

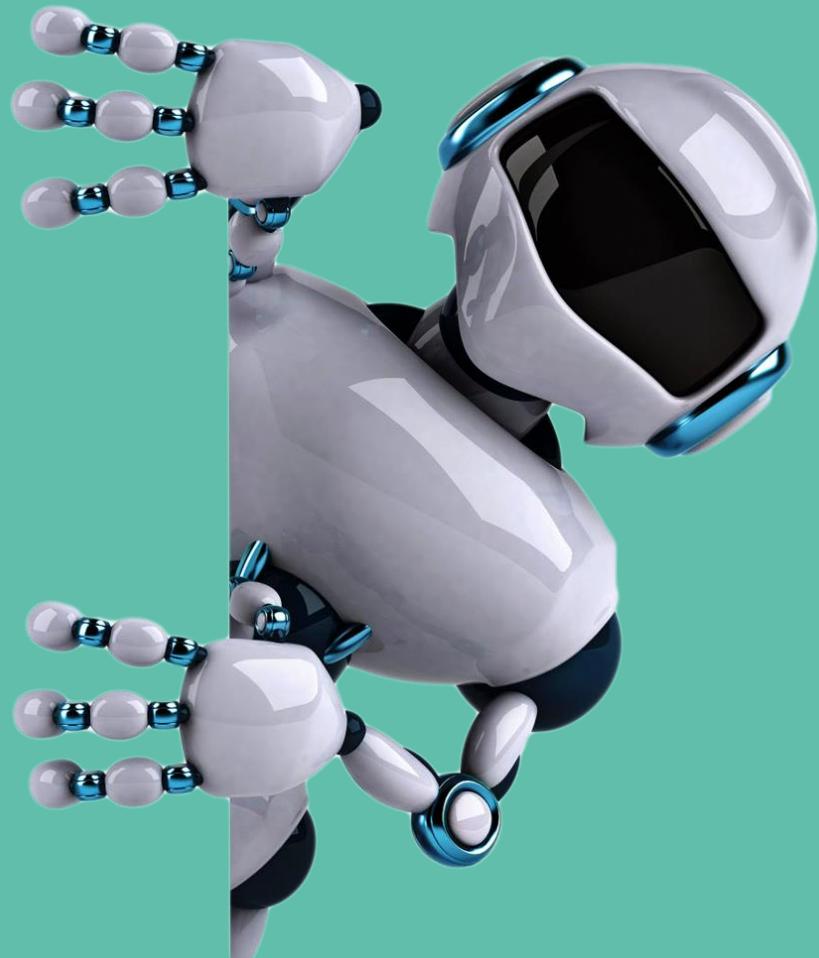
دورهی آموزشی «علم داده»

Data Science Course

جلسه بیست و پنجم یادگیری ماشین و عمیق به زبان ساده



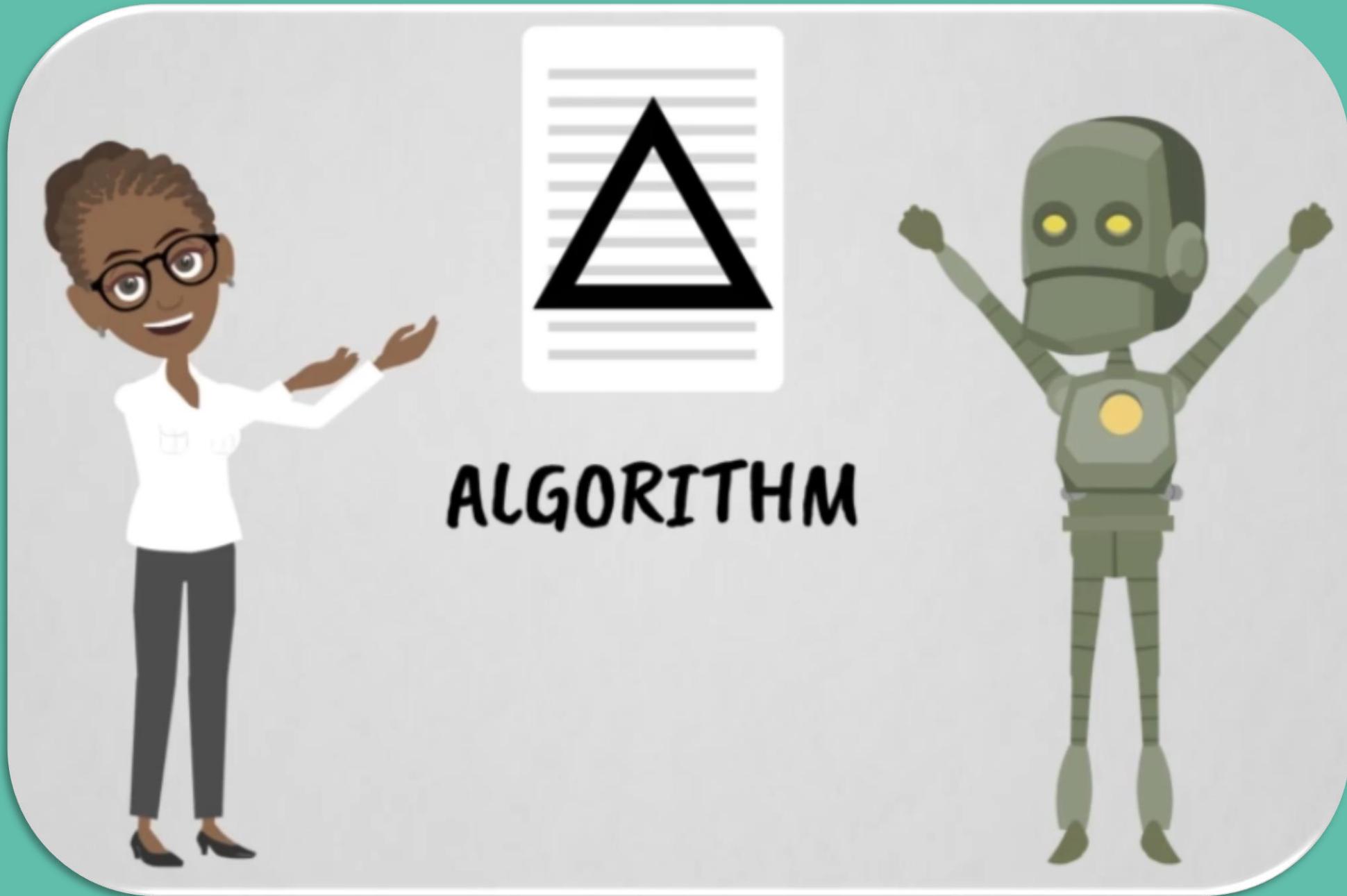
مدرس: محمد فزونی
عضو هیئت علمی دانشگاه گنبدکاووس



