In the name of who surround me with blessing that I can not count

AI: From the pages of *science*, to the future of our lives.

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Goals

In this lab you will:

- have a brief introduction on *AI* and *ML*
  - basic concept of machine learning
- main algorithm
  - supervised
    - `regression`
    - classification
  - unsupervised
- Learn to implement linear `regression`

What Is AI or Artificial Intelligence?

Artificial intelligence or AI is the branch of computer science that studies machine intelligence.

EXAMPLES OF APPLICATIONS

- Search engines (Google)
- Content recommendations (Netflix, YouTube)
- Self-driving vehicles
- Automatic language translation
- Facial recognition
- Computer games
- Spam filters

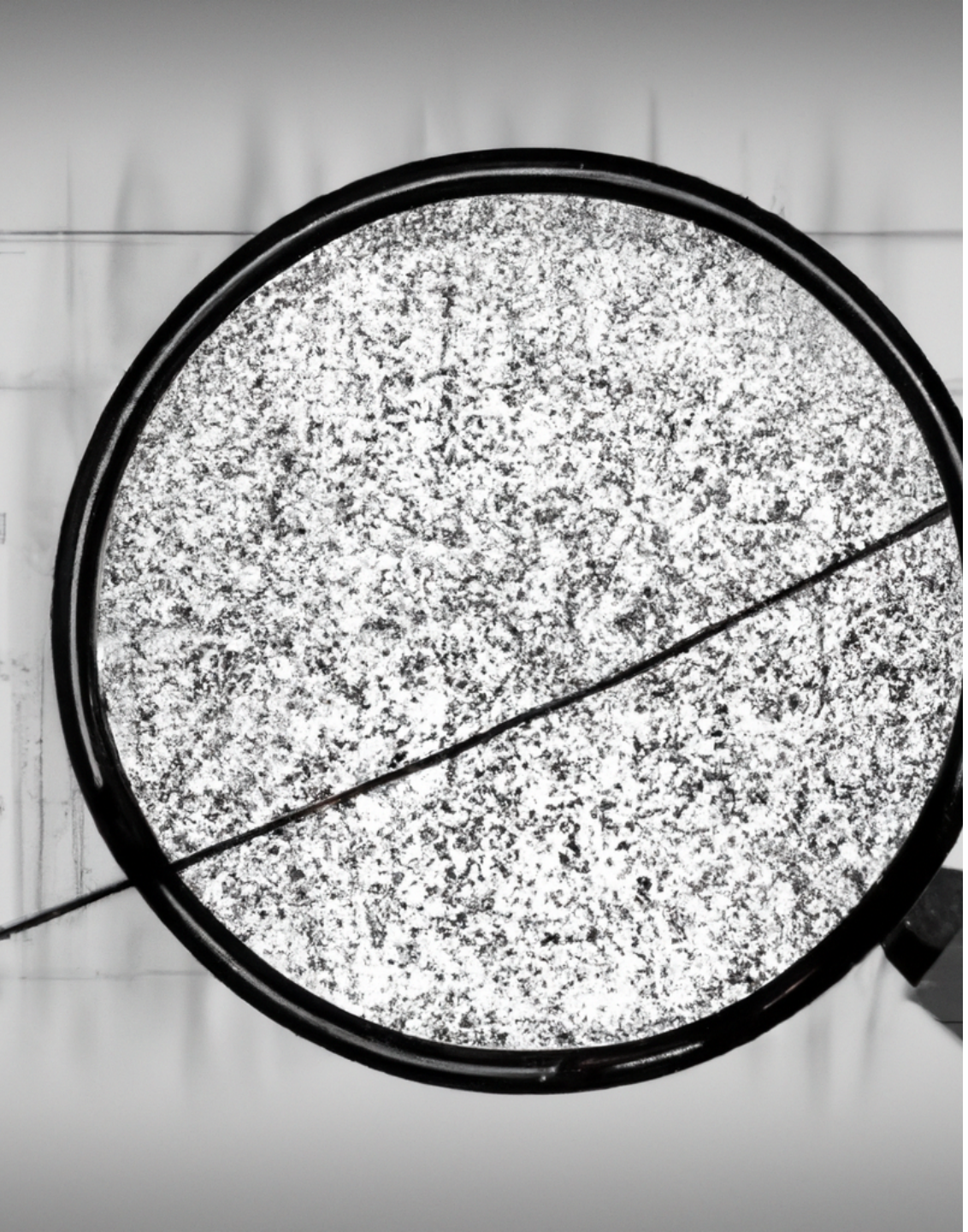
An AI is a computer system that performs tasks that usually require human intelligence.

machine learning

Subfield of AI in order to make intelligent machine

> Field of study that gives the computers the ability to learn without `explicitly` programmed

