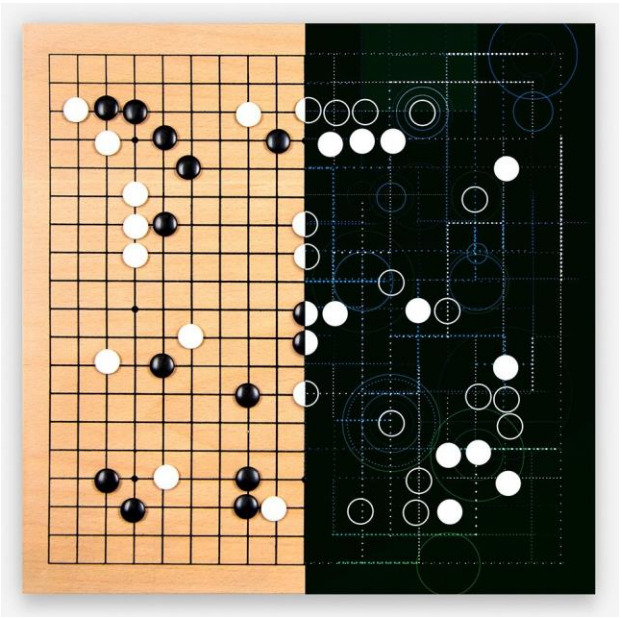
- **Unsupervised learning:** Given some data x, we find somethig useful about their structure. There is NO label y.

Types of machine learning

- **Reinforcement learning:** Consists of finding optimal strategies to perform certain tasks.