MACHINE LEARNING (ML)

Creating an algorithm, which a computer then uses to find a model that fits the data as best as possible. And makes very accurate predictions based on that

قراره یک الگوریتم بسازیم که کامپیوتراستفاده از اون،
مدلی بر مبنای داده‌های موجود بساز.
این مدل، باید بتوانه به بهترین شکل ممکن، آینده رو
پیش‌بینی کنه





ML algorithm

Data

Model

Objective
Function

Optimization
Algorithm

four ingredients

a trial-and-error process

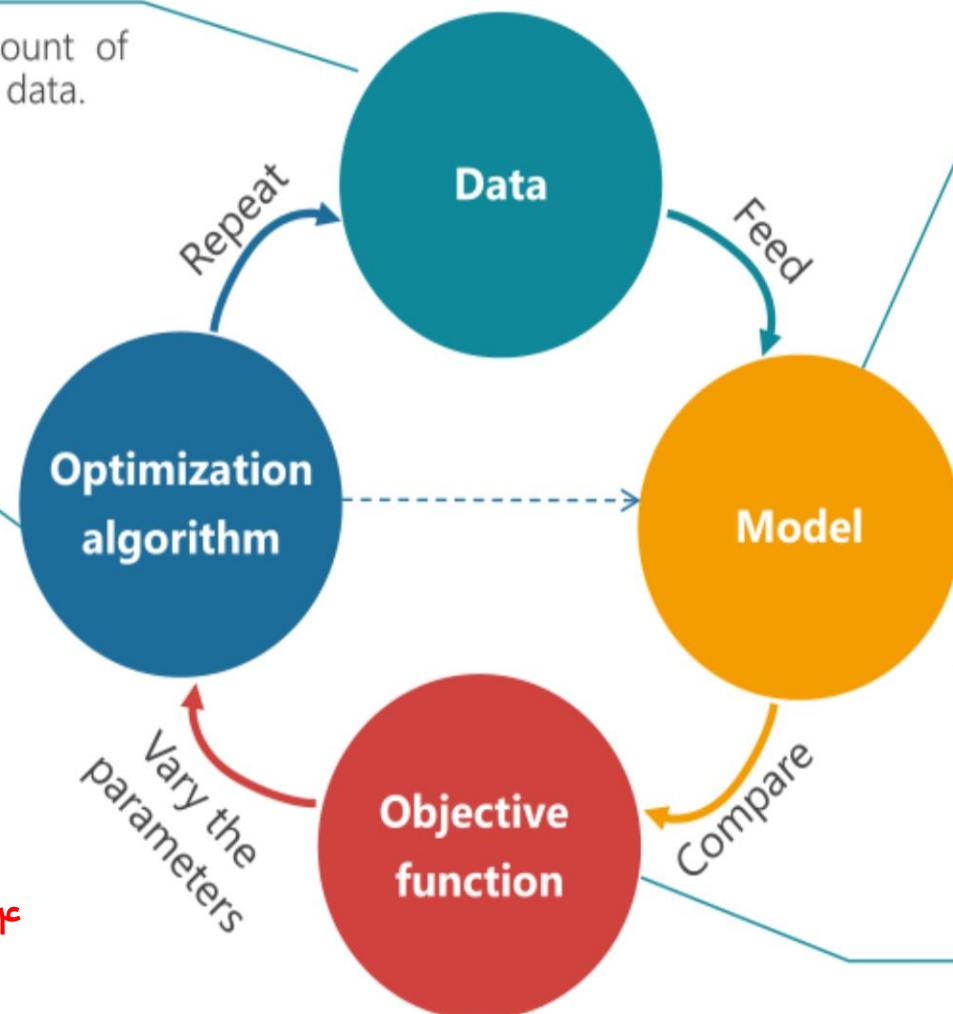
! each consecutive trial is
at least as good as the
previous one

First, we need to prepare a certain amount of **data** to train on. Usually, we take historical data.

۱- اول کمی داده نیاز داریم

We achieve the optimization using an **optimization algorithm**. Using the value of the objective function, the optimization algorithm *varies the parameters* of the model. This operation is repeated until we find the values of the parameters, for which the objective function is optimal.

۴- پارامترها را و تغییر بده تا به بهترین تابع هدف بررسیم



We choose the type of **model**. Roughly speaking, this is some function, which is defined by the *weights* and the *biases*. We feed the input data into the model. Essentially, the idea of the machine learning algorithm is to find the *parameters* for which the model has the highest predictive power.

