

OSLOMET

Machine Learning

DAVE3625

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Some core and important concepts

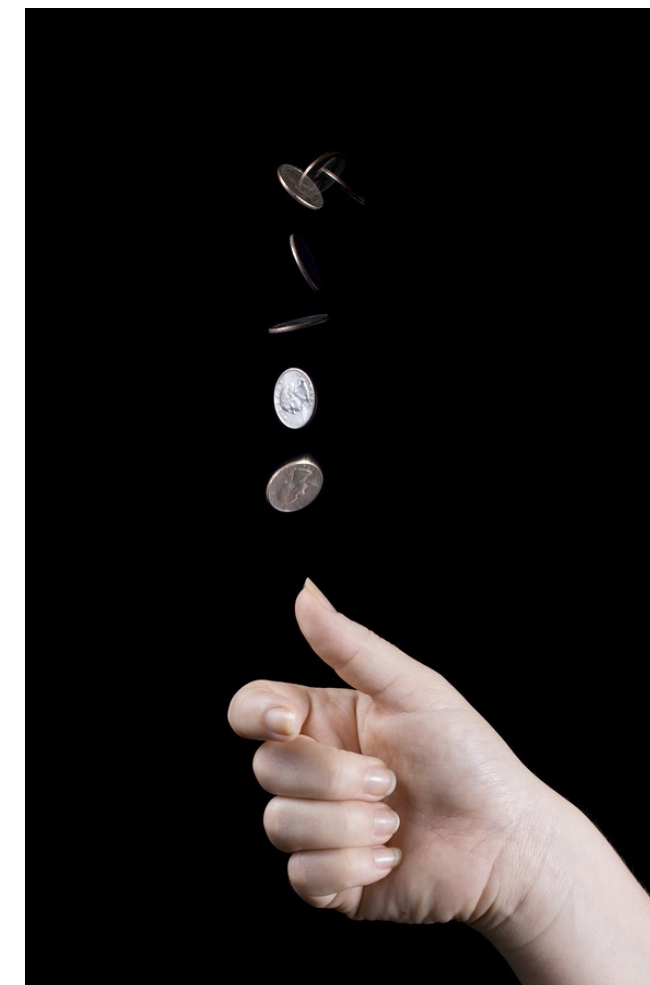
Probability

How likely something is to happen

Example 1: Coin Flipping

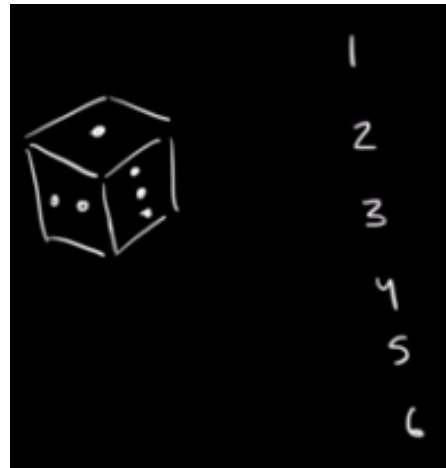
$P(H) = (\text{number of ways it can happen}) / (\text{Total number of outcomes})$

$P(H) = \frac{1}{2} = 0.5$ or 50%



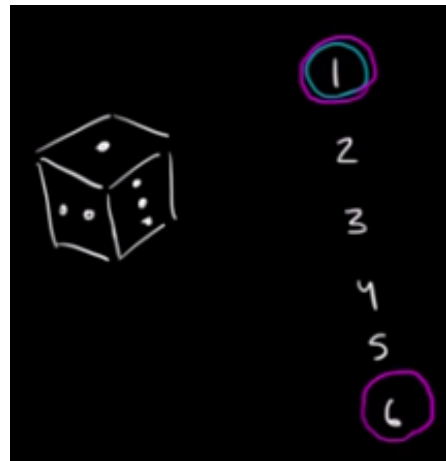
Ref image :
<https://www.bellevuerarecoins.com/history-coin-flip/>

Another example



What's the probability of rolling a one?

$$P(1) = \frac{1}{6}$$






What's the probability of rolling a one or a six?

$$P(1 \text{ or } 6) = \frac{2}{6} = \frac{1}{3}$$

Uses of Probability



C11	:				=PROB(B4:B7,C4:C7,C9,C10)
	A	B	C		
1					
2					
3		Product Sales	Probability		
4		20	0.23		
5		50	0.50		
6		80	0.18		
7		110	0.09		
8					
9		Lower limit	50		
10		Upper limit	80		
11		Probability	0.68		
12					

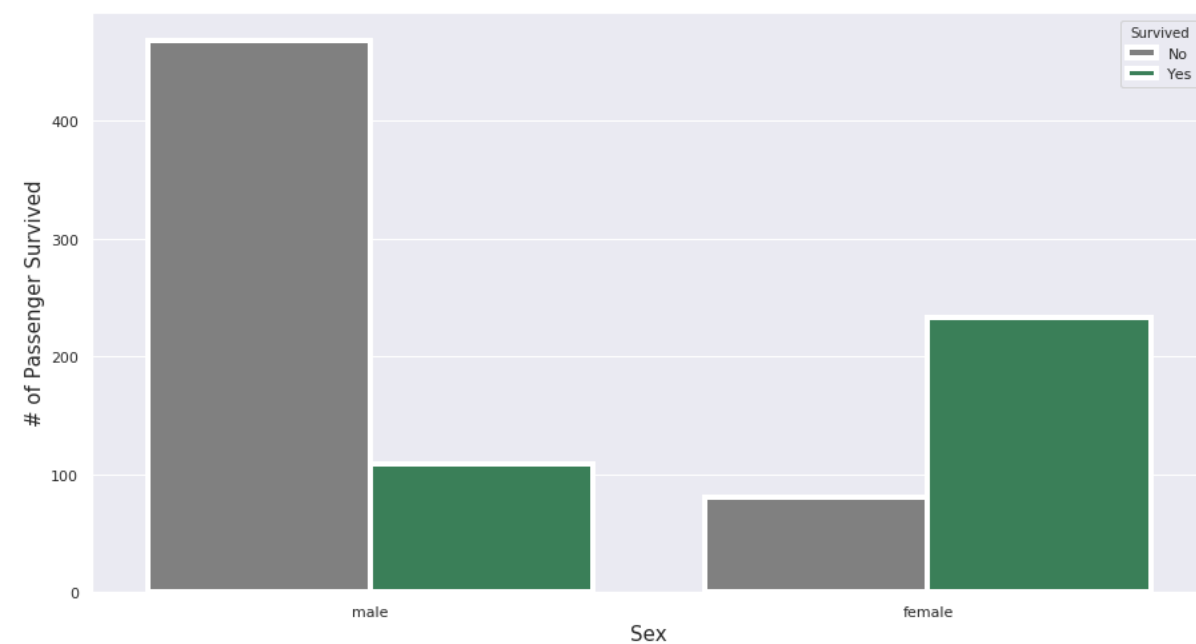
Statistics

Statistics is a traditional field, broadly defined as a *branch of mathematics dealing with data collection, organization, analysis, interpretation and presentation*