Chess



Alpha go

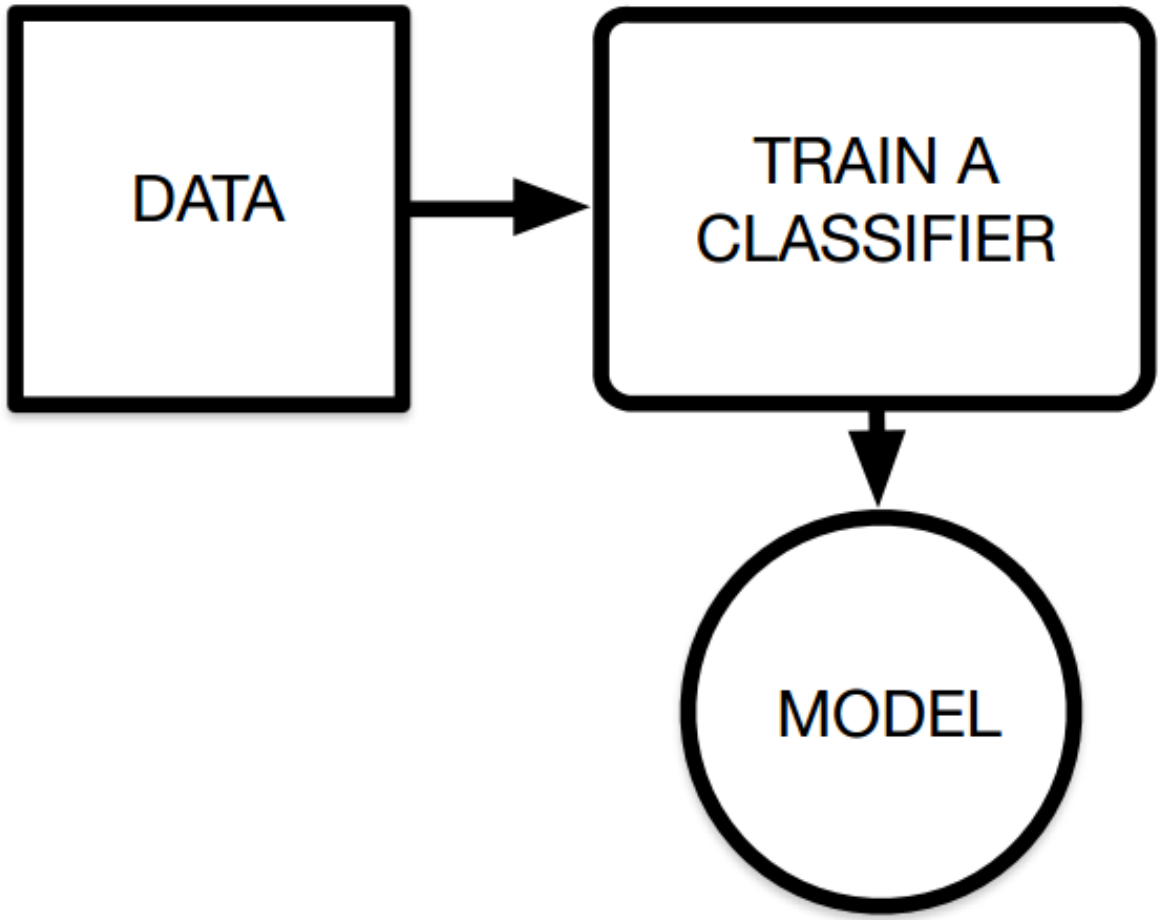
Types of machine learning

- **Supervised learning:** Data: {(x,y)}
- **Unsupervised learning:** Data: {x}