۲- مدل رو انتخاب کن

۳- قدرت پیش‌بینی مدل رو اندازه بگیر

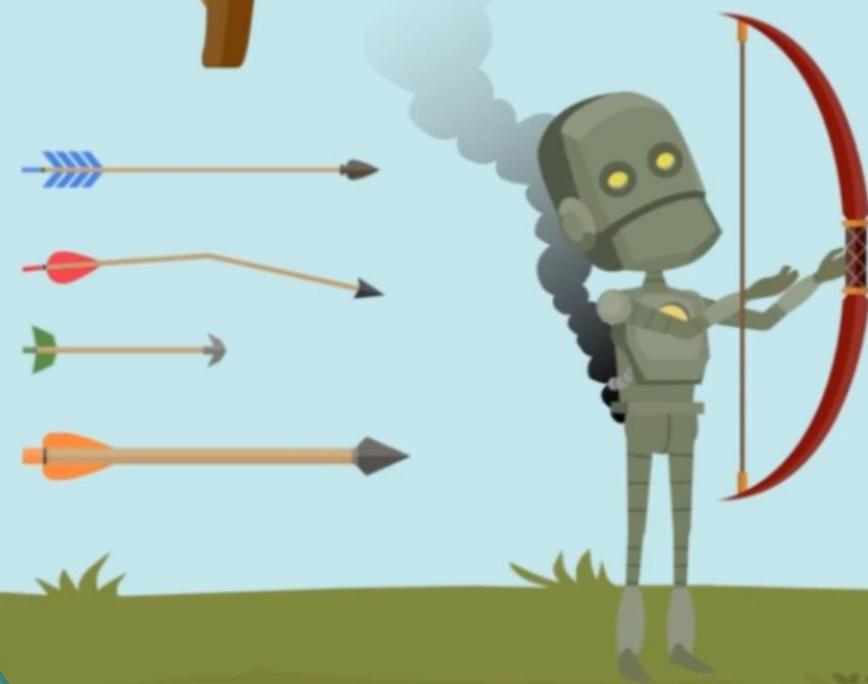
The **objective function** measures the predictive power of our model. Mathematically, the machine learning problem boils down to *optimizing* this function. For example, in the case of loss, we are trying to *minimize* it.

Data



Model

the usage of
the bow



Objective
Function

calculate how far
from the target

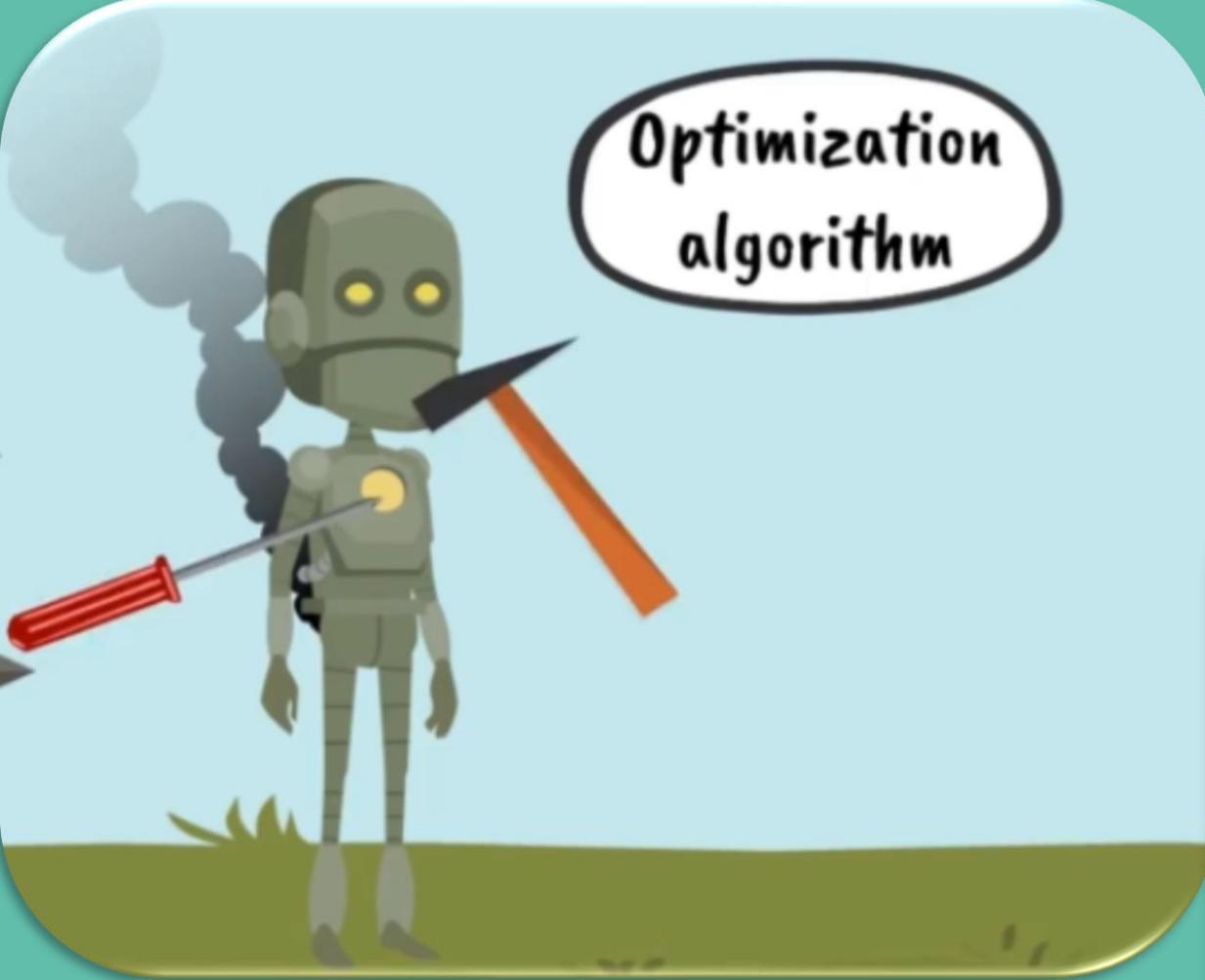


Optimization
algorithm

mechanics that will
improve the model's
performance



TARGET



TRAINING YOUR MODEL



a final goal



place the arrow in the
centre of the target



100,000 tries → it may have learned
how to be the best archer out there

9/10 → good level of accuracy → stop it!