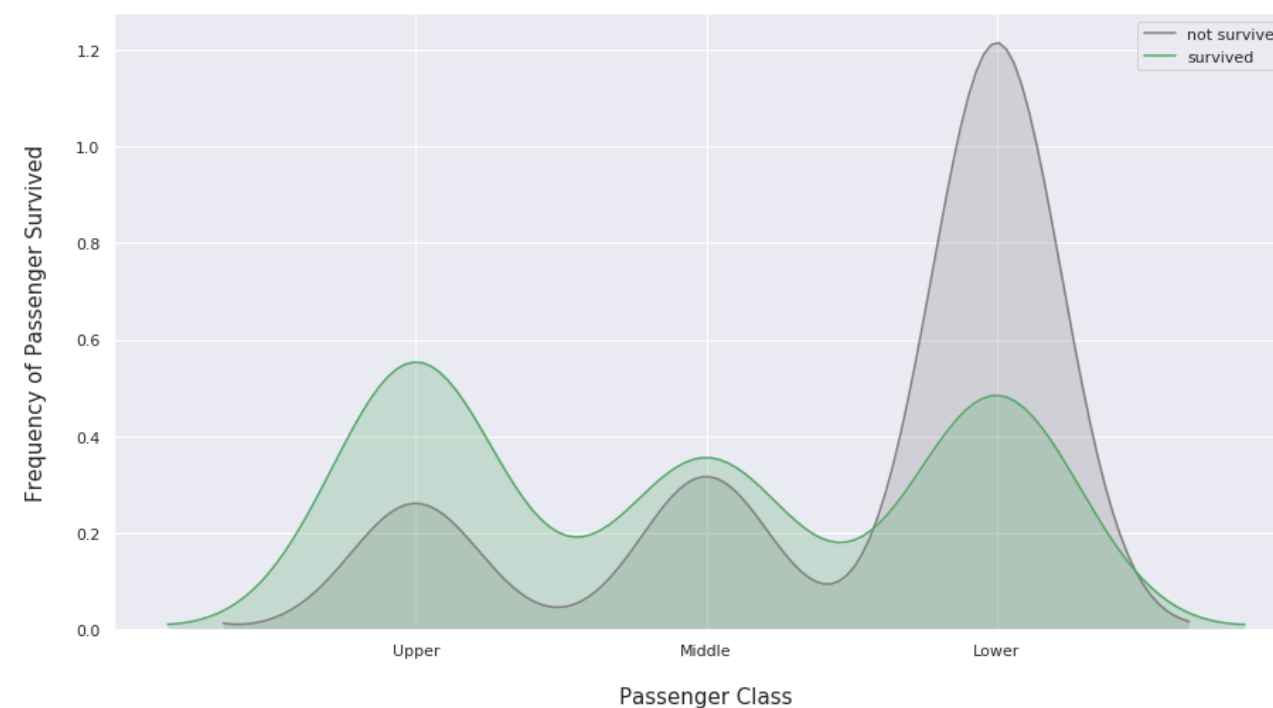
(Ref: Wikipedia)

Titanic data set

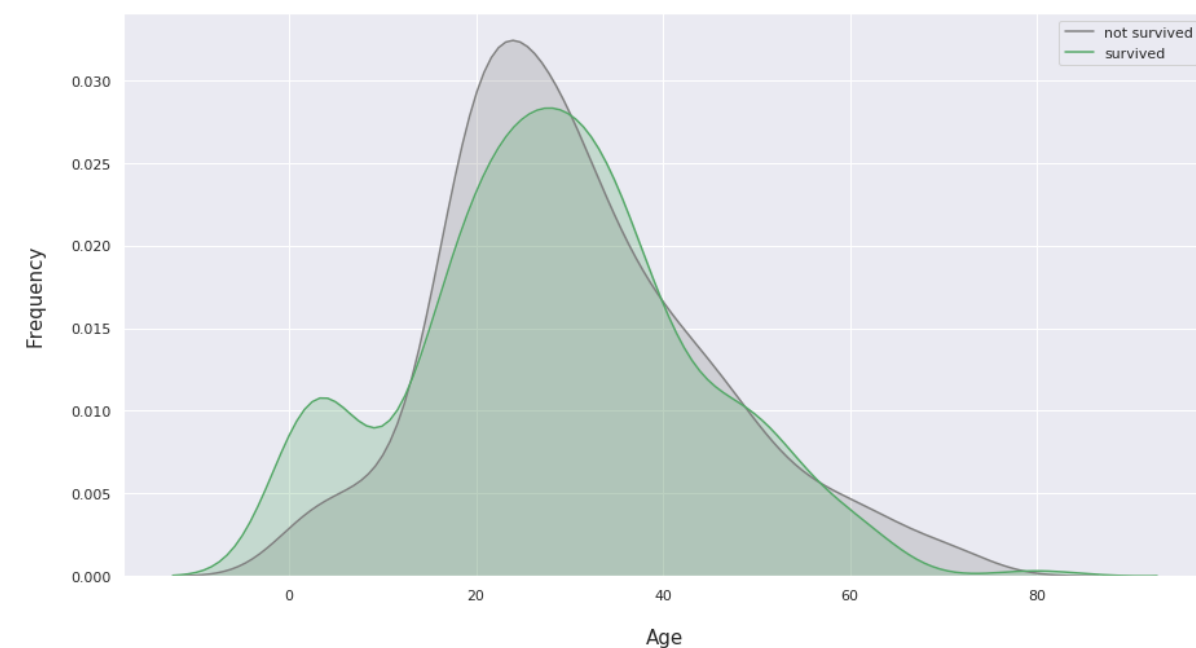
Passenger Gender Distribution - Survived vs Not-survived