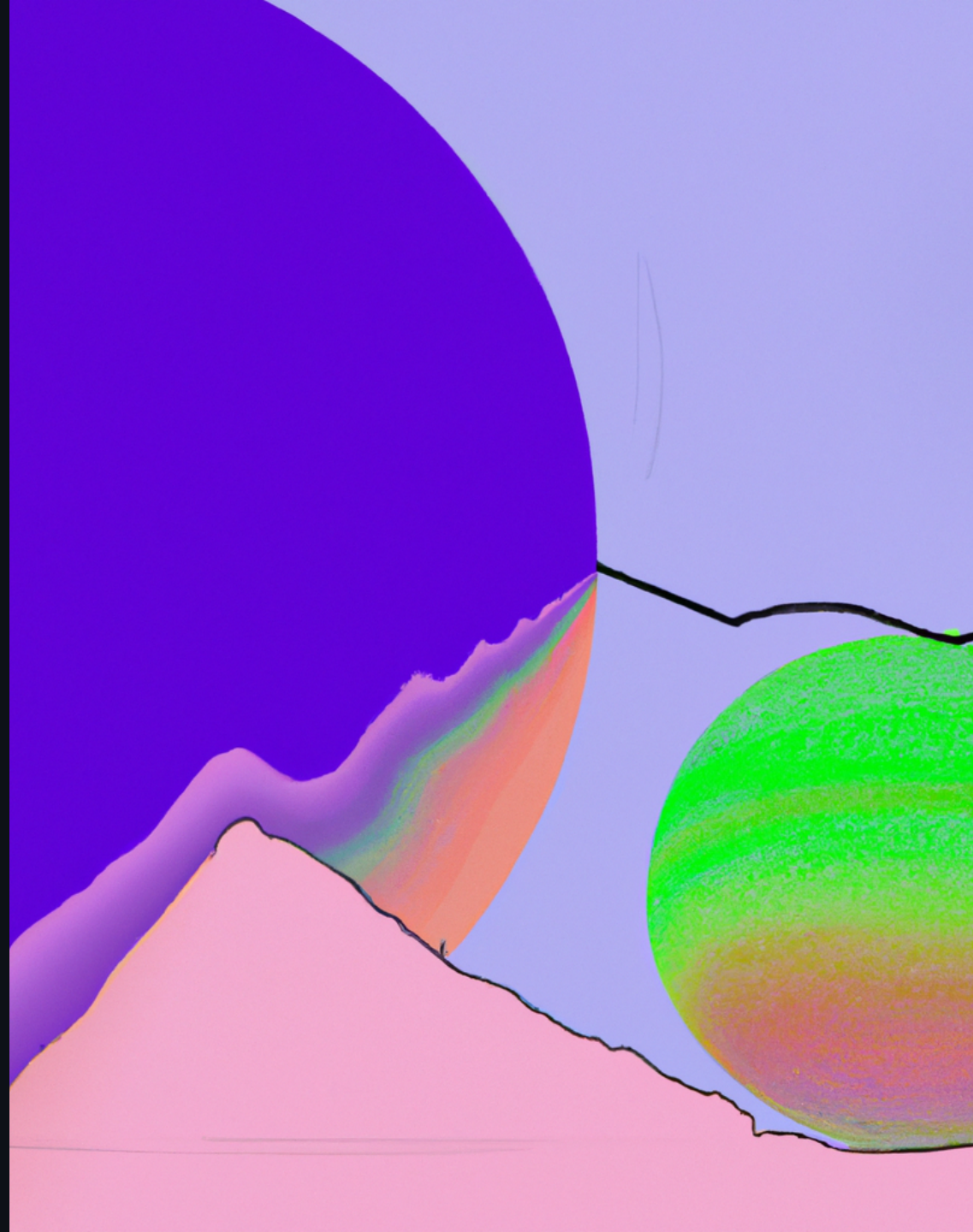
- Arthur samuel `1959`



Supervised learning

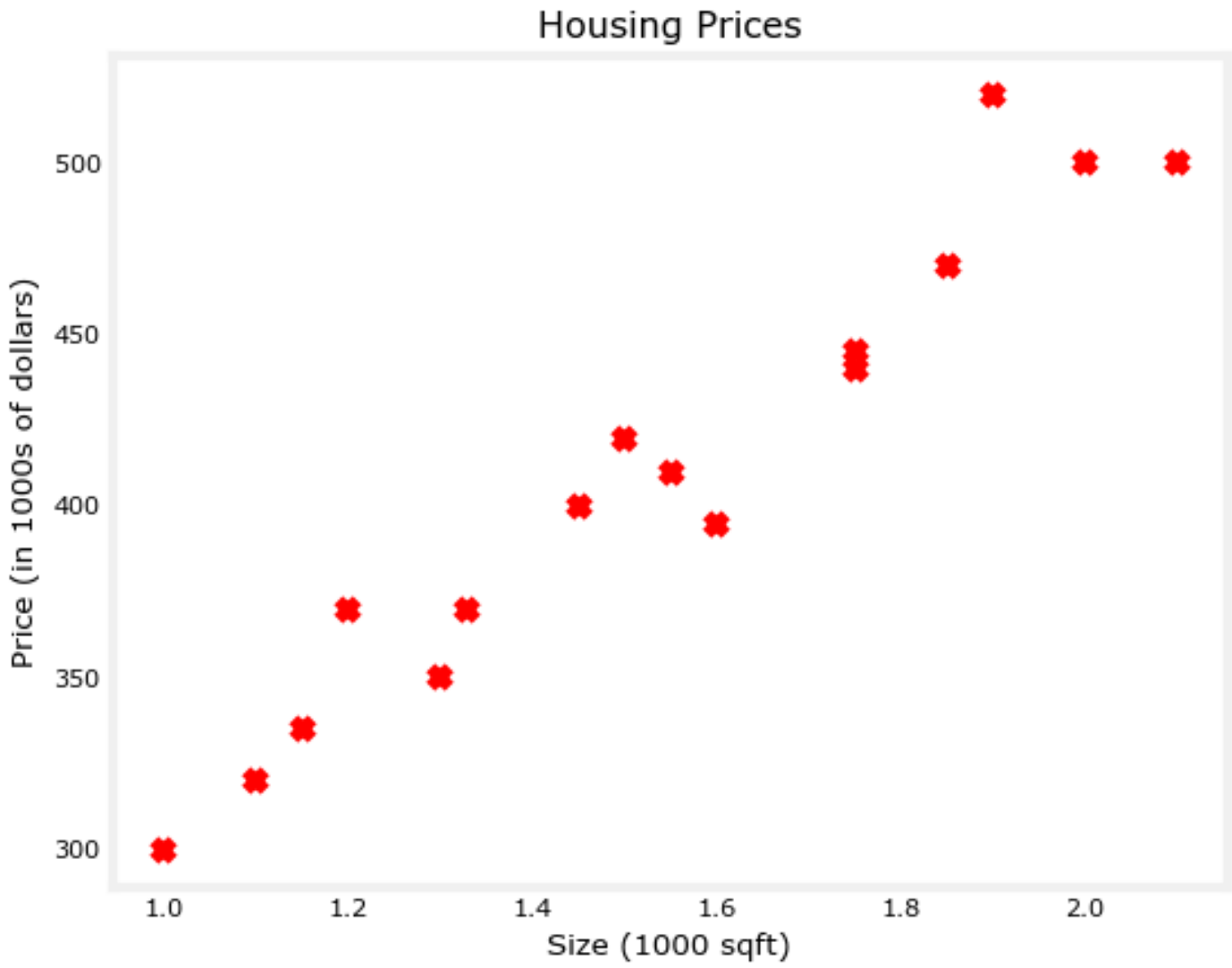
- learn from being given **right answers**
  - correct pairs of input (x) and output (y)

input	*output*	*application*
email	spam?(0,1)	
audio	text transcript	
English	Spanish	
ad-User	click?(0,1)	
image-radar	position of other car	
image of phone	defect?(0,1)	