- **Reinforcement learning:** Strategies

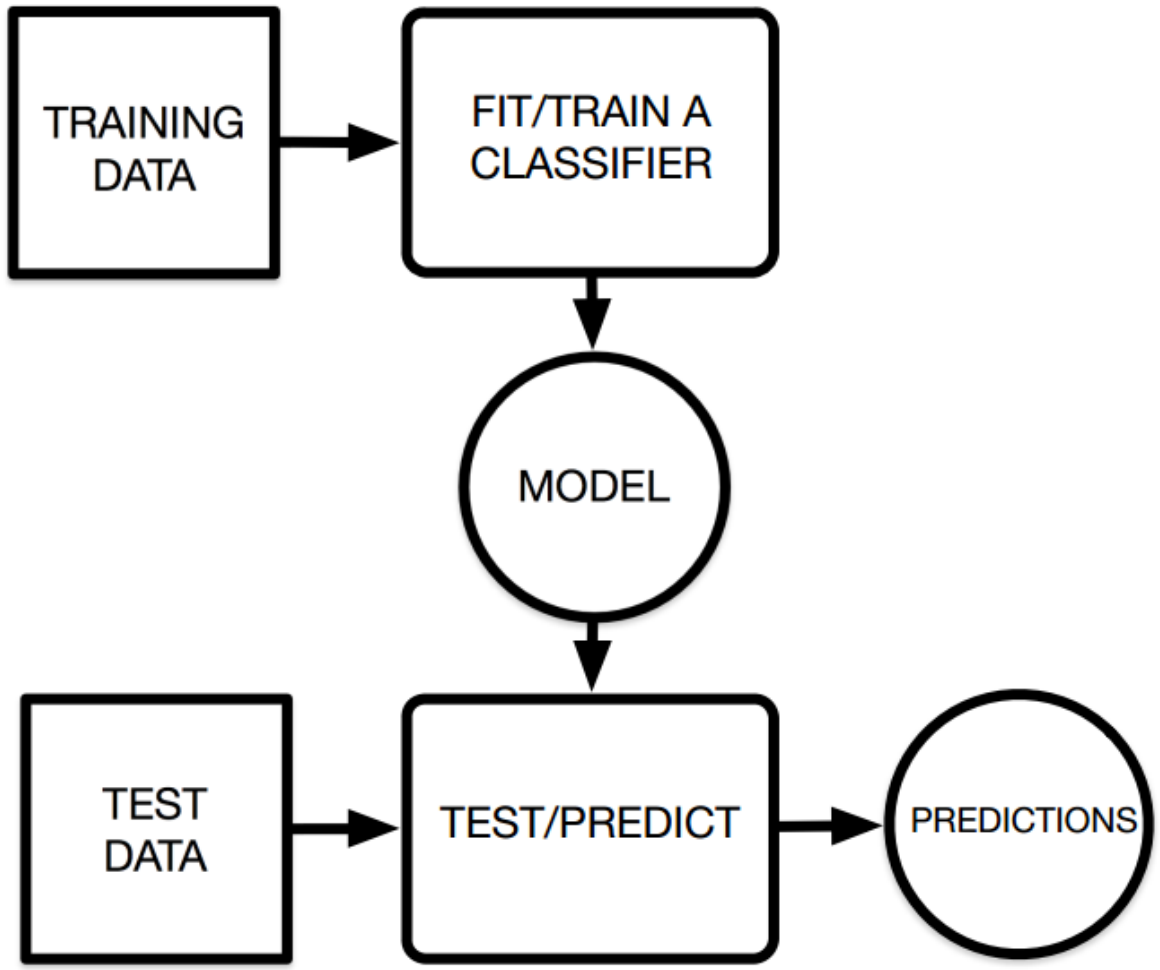
What type of Ml algorithm corresponds to each problem?