Passenger Class Distribution - Survived vs Non-Survived

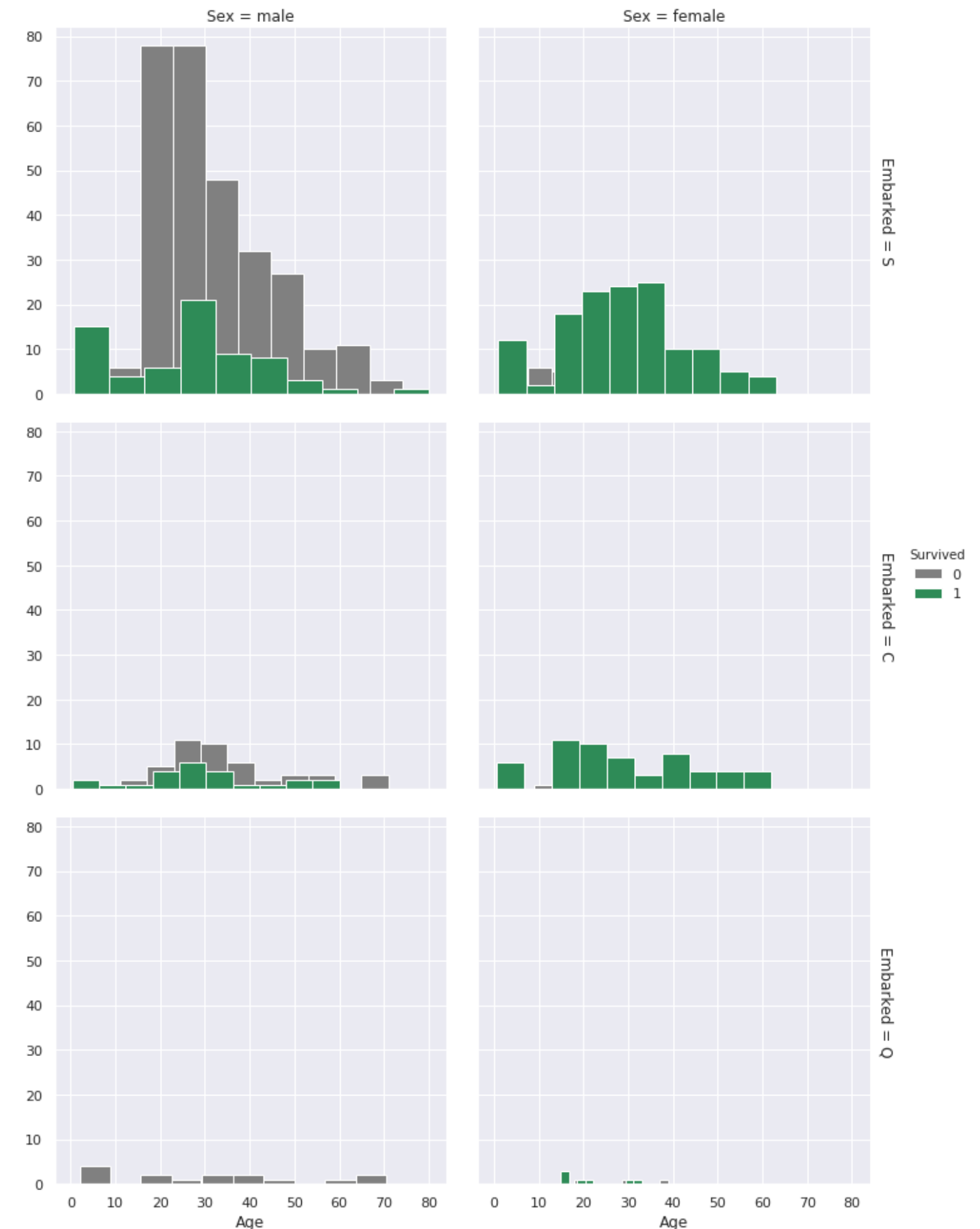


Age Distribution - Survivor V.S. Non Survivors

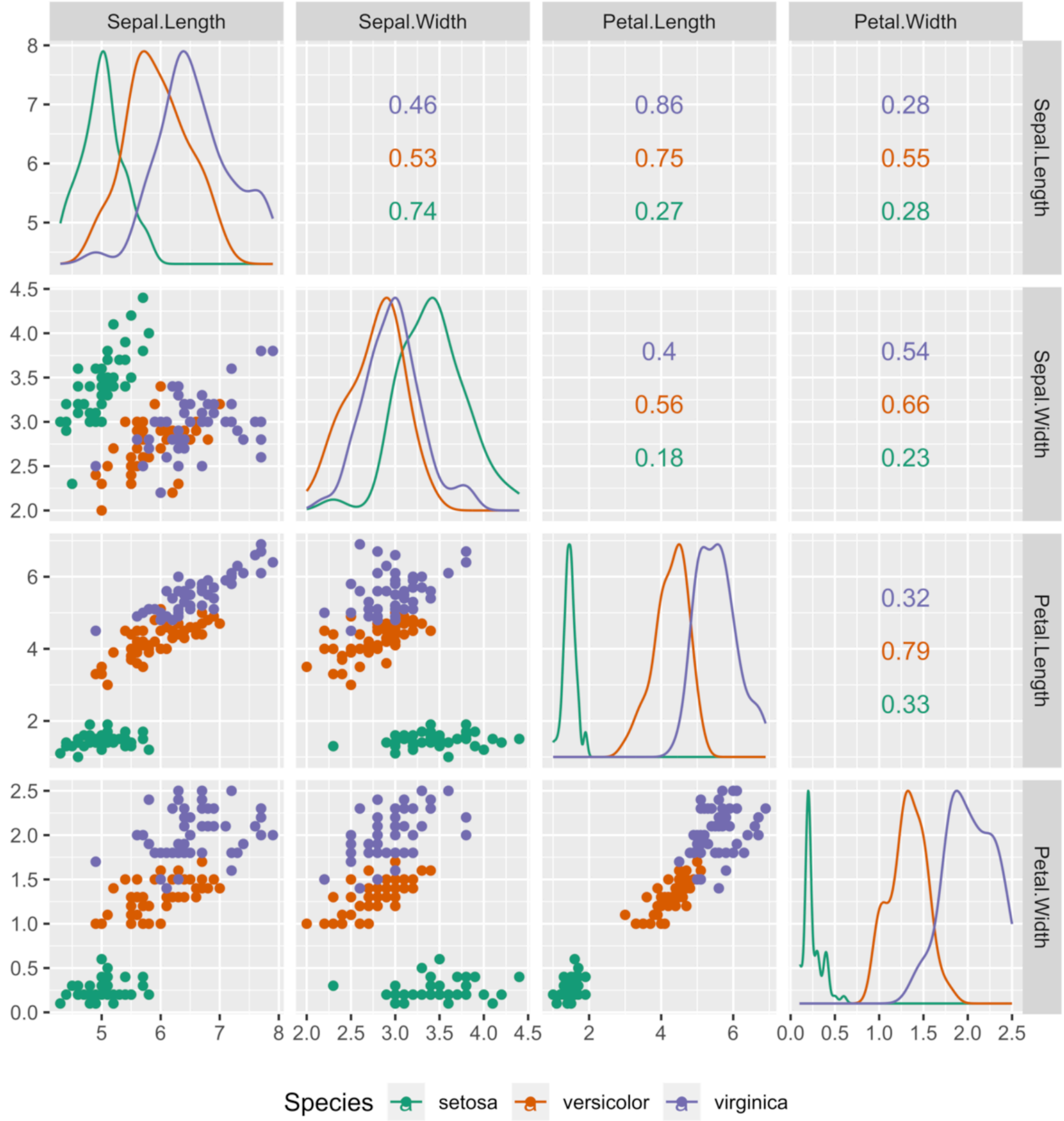


- Most passengers seem to be boarded on Southampton(S).
- More than 60% of the passengers died boarded on Southampton.
- More than 60% of the passengers lived boarded on Cherbourg(C).
- Pretty much every male that boarded on Queenstown(Q) did not survive.
- There were very few females boarded on Queenstown, however, most of them survived.

Survived by Sex and Age



Scatter plots



What is Machine Learning

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.

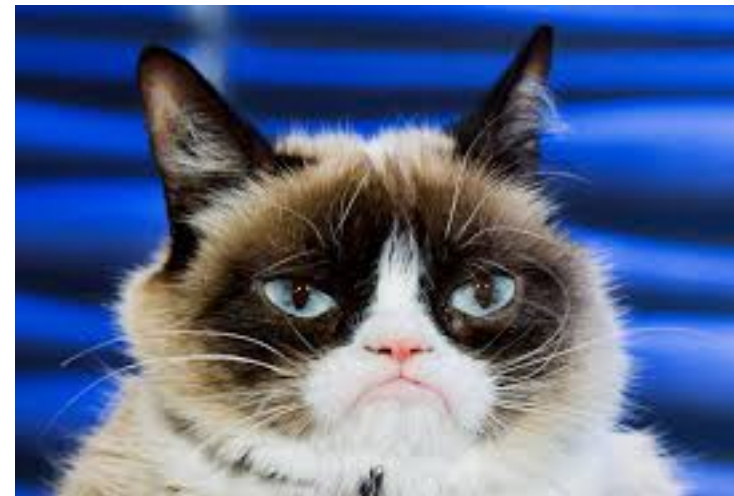
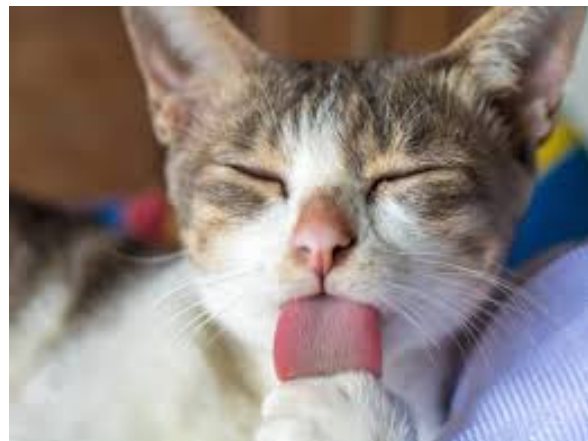
Uses of M.L

Example: Search for cats on google. How does this search work ?