Regression

predict a `number` from infinitely many possible `outputs`



Classification

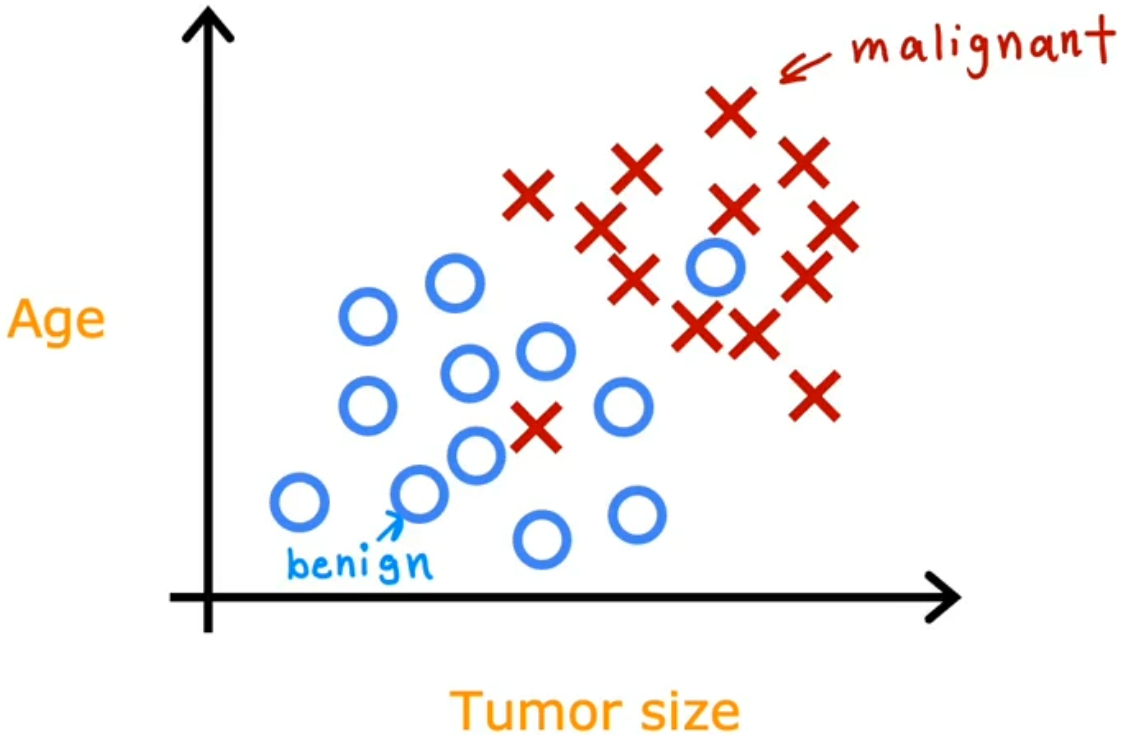
many `inputs`

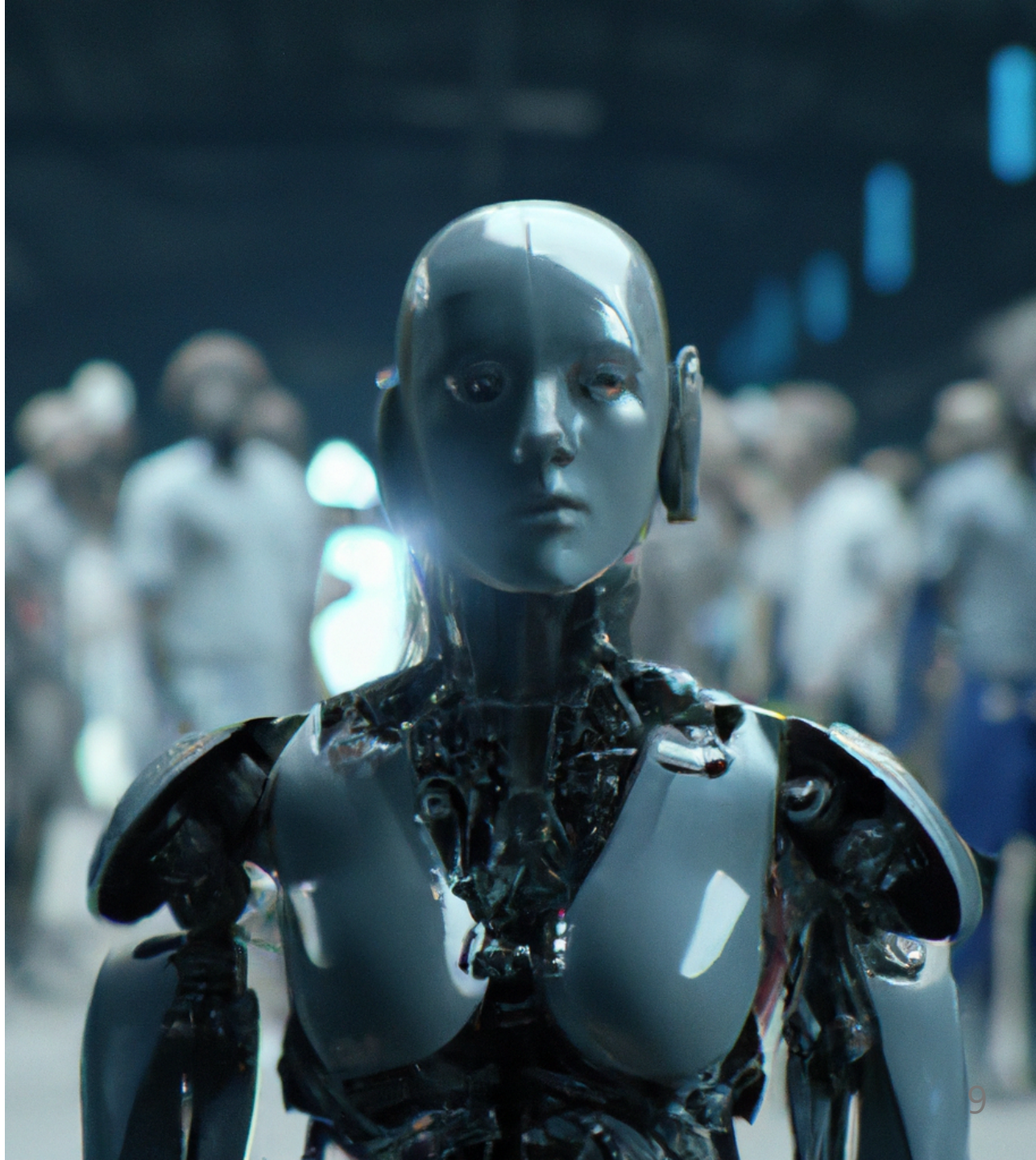
some outputs called

`categories`

Size	*diagnosis*
6	1
8	1
2	0
5	0
1	0

Two or more inputs






Recap
In every living man a child is hidden that wants to play

Supervised learning

Learns from being given "right answers"

