Machine Learning

Machine learning using scikit-learn

Contents

- Use cases
- What is ML & models
- Evaluating
- Examples
- Hackathon!

What can machine learning do?

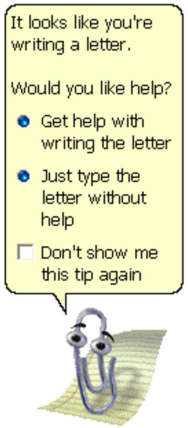
- Automate - Save $$$

What can machine learning do?

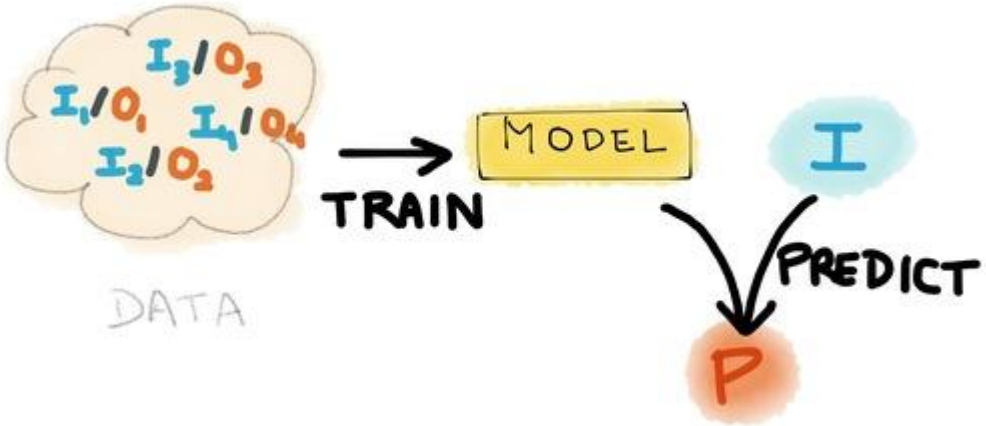
- Detect anomalies (security, fraud, …)

What can machine learning do?

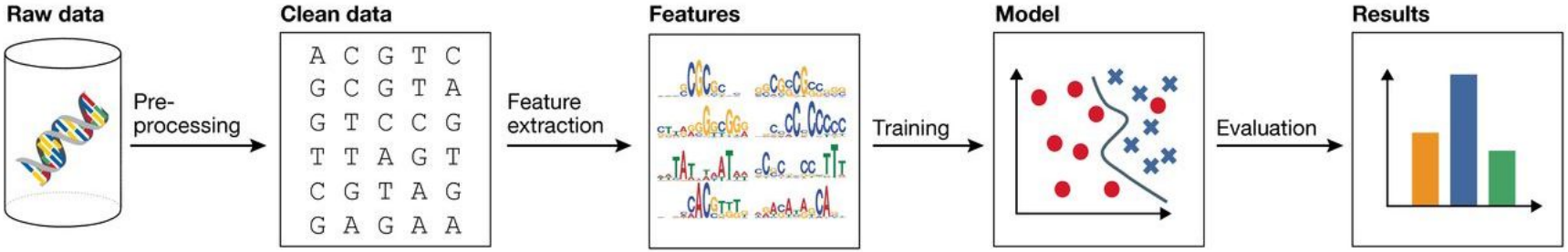
- Healthcare - Save lives
- GeriMedica - Second Opinion



What is machine learning?