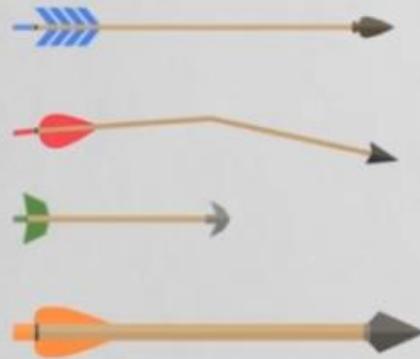


- model: trained
- objective function: minimized
- optimization algorithm: has done its job

AFTER

TRAINING YOUR MODEL

types of arrows:



BENEFIT: the robot can learn to fire more effectively than a human!

+ discover that we have been holding bows in a wrong way for centuries

USE: improve complex computational models

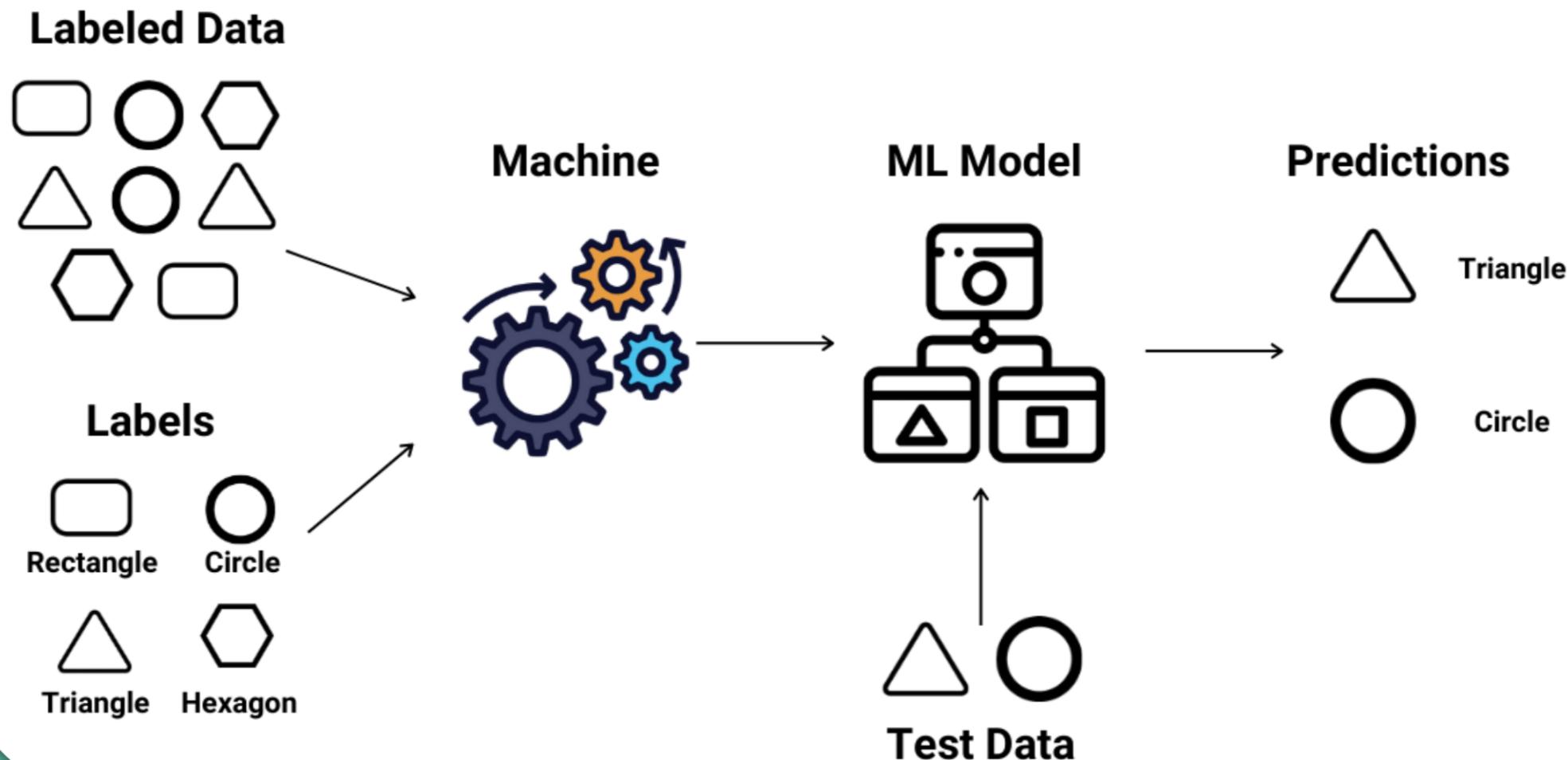
TYPES OF MACHINE LEARNING (ML)

1. Supervised learning



training an algorithm resembles a teacher
supervising her students

Supervised Learning



OUTPUT	CORRECT VALUE	OBJECTIVE FUN.	VALUE
		far from reality	200
		Closer	100
		Very close	0