- I want to retrieve similar movies to the one i like the most
- I want to know if tomorrow is going to rain.
- I want to design a self-driving car

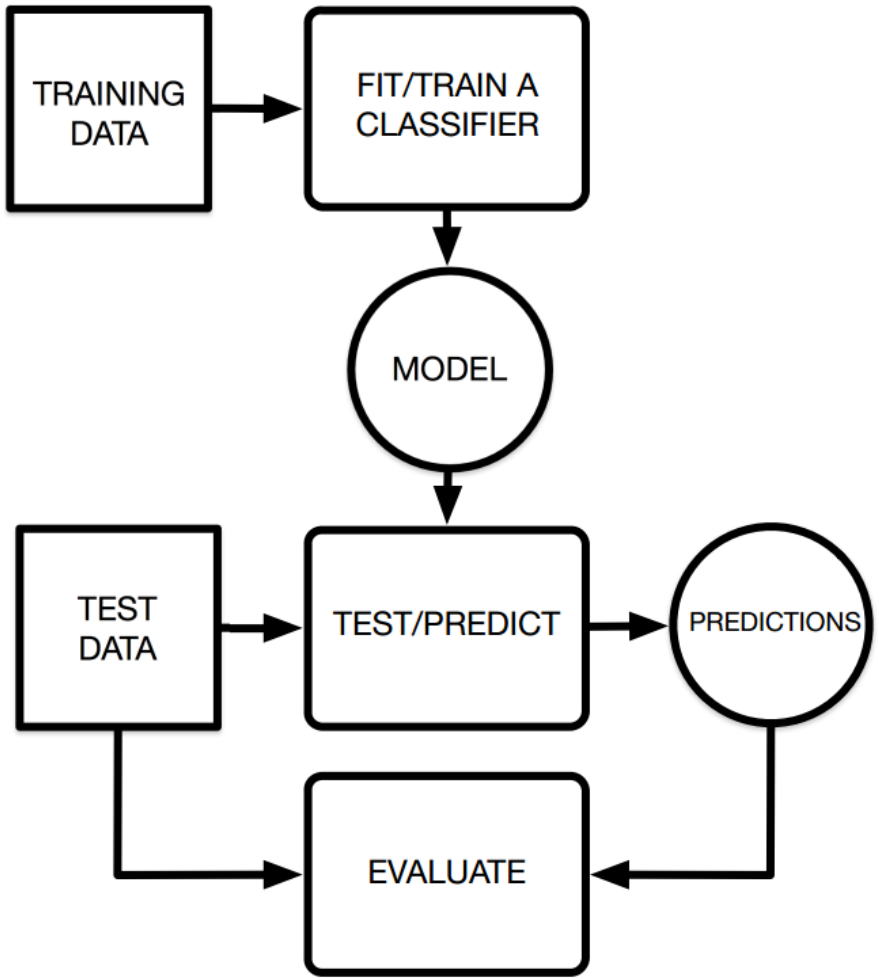
Machine learning pipeline



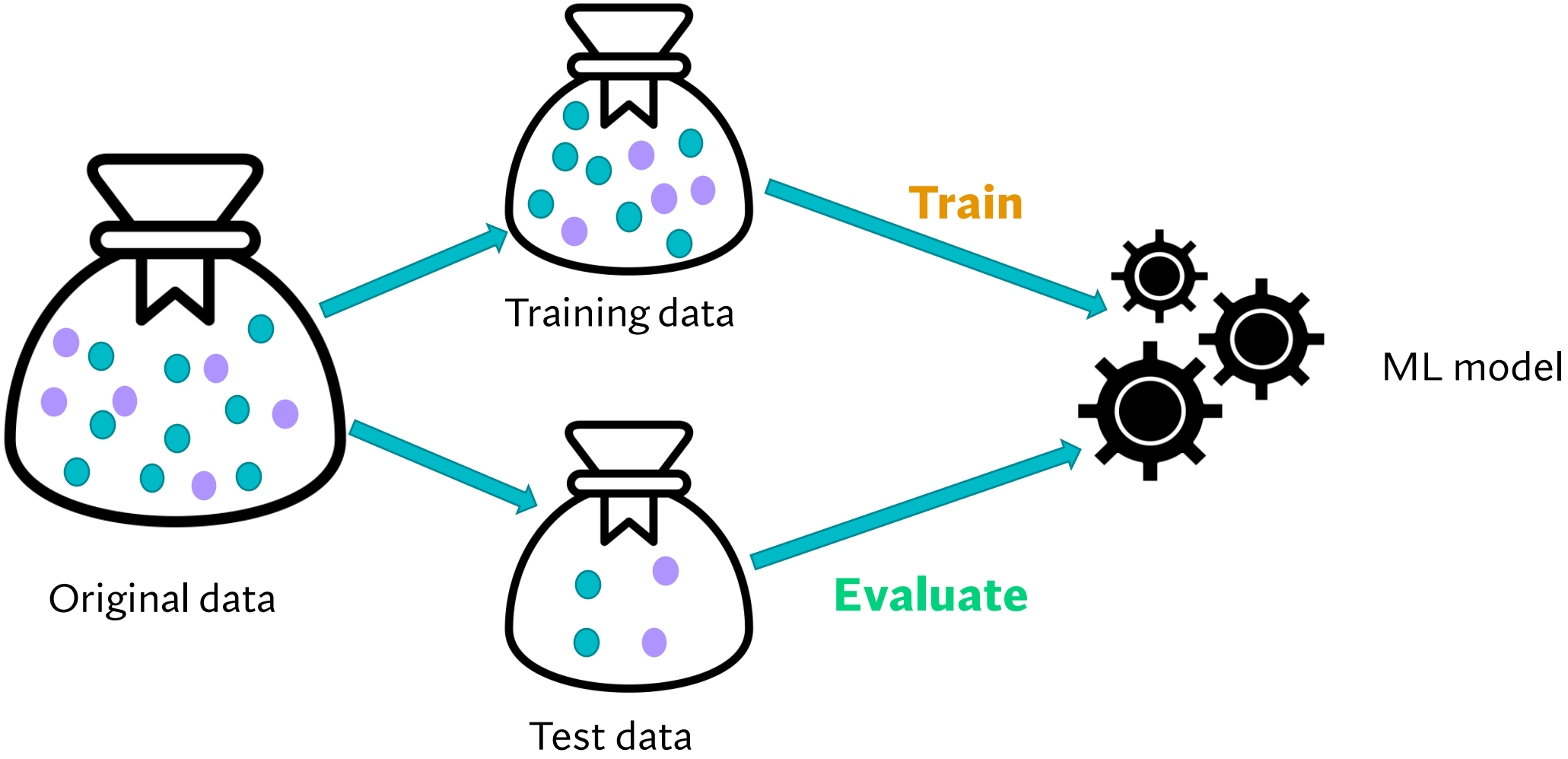
Machine learning pipeline



Machine learning pipeline



Train and test sets



Model selection

Suppose that we have two different models. We want to select the one that has a better performance in unseen data. What do we do?