Regression

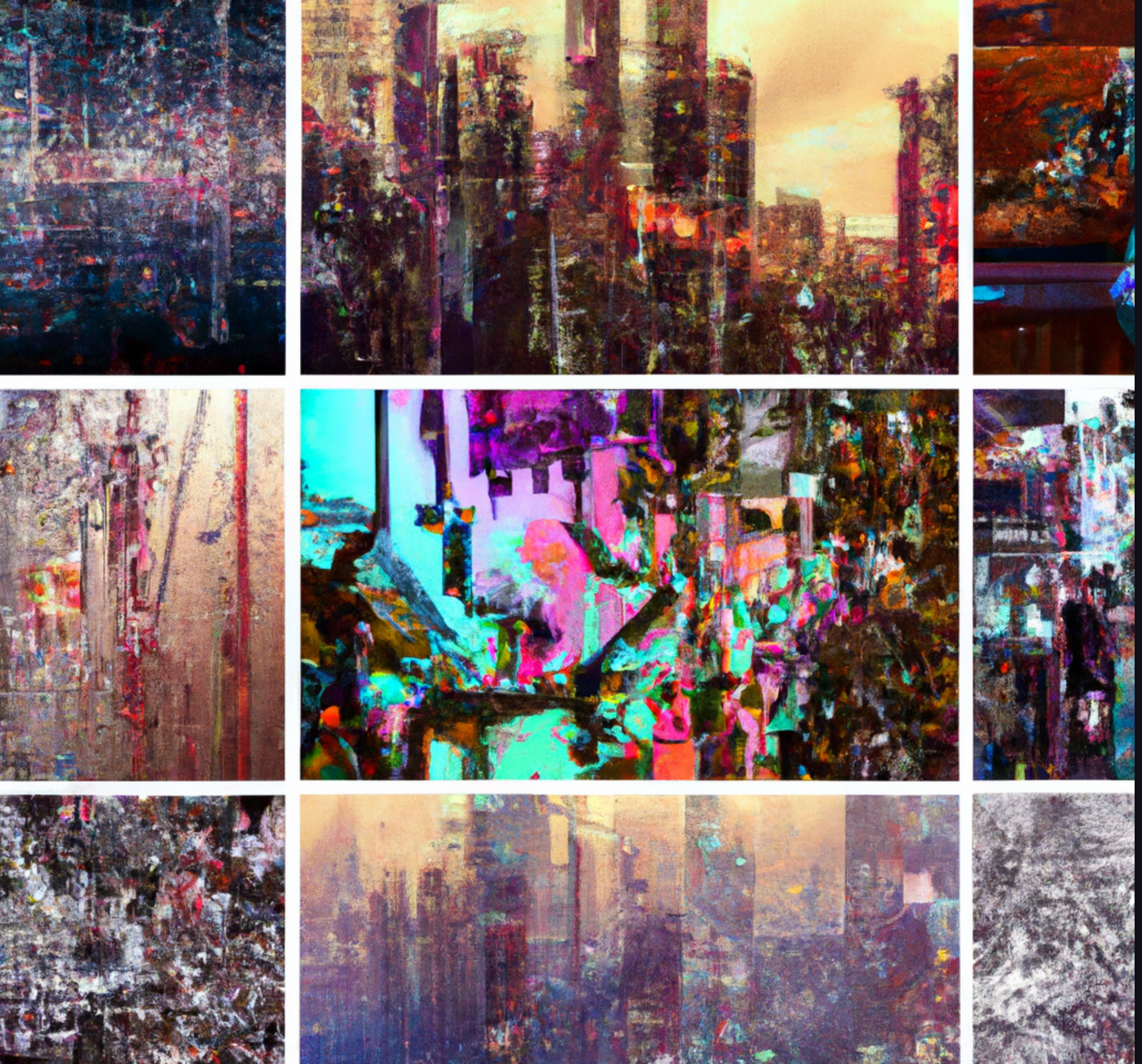
Predict a number

infinitely many possible outputs

Classification

predict categories

small number of possible outputs

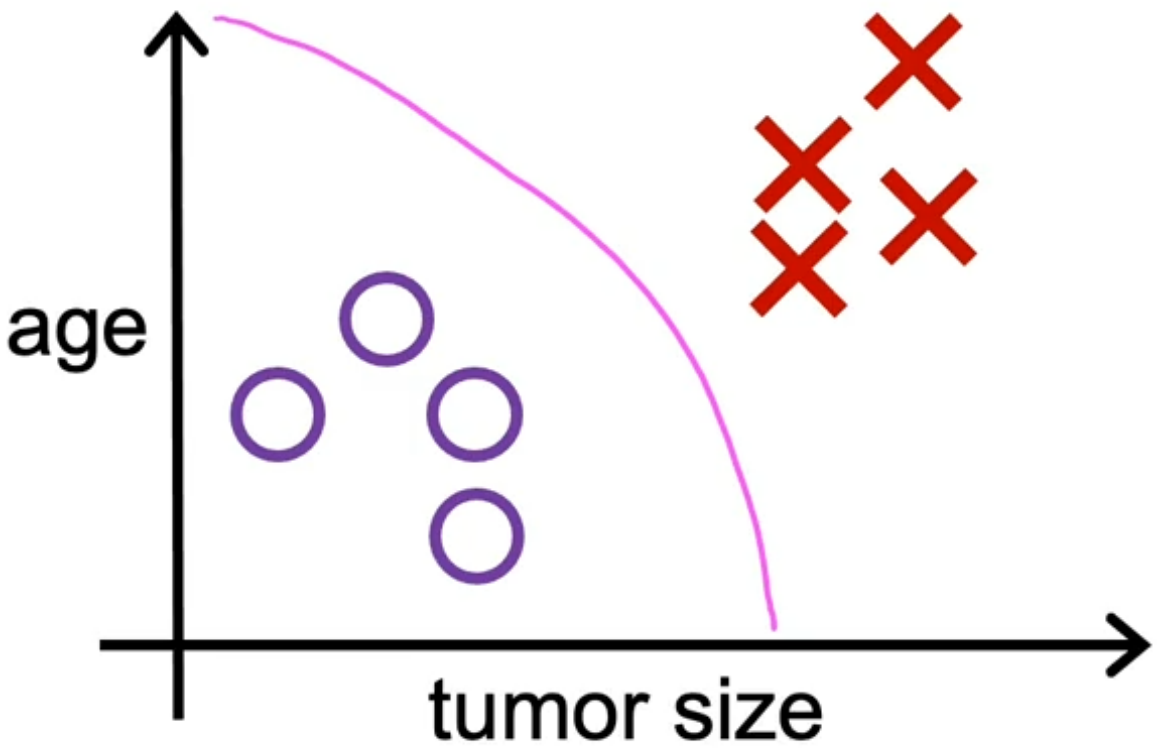


Unsupervised learning

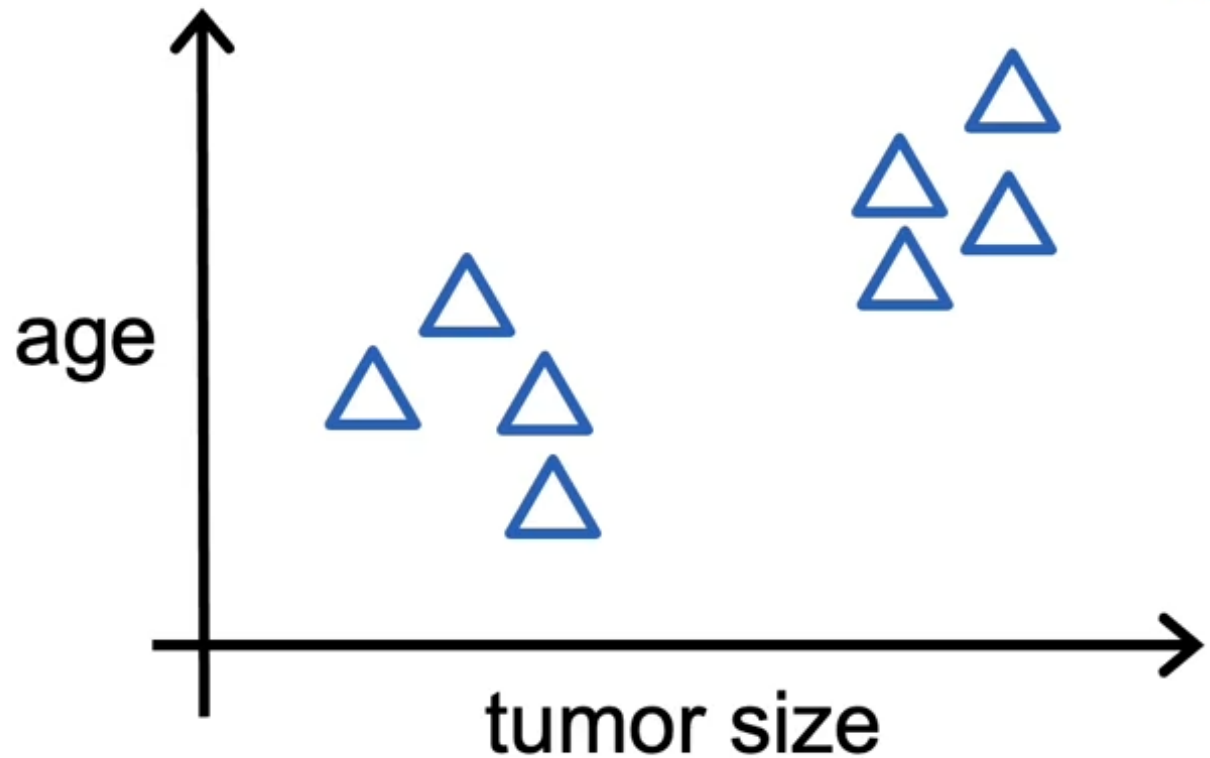
Find something intreating in (unlabeled) Data

- Clustering
- anomaly detection