Data

LABELLED

you can assess
the accuracy of
each shot



Model



TARGET



labelled data = associating, or 'labelling',
a target to a type of arrow





SUPERVISED LEARNING

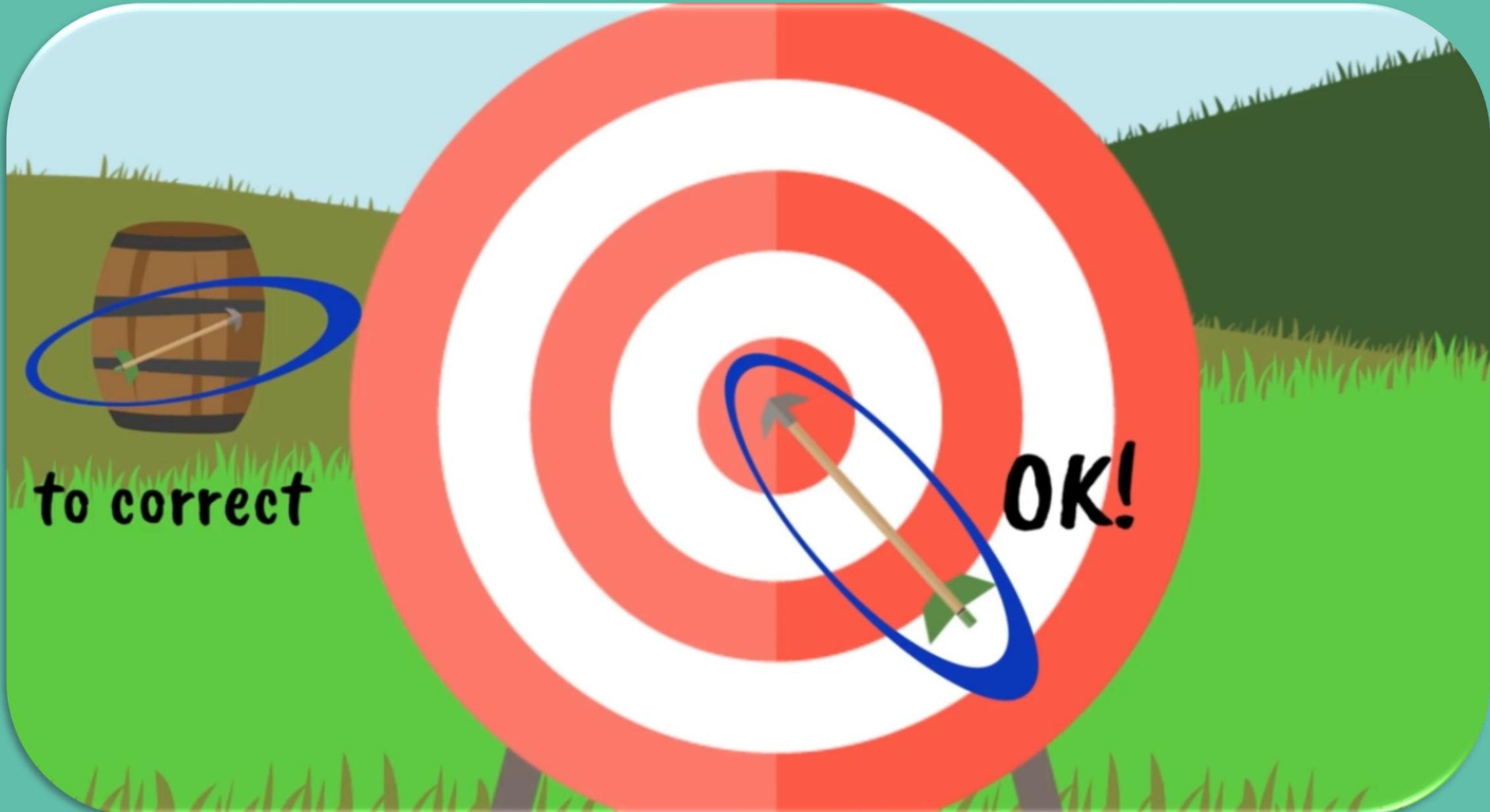
labelled data → we know the target prior to the shot
→ we can associate that shot with a target