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Separate training data into train and validation

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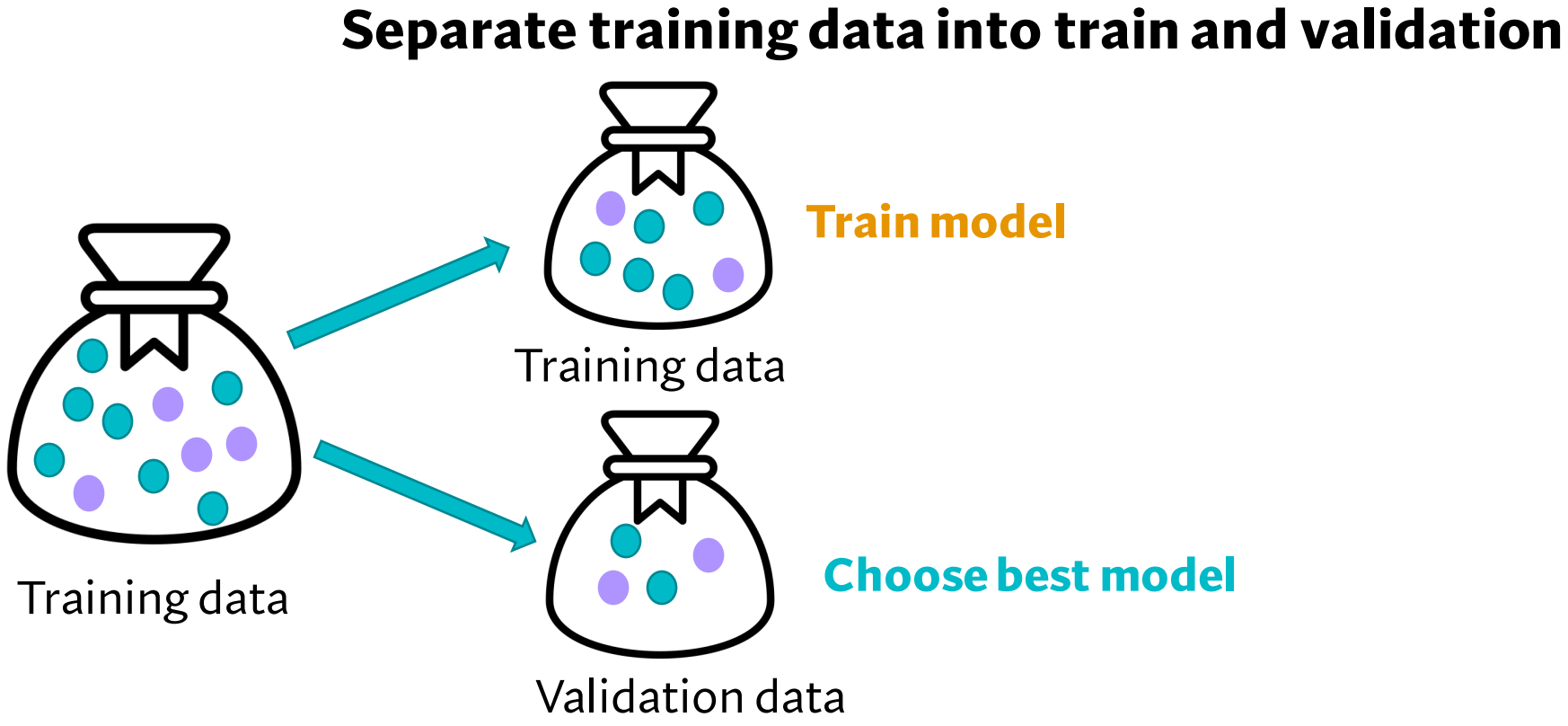

All together