- Dimensionality reduction

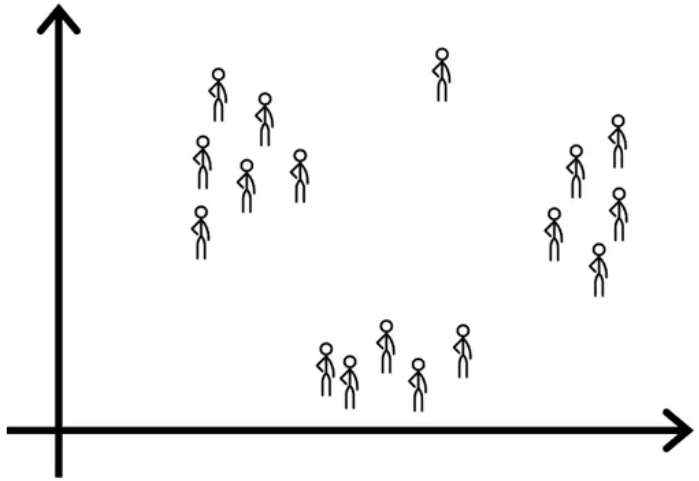
Supervised learning
Learn from data labeled with the "right answers"



Unsupervised learning
Find something interesting in unlabeled data.



Clustering: Grouping customers



Question

Of the following examples, which would you address using an unsupervised learning algorithm?