- Google first gets a large quantity of examples of photos labeled “cat”
- Then the Machine learning algorithm looks for patterns of pixels and patterns of colors that will help it predict if the image is of “cat”.
- At first, Google’s computers make a random guess of what patterns are good in order to identify an image of a cat.
- If it makes a mistake, then a set of adjustments are made (by humans) in order for the algorithm to get it right.
- In the end the algorithm will learn such patterns and improve its output

Q. How would you build such a M.L algorithm ?

1. Collect data
2. Label the data

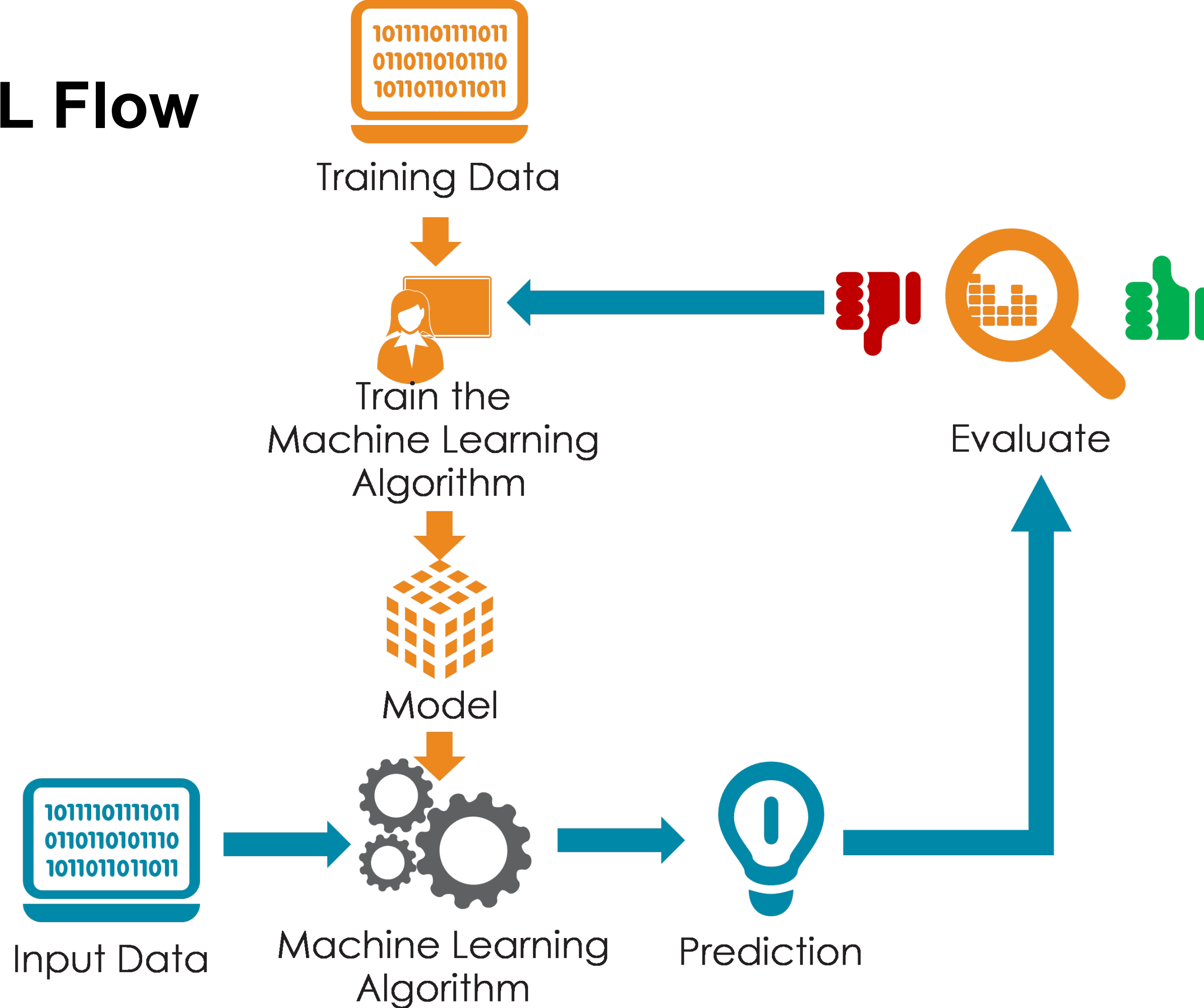


3. Train the machine learning model with data

The model will look for patterns in the images in order to identify cats and lions