Objective
Function

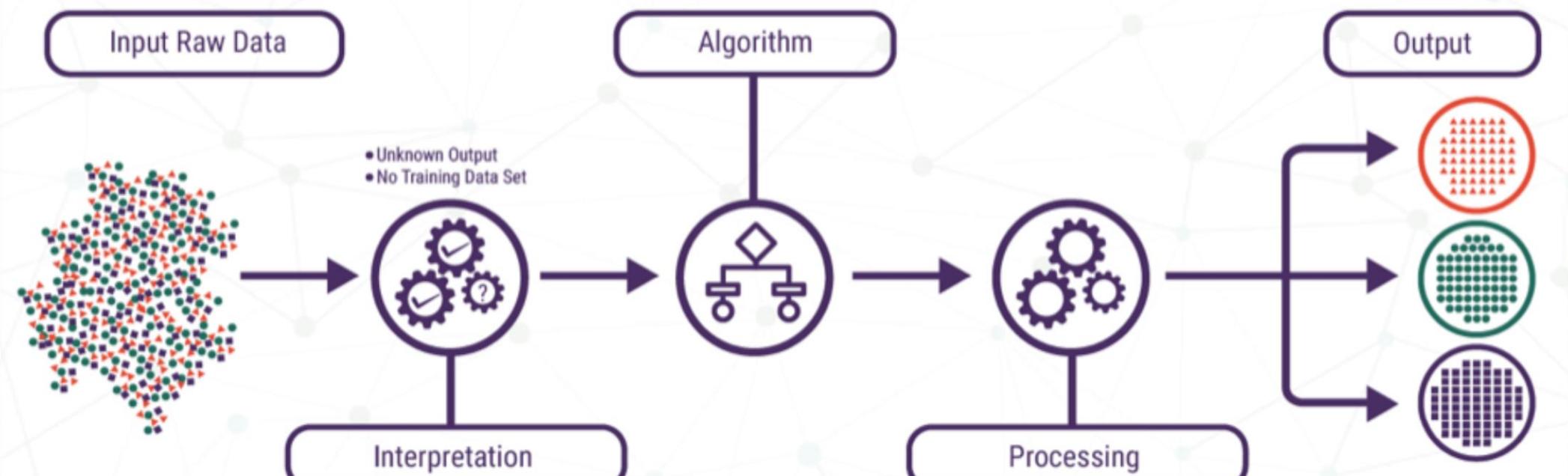
→ to measure the inaccuracy

Optimization
algorithm

→ to improve the way the robot shoots

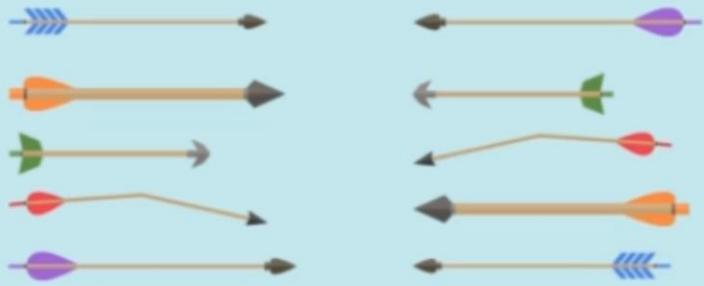


UNSUPERVISED LEARNING



Data

UNLABELLED

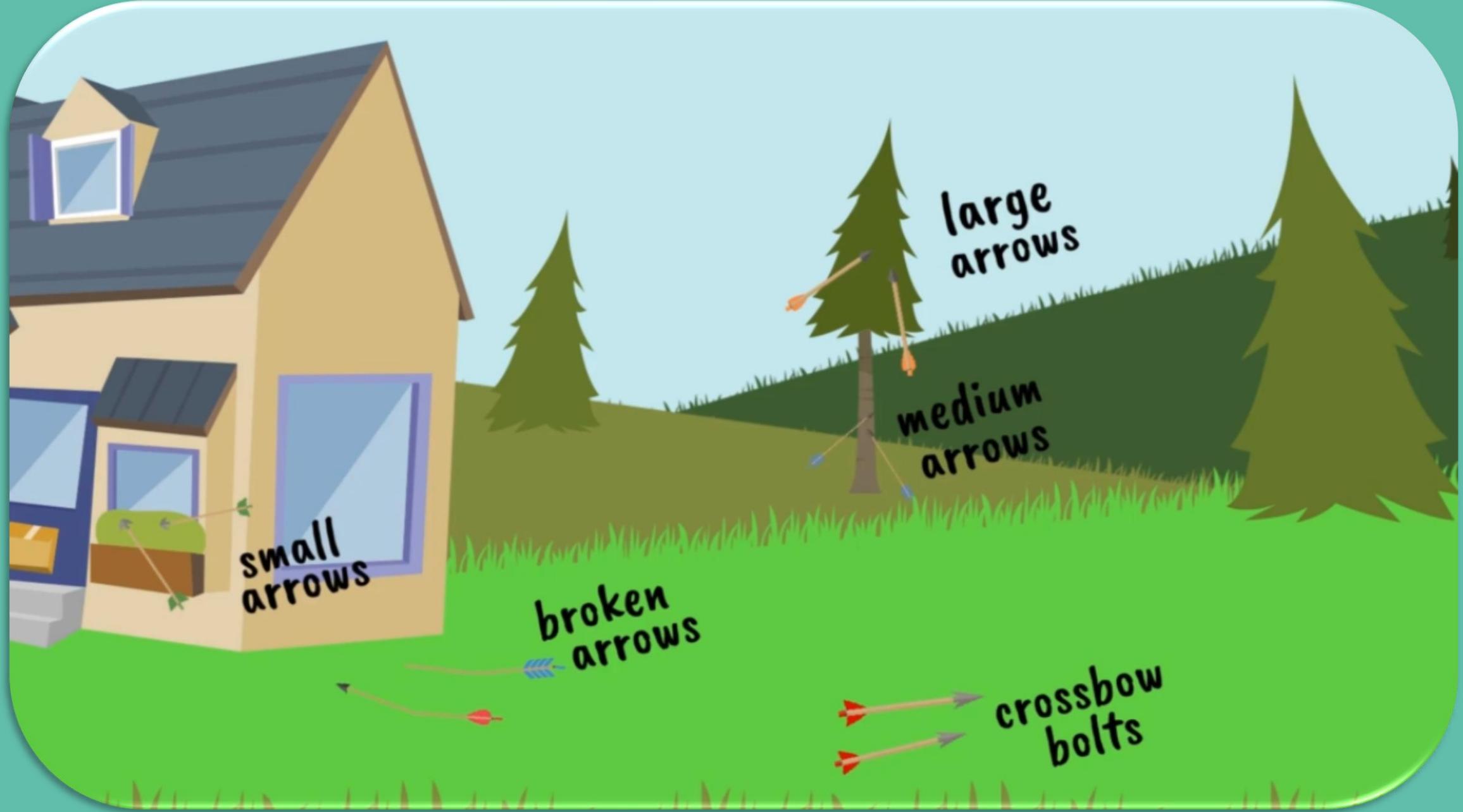


FIRE!