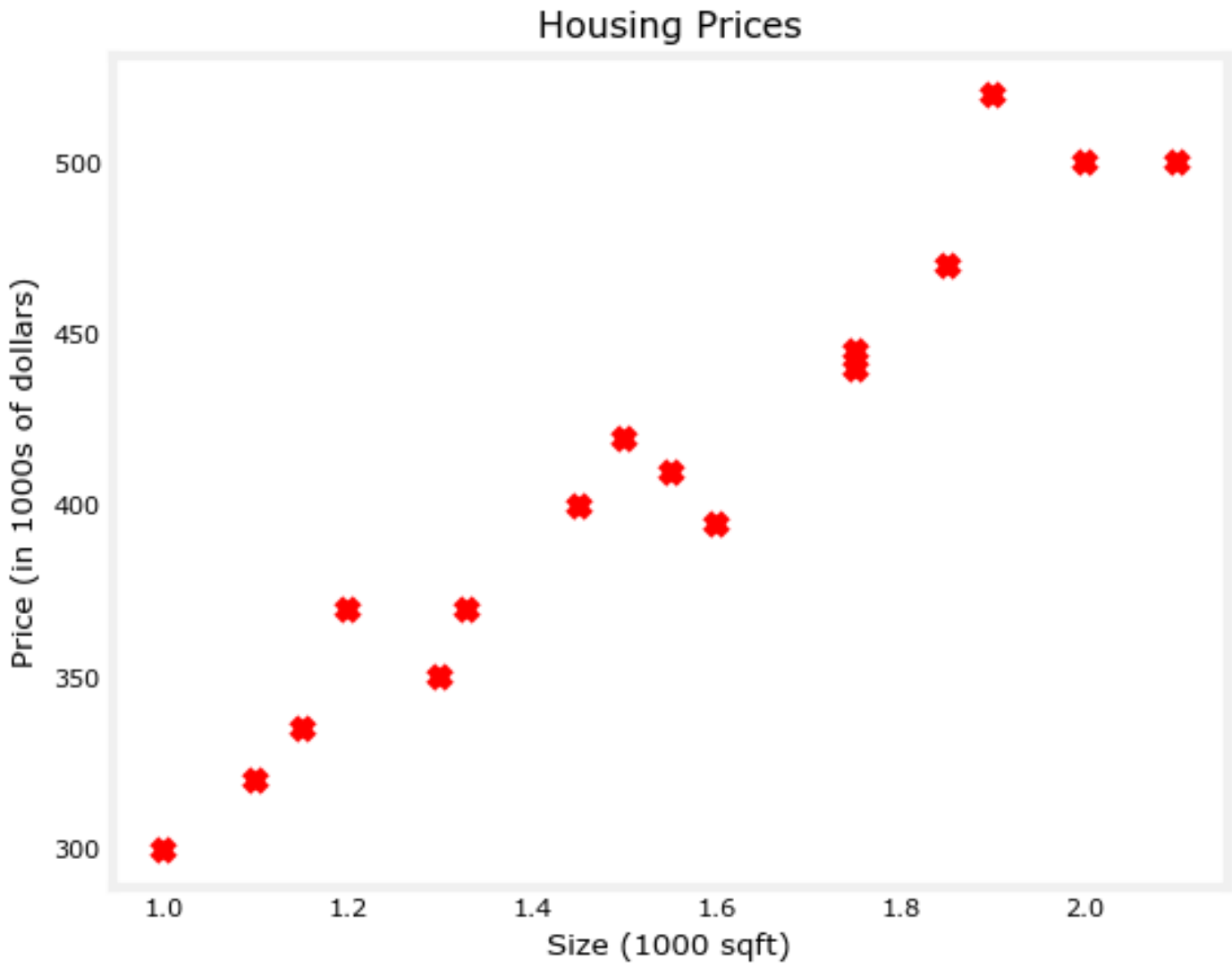
- [ ] Given email labeled as spam/not spam, learn a spam filter.
- [ ] Given a set of news articles found on the web, group them into sets of articles about the same story.
- [ ] Given a database of customer data, automatically discover market segments and group customers into different market segments.
- [ ] Given a dataset of patients diagnosed as either having diabetes or not, learn to classify new patients as having diabetes or not