4. Once the model is trained, we give it different input images to test and see if the model gives us the right answer.

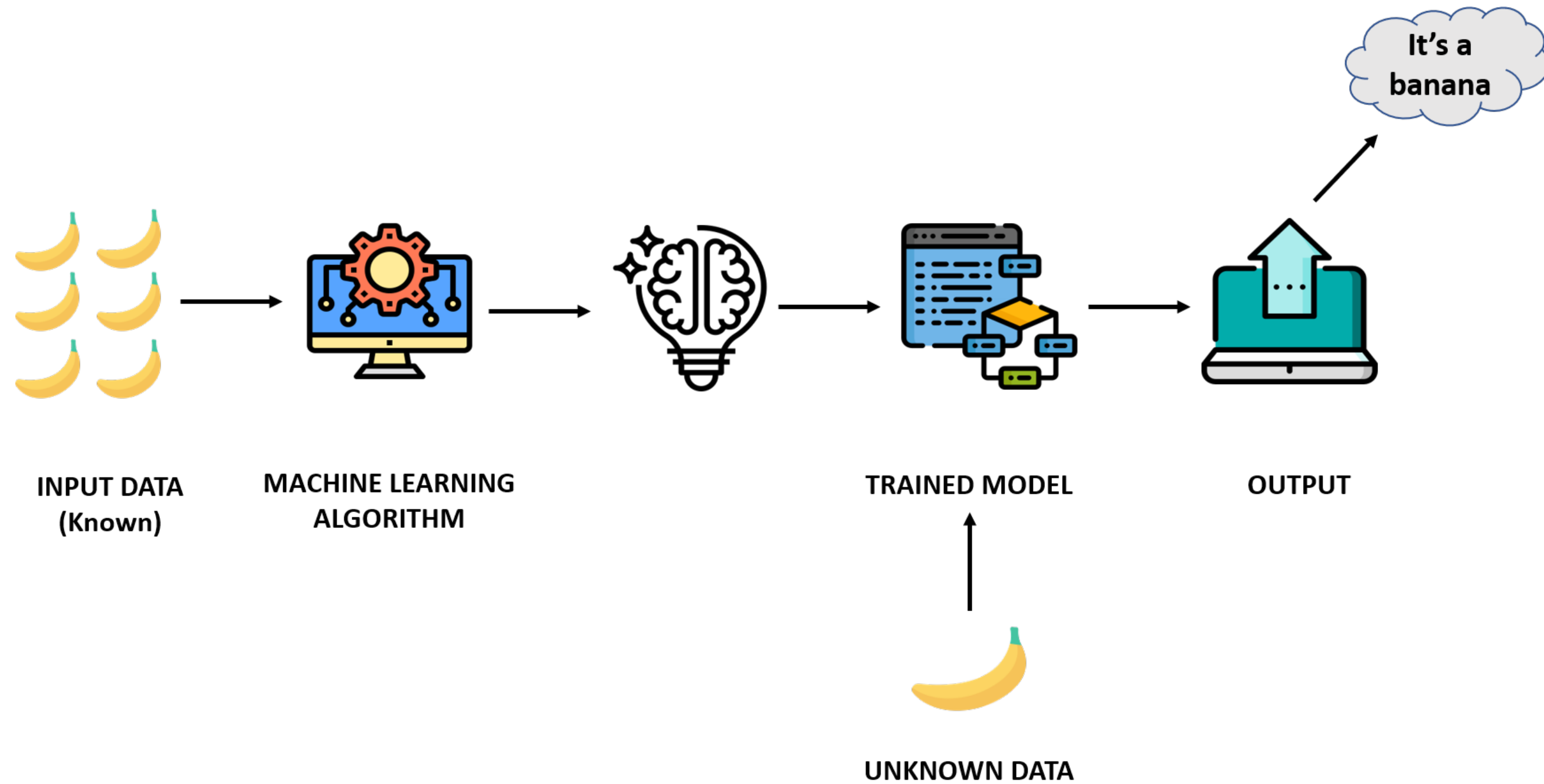
Typical M.L Flow



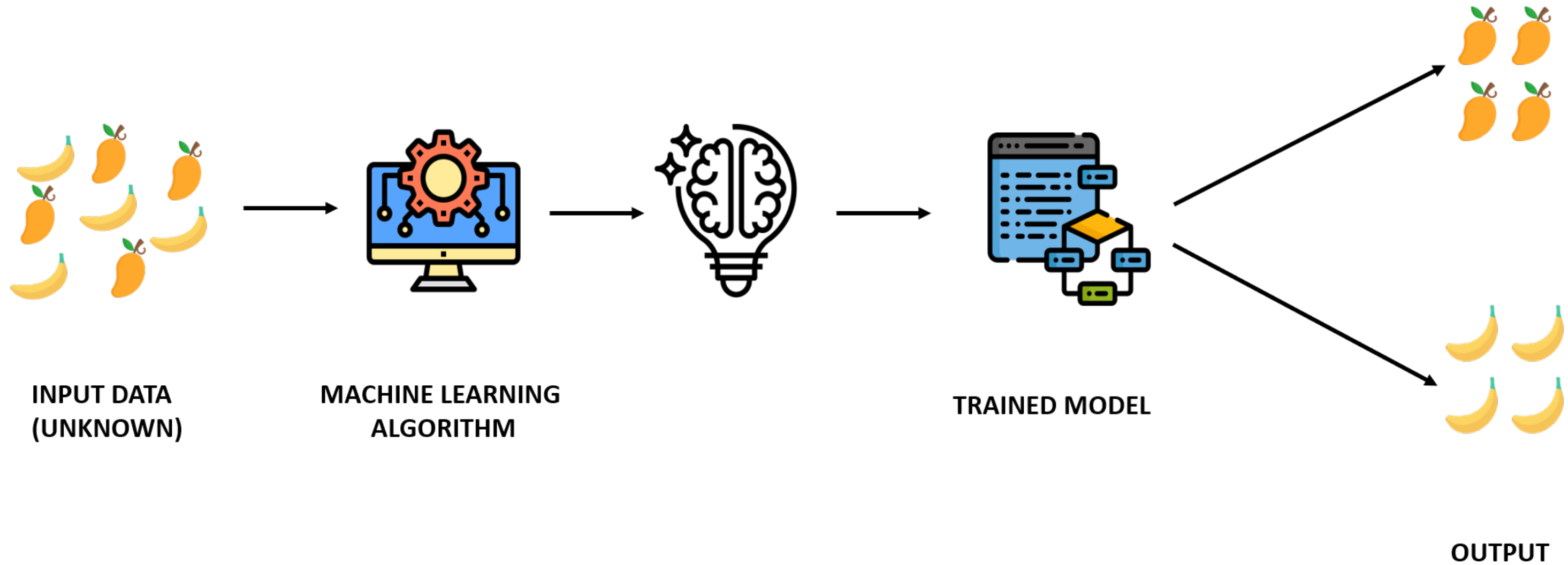
Types of Machine Learning algorithms

- Supervised learning
- Unsupervised learning
- Reinforcement learning
- Recommender systems

Supervised learning



Unsupervised learning



Reinforcement learning

- Reinforcement Learning is a type of machine learning technique that enables an agent to learn in an interactive environment by trial and error using feedback from its own actions and experiences.
- Whenever the model predicts or produces a result, it is penalized if the prediction is wrong or rewarded if the prediction is correct.

Challenges with Reinforcement learning

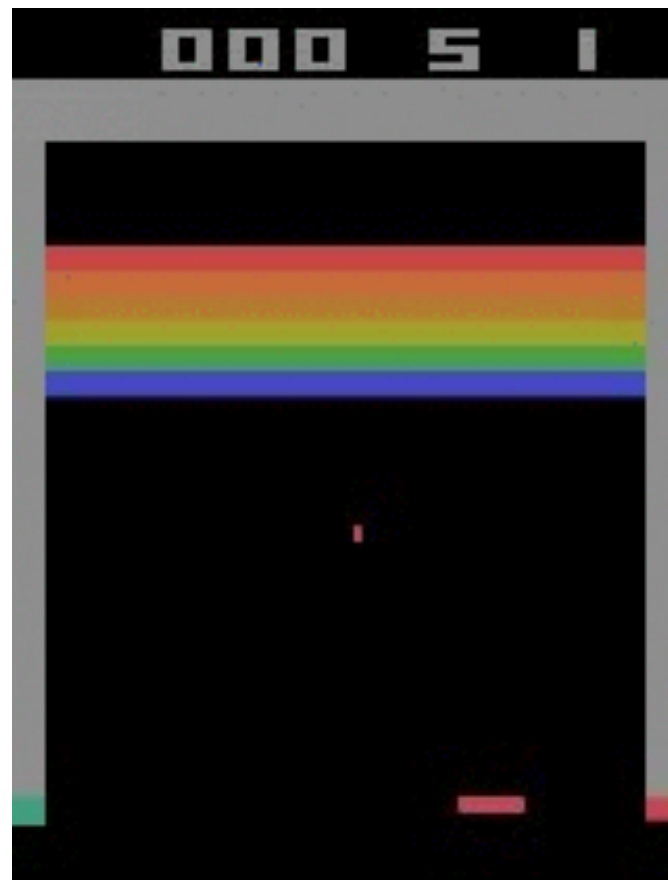
- The main challenge in reinforcement learning lays in preparing the simulation environment, which is highly dependant on the task to be performed.
- Scaling and tweaking the neural network controlling the agent is another challenge. There is no way to communicate with the network other than through the system of rewards and penalties.

There are agents that will optimize the prize without performing the task it was designed for. An interesting example can be found in the OpenAI video (below), where the agent learned to gain rewards, but not to complete the race.

