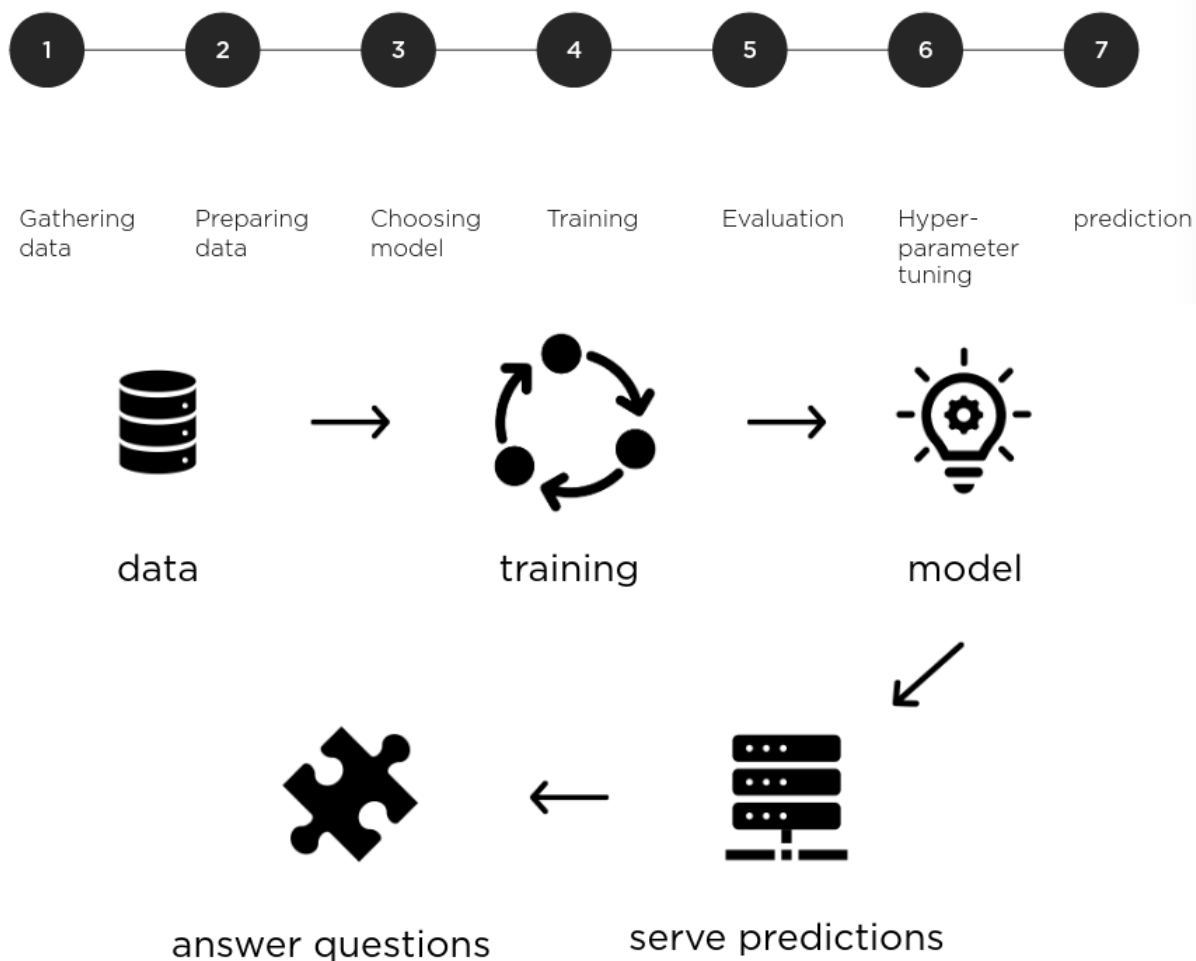


# Introduction to Machine Learning

## 1 Machine Learning Lifecycle



- Randomise the data order so that the model doesn't train for specific orders
- Two types of data, training and evaluation, to train and assess the model respectively
- To determine how to differentiate between things using our model rather than using human judgement and manual rules
- We can extrapolate the ideas to other problem domains as well, where the same principles apply

## 2 What is machine learning?

### Definition: Machine Learning

A computer program is said to learn from experience  $E$  with respect to some class of tasks  $T$  and performance measure  $P$  if its performance at tasks in  $T$ , as measured by  $P$ , improves with experience  $E$ .

Machine learning is the study of algorithms that:

- Improve their performance  $P$
- At some task  $T$
- With experience  $E$

A well defined learning task is given by  $\langle P, T, E \rangle$

### 3 Supervised Learning (regression)

To learn the mapping (the rules) between a set of inputs and outputs

Labelled data is provided of past input and output pairs during the learning process to train the model how it should behave

### 4 Unsupervised learning

To learn the hidden pattern (the rules) from a set of inputs (no output)

Unlabelled data is provided of past input during the learning process to train the model how it should behave

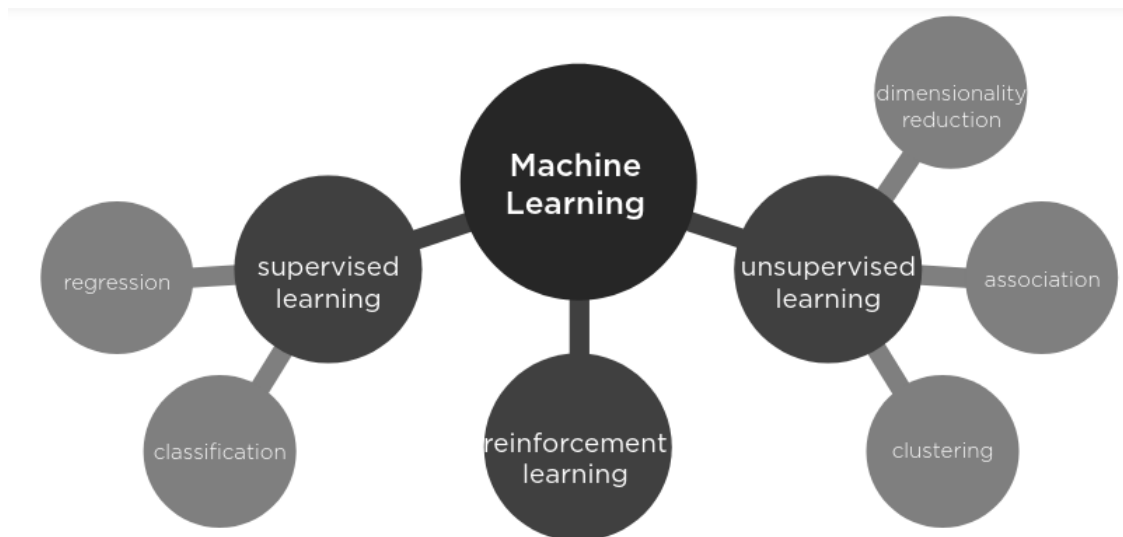
**Dimensionality reduction** - Get rid of unused parameters and aspects of the system

### 5 Reinforcement learning

Occasional positive and negative feedback is used to reinforce behaviours

- Good behaviours are rewarded with a treat and become more common
- Bad behaviours are punished and become less common

A reinforcement learning algorithm just aims to maximise its rewards by playing the game over and over again



### 6 Key terms

**Label** - The variable that we are predicting typically represented by the variable  $y$

**Features** are input variables that describe our data typically represented by the variables  $x_1, x_2, x_3, \dots, x_n$

**Example** - A particular instance of data,  $x$

**Labelled example** - Has {features,label}:( $x,y$ ) used to train the model

**Unlabelled example** - Has {feature,?}:( $x,?$ ) used for making prediction on new data

**Model** - Maps examples to predict labels:  $\hat{y}$  defined by internal parameters, which are learned

**Training** - Creating or learning the model

**Inference** - Applying the trained model to unlabelled examples