linear regression

$$f_{w,b}(x) = wx + b$$

w , b > parameters , weight

x > single feature



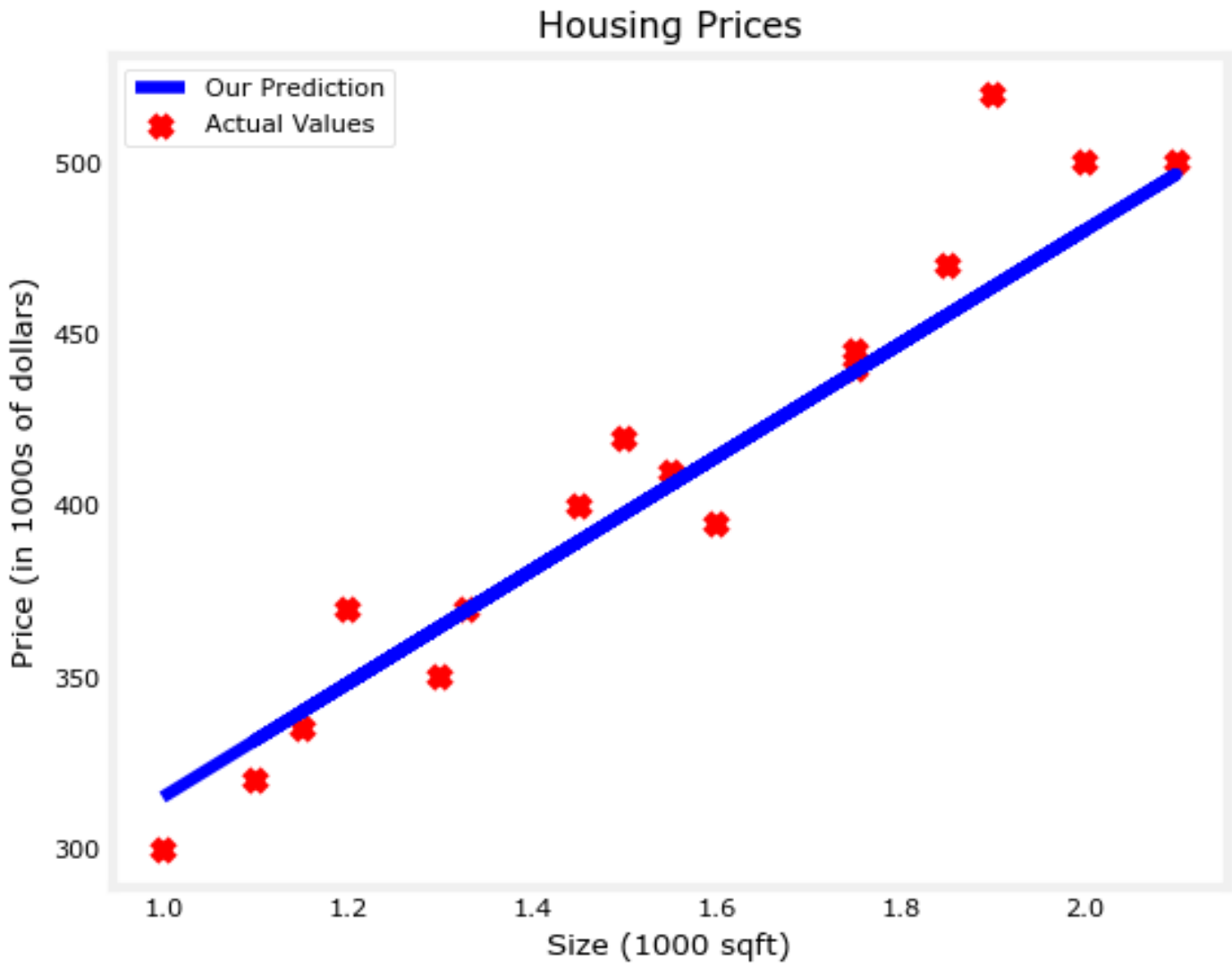
Cost function

$$J(w,b) = \frac{1}{2m}\sum_{i=0}^{m-1}(f_{w,b}(x^{(i)}) - y^{(i)})^2$$

where

$$yHat = f_{w,b}(x^{(i)}) = wx^{(i)} + b$$

m = number of example



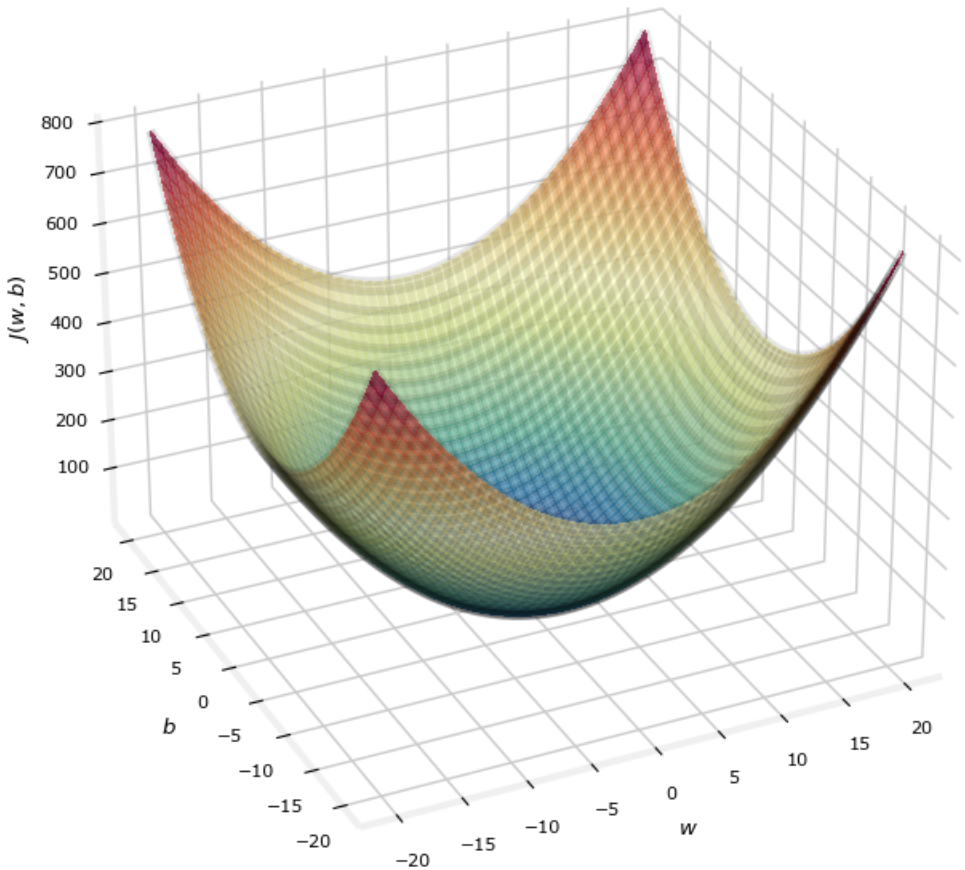
Example

choose w to minimize J(w)

$$yHat = f_w(x^{(i)}) = wx^{(i)}$$

$$J(w) = \frac{1}{2m}\sum_{i=0}^{m-1}(f_w(x^{(i)}) - y^{(i)})^2$$

$J(w, b)$
[You can rotate this figure]