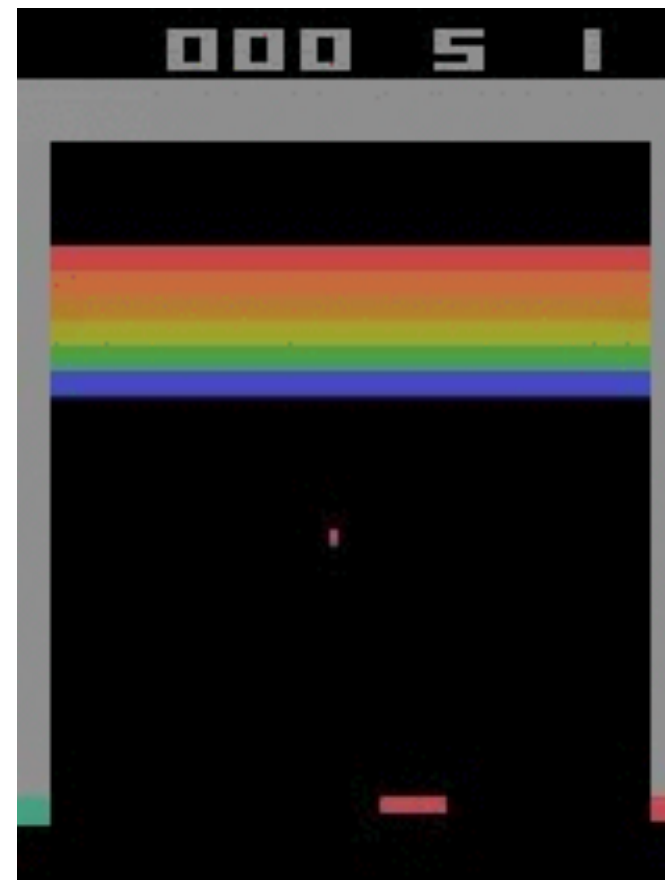


Breakout game - Atari

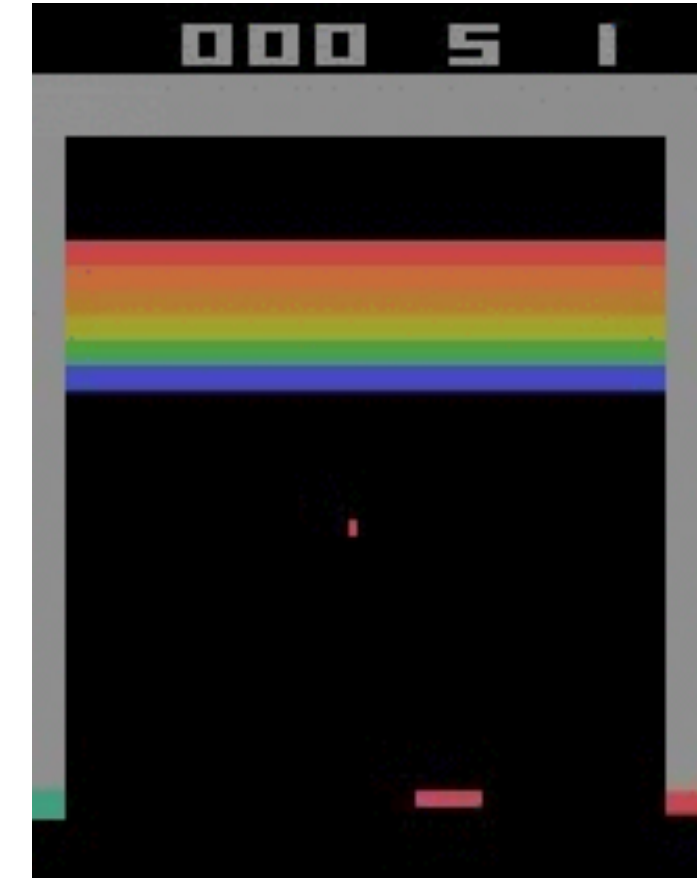
Initial performance



After 15 min of training

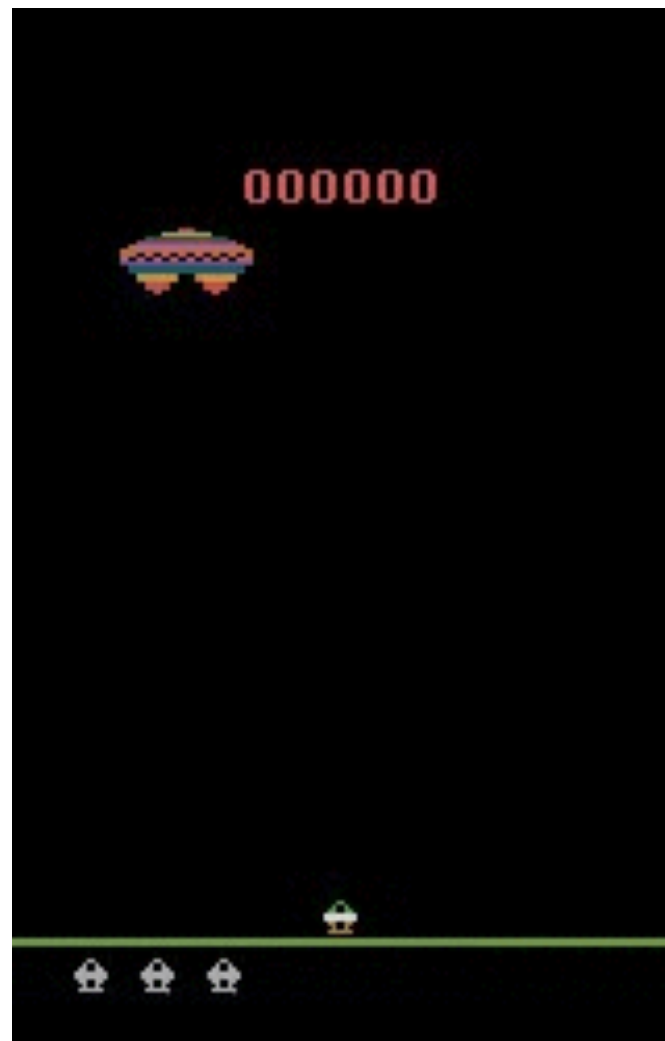


After 30 min of training

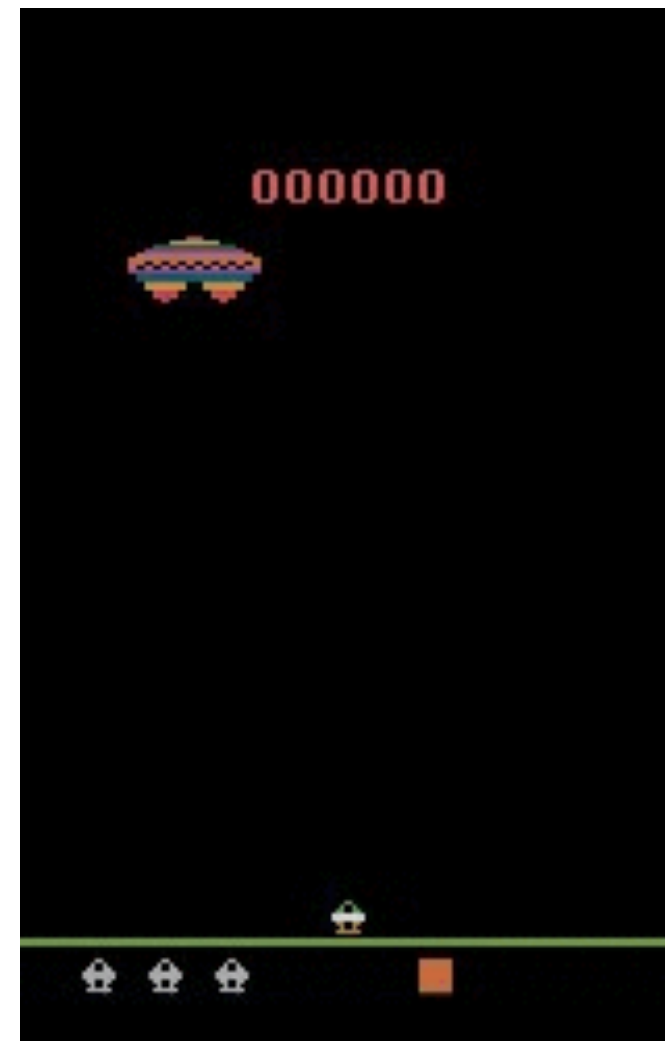


Assault game - Atari

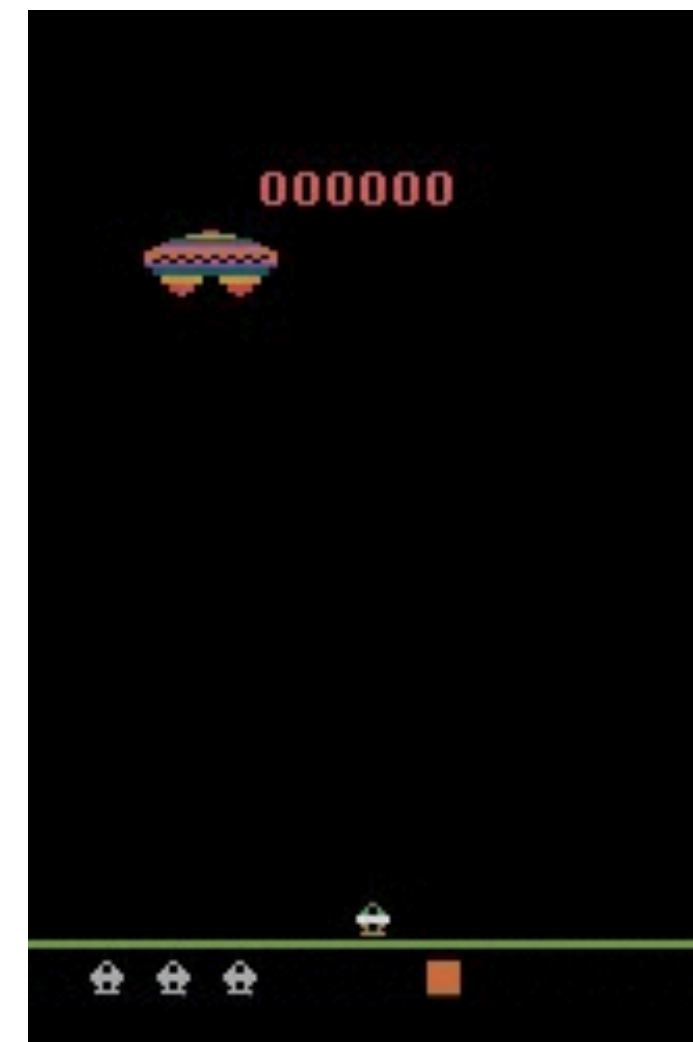
Initial performance

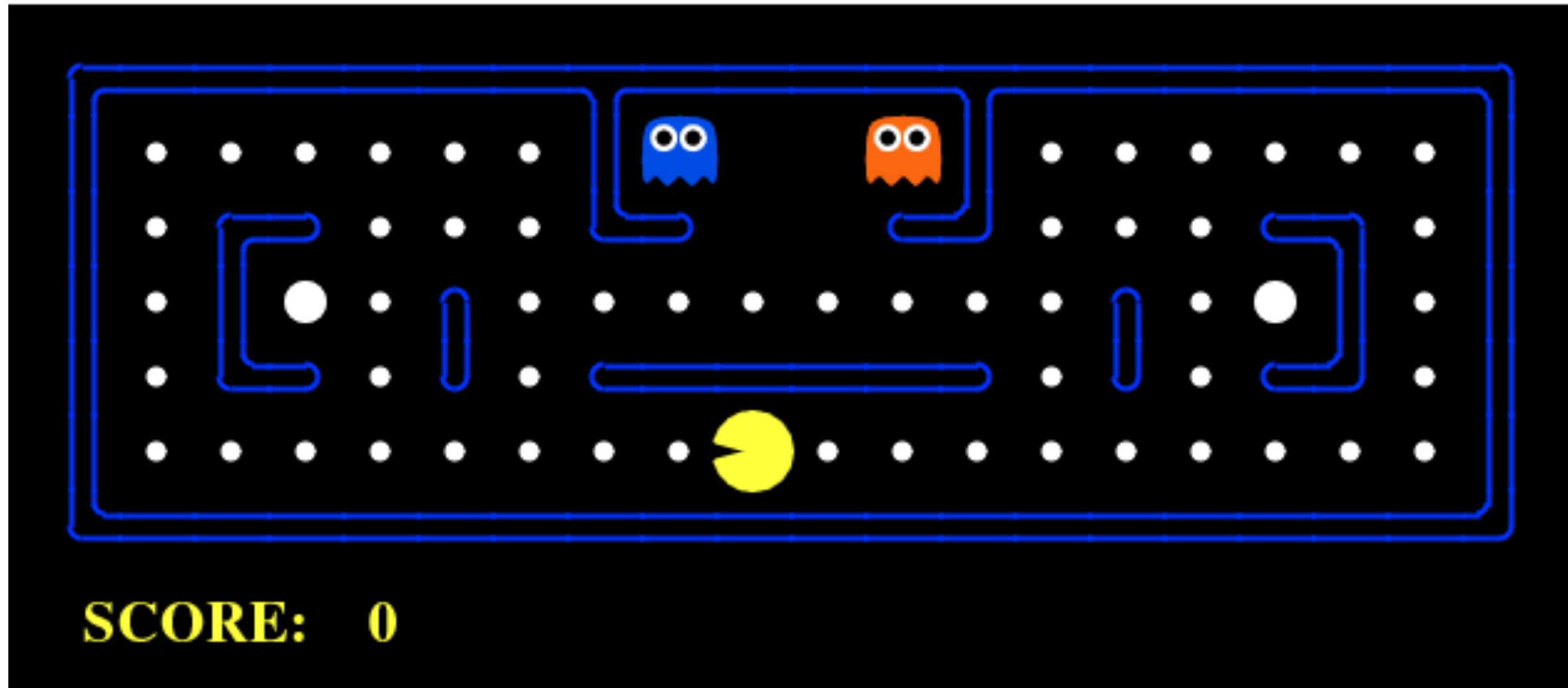


After 15 min of training



After 30 min of training