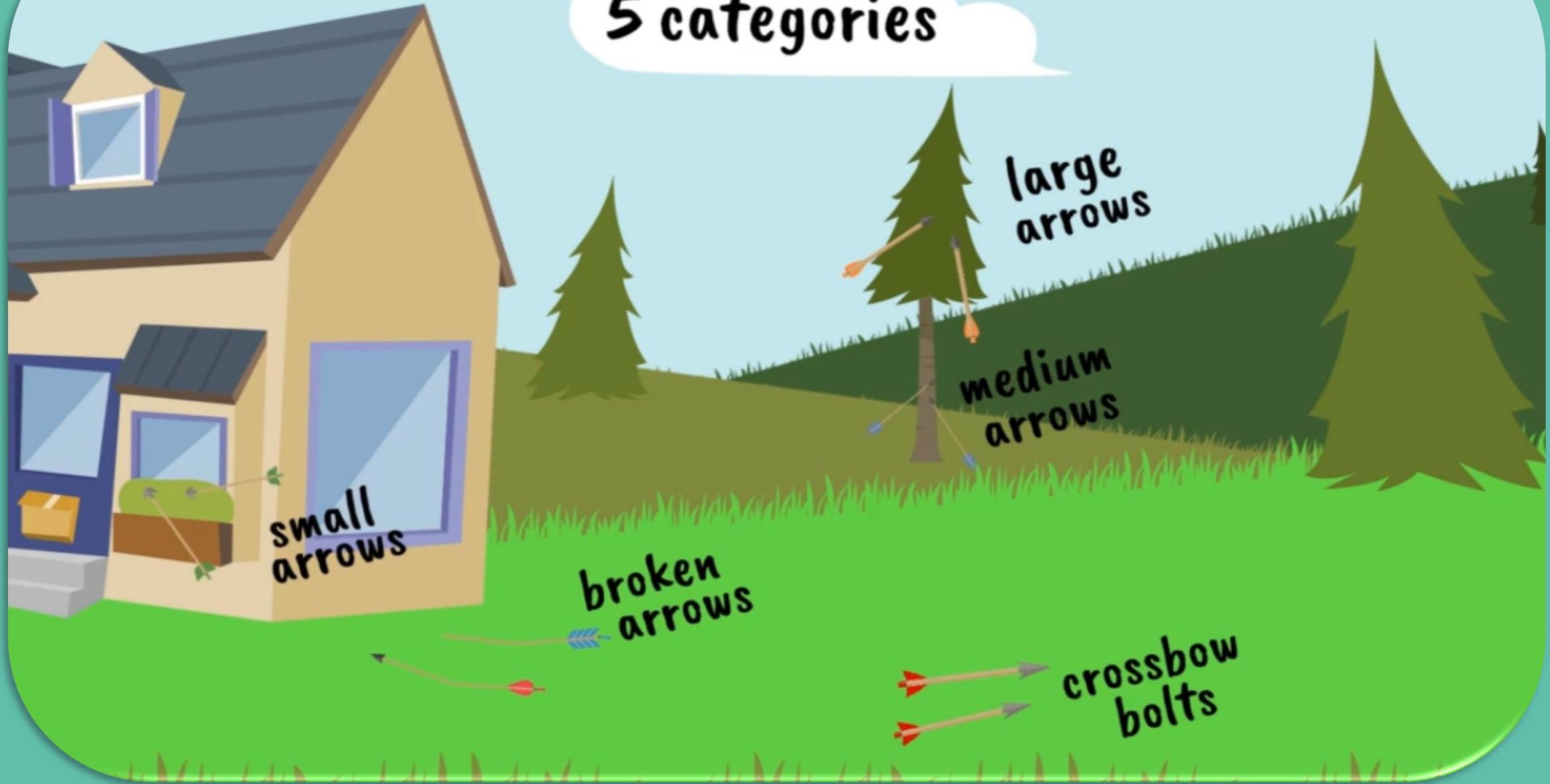
Unsupervised learning

look for a model that divides
the arrows in a certain way





5 categories



TYPES OF MACHINE LEARNING (ML)

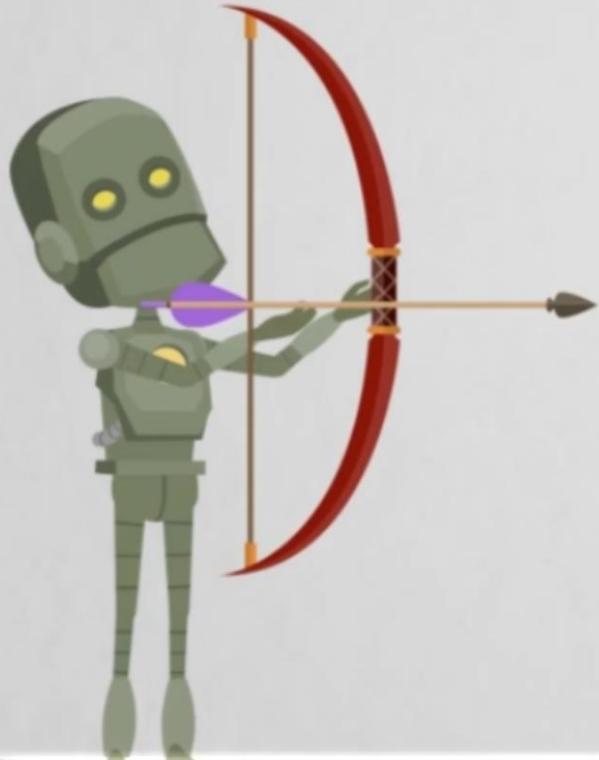
- 1. Supervised learning**
- 2. Unsupervised learning**
- 3. Reinforcement learning**

+ a reward system

Better?



Worse?



Better?
Worse?

+ 1
+ 0

}

POSITIVE REINFORCEMENT



abstract
example:

Data



reality:

```
array([[-1.61291725,  1.12765133,  0.73512365, ..., -0.1485598 ,  
       -0.70212918, -0.43455738],  
      [-1.51839554,  1.12765133,  0.73512365, ..., -0.1485598 ,  
       3.69660123, -0.43455738],  
      [-1.43347046,  0.05694634, -0.08950727, ...,  1.97762683,  
       0.76033531, -0.43455738]])
```

Model



TARGET

$$\delta_j = \sum_k \delta_k w_{jk} y_j (1 - y_j) x_i$$

various and
quantifiable goals

DEEP LEARNING

- new, revolutionary approach
(state-of-the-art ML)
- fundamentally different from the other approaches
- broad practical scope of application
(extremely high accuracy)

DEEP LEARNING

1. Supervised
2. Unsupervised
3. Reinforcement

یادگیری عمیق به این سه بخش تقسیم میشود وی روش کارش کاملا متفاوت هست

Deep Learning Vs Machine Learning

Factors

Data Requirement

Accuracy

Training Time

Hardware Dependency

Hyperparameter Tuning

Deep Learning

Requires large data

Provides high accuracy

Takes longer to train

Requires GPU to train properly

Can be tuned in various
different ways.