$J(w, b)$
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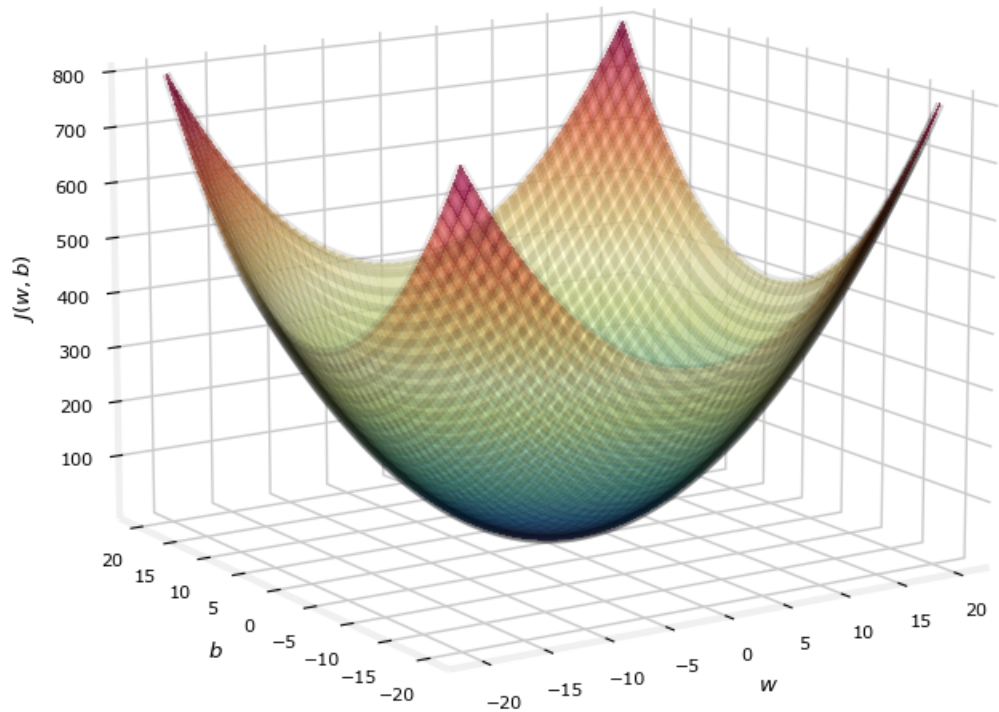

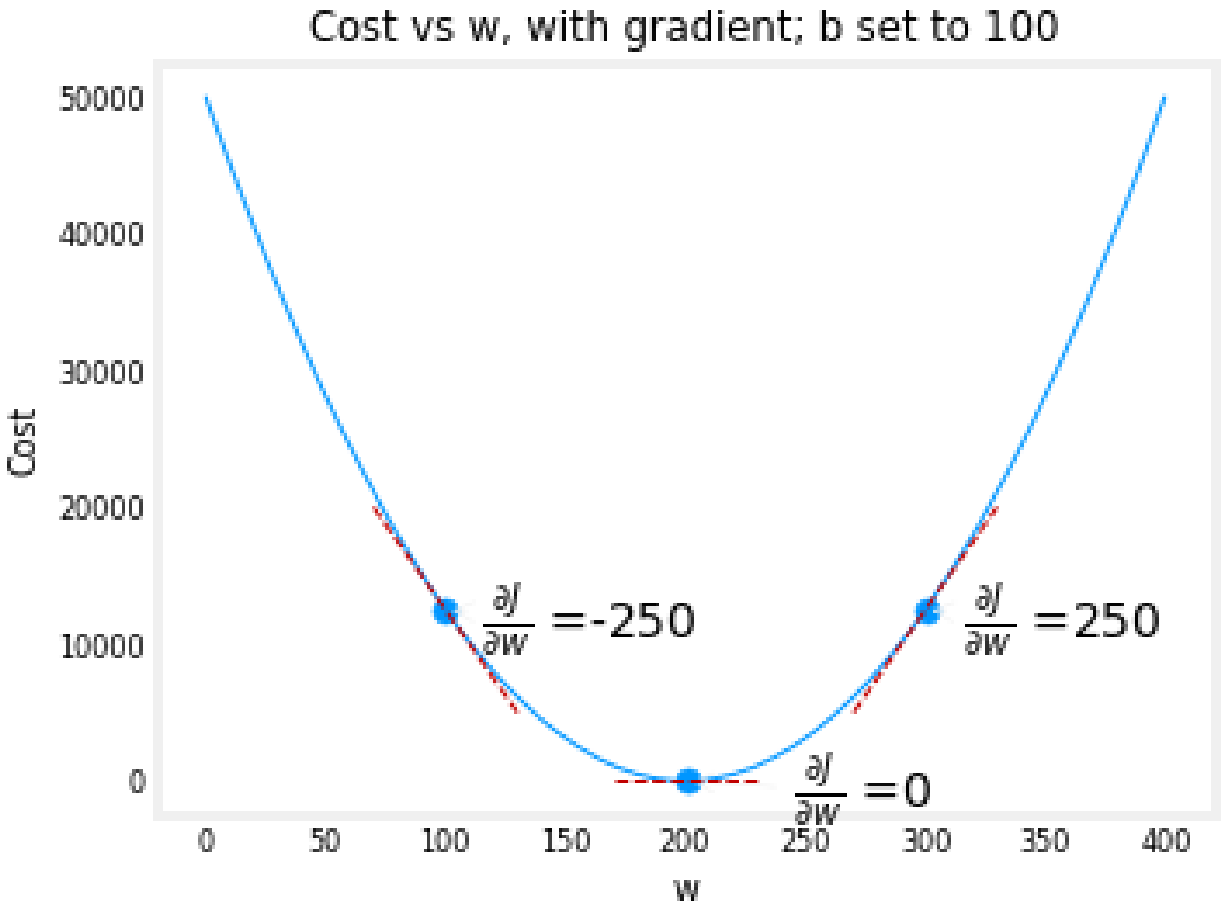

Gradient descent

a more systematic way to minimize j(w,b)

repeat until convergence: {

$$w = w - \alpha \frac{\partial}{\partial w} J(w,b)$$

$$b = b - \alpha \frac{\partial}{\partial b} J(w,b)$$

}

Derivative of the Cost func

$$J(w,b) = \frac{1}{2m} \sum_{i=0}^{m-1} (f_{w,b}(x^{(i)}) - y^{(i)})^2$$

$$\frac{\partial}{\partial w} J(w,b) = \frac{1}{m} \sum_{i=0}^{m-1} (f_{w,b}(x^{(i)}) - y^{(i)}) x^{(i)}$$

$$\frac{\partial}{\partial b} J(w,b) = \frac{1}{m} \sum_{i=0}^{m-1} (f_{w,b}(x^{(i)}) - y^{(i)})$$

optional

if alpha is too small :

if alpha is too big :

$$\alpha \frac{\partial}{\partial w} J(w, b)$$

calculate Derivative : ☻

Lets get our hands dirty

- step 1
  - read our data
- step 2
  - write our functions
    - calculate yHat
    - calculate cost
    - calculate gradient
    - implement gradient descent
- step 3
  - congratulations