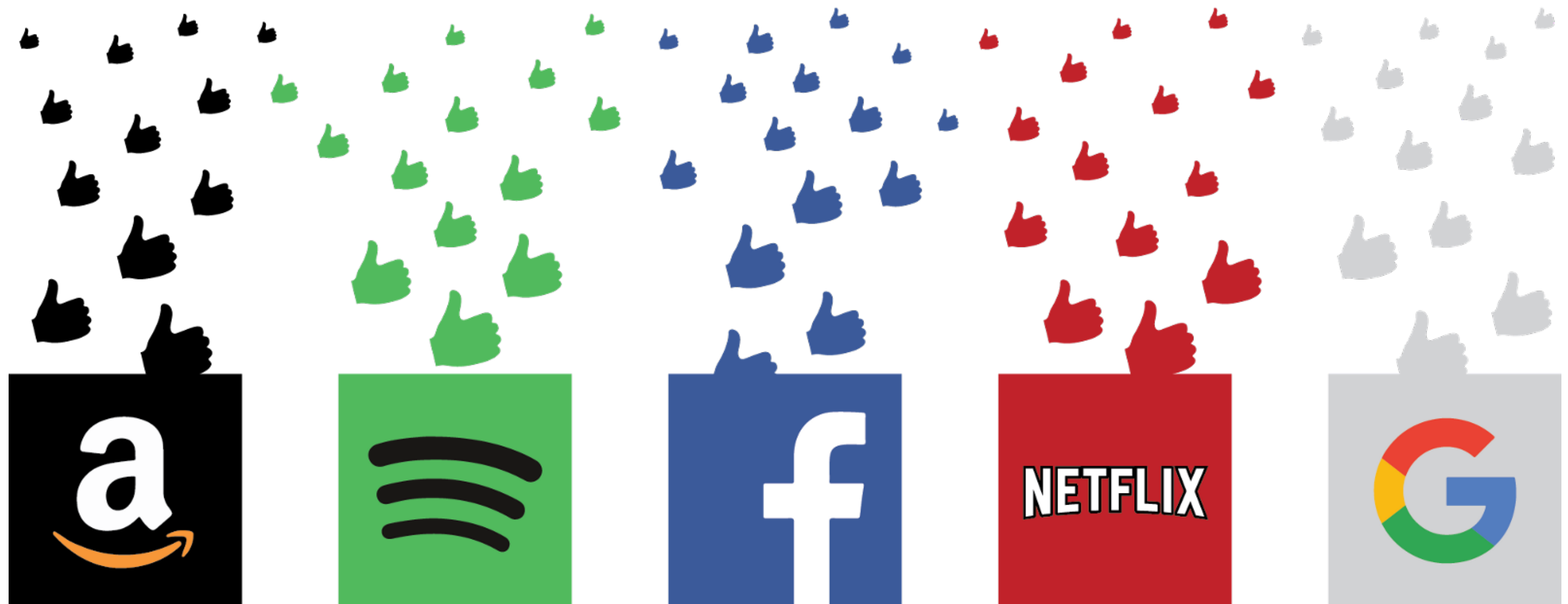


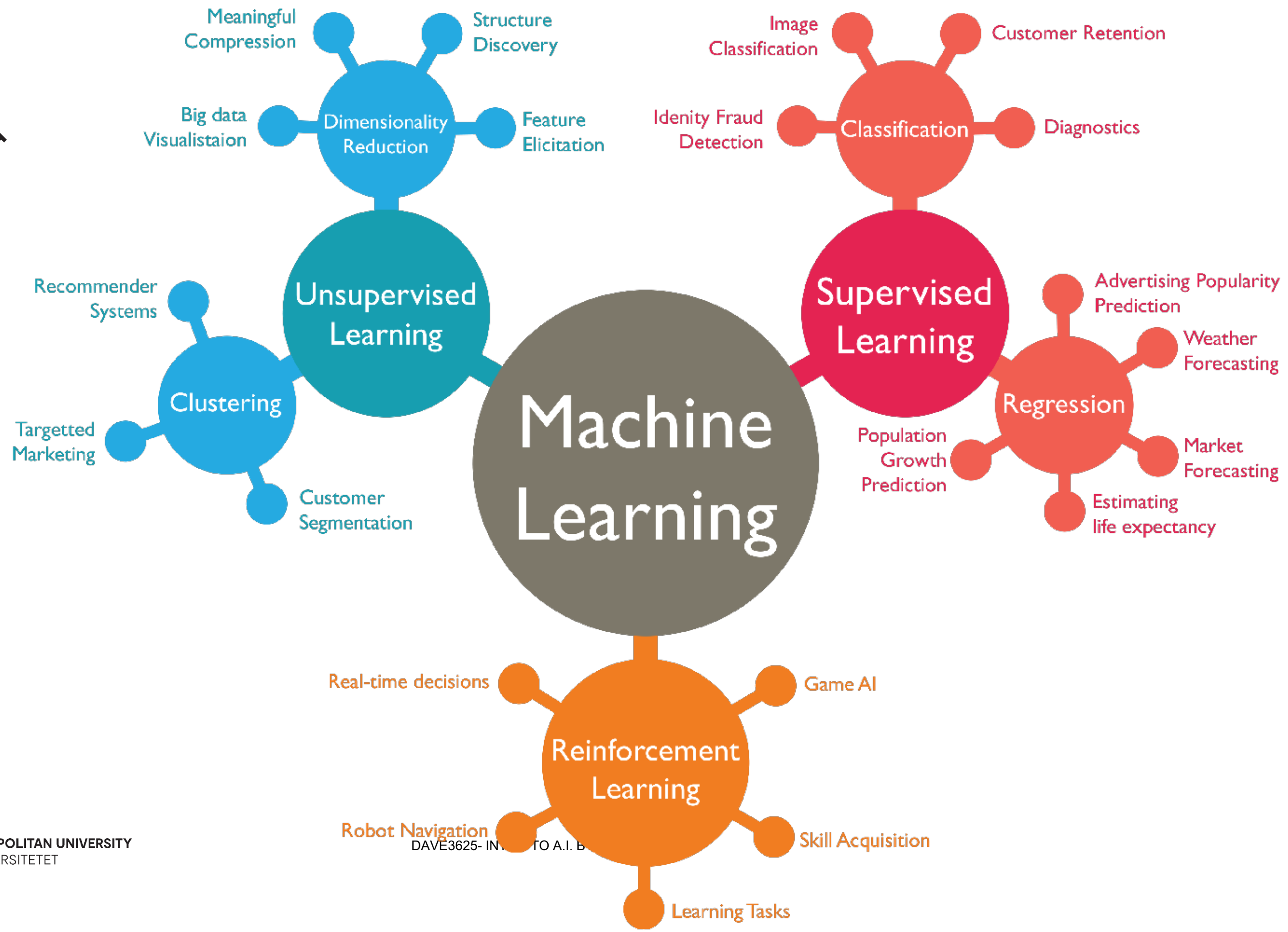
Wanna try some A.I reinforcement learning in games ?

<https://gym.openai.com/>

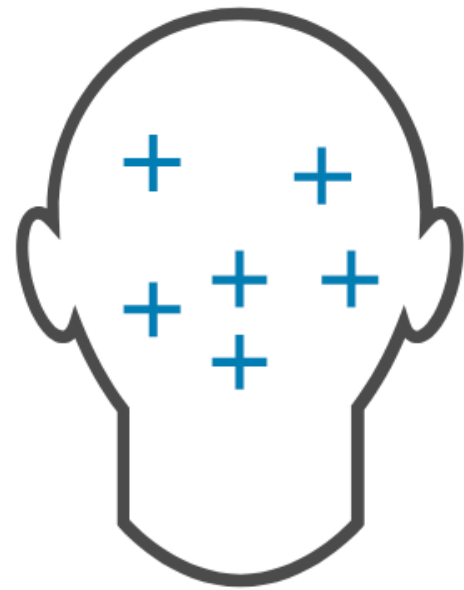
Reccomender systems

- *Recommender systems* are an important class of machine learning algorithms that offer "relevant" suggestions to users.
- These systems predict the most likely product that the users are most likely to purchase and are of interest to them





When should we use machine learning ?



Hand-written rules and equations are too complex—as in face recognition and speech recognition.



The rules of a task are constantly changing—as in fraud detection from transaction records.



The nature of the data keeps changing, and the program needs to adapt—as in automated trading, energy demand forecasting, and predicting shopping trends.