Machine Learning

Can train on lesser data

Gives lesser accuracy

Takes less time to train

Trains on CPU

Limited tuning capabilities

Two tangible and concrete examples

- Fraud Detection
- Client Retention

FRAUD DETECTION

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
Observation 1										
Observation 2										
Observation 3										
Observation 4										
Observation 5										
Observation 6										
Observation 7										
Observation 8										
Observation 9										
Observation 10										



ID	NAME	AGE
001	JANE	19
002	JOHN	35
003	JESS	21
004	TONYA	24
005	IVAN	46
...

ID	NAME	AGE
001	JOHN	35
002	ALAN	24
003	JANE	29



FRAUD DETECTION

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
Observation 1										
Observation 2										
Observation 3										
Observation 4										
Observation 5										
Observation 6										
Observation 7										
Observation 8										
Observation 9										
Observation 10										



ID	NAME	AGE
001	JOHN	35
002	ALAN	24
003	JANE	29



ID	NAME	AGE
001	JANE	19
002	JOHN	35
003	JESS	21
004	TONYA	24
005	IVAN	46
...



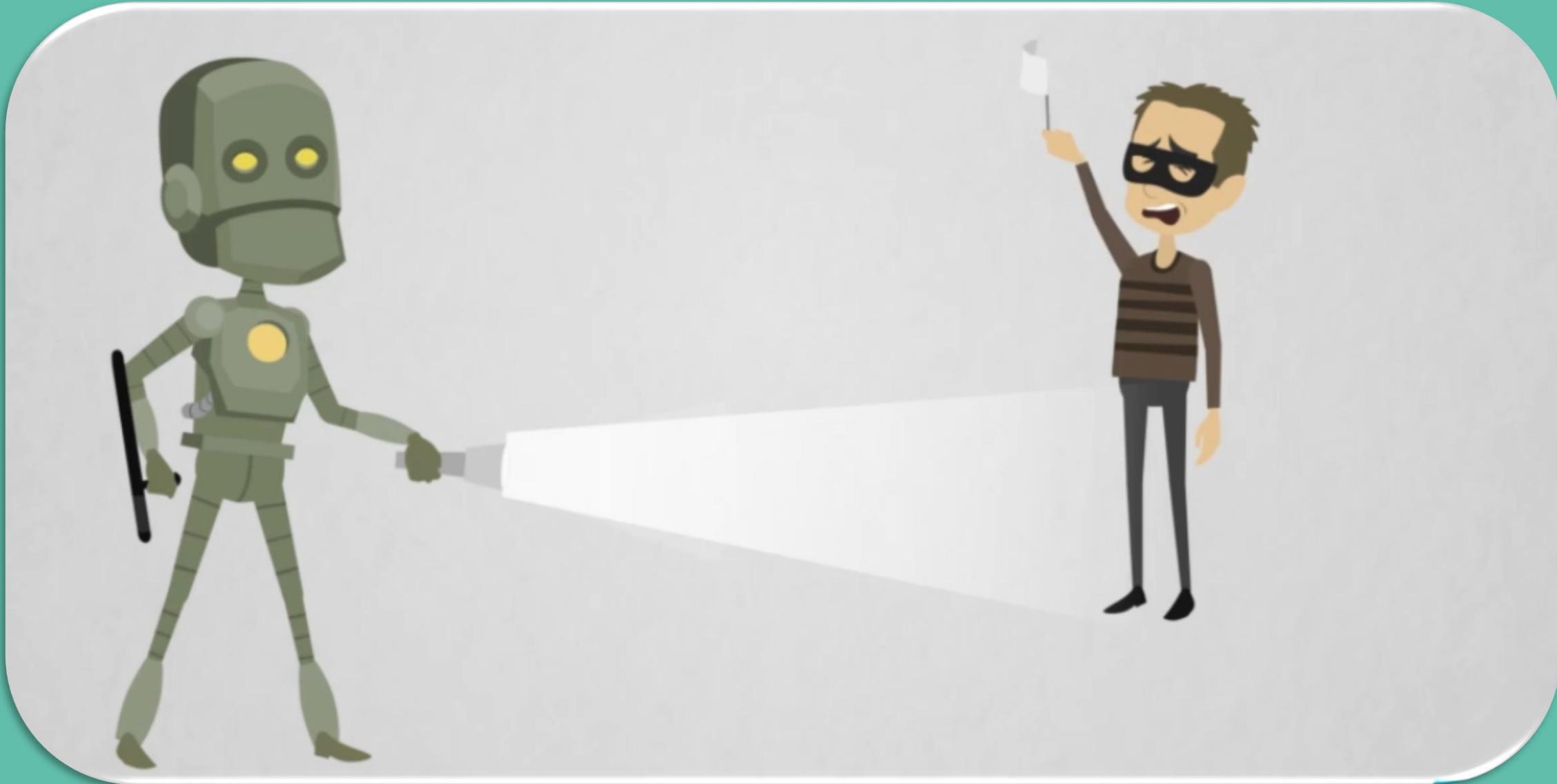
Observation 1 = **good**

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Observation 3										
Observation 4										
Observation 5										
Observation 6										
Observation 7										
Observation 8										
Observation 9										
Observation 10										



Observation 2 = **bad**





CLIENT RETENTION



هدف ما در جلسه‌ی بعد چیست؟

در خصوص محتویات فرآیند یادگیری
ماشین، دقیق‌تر صحبت خواهیم کرد.

Almost all the slides that have
been used here obtained
from a course by

365 Data Science Team

<https://365datascience.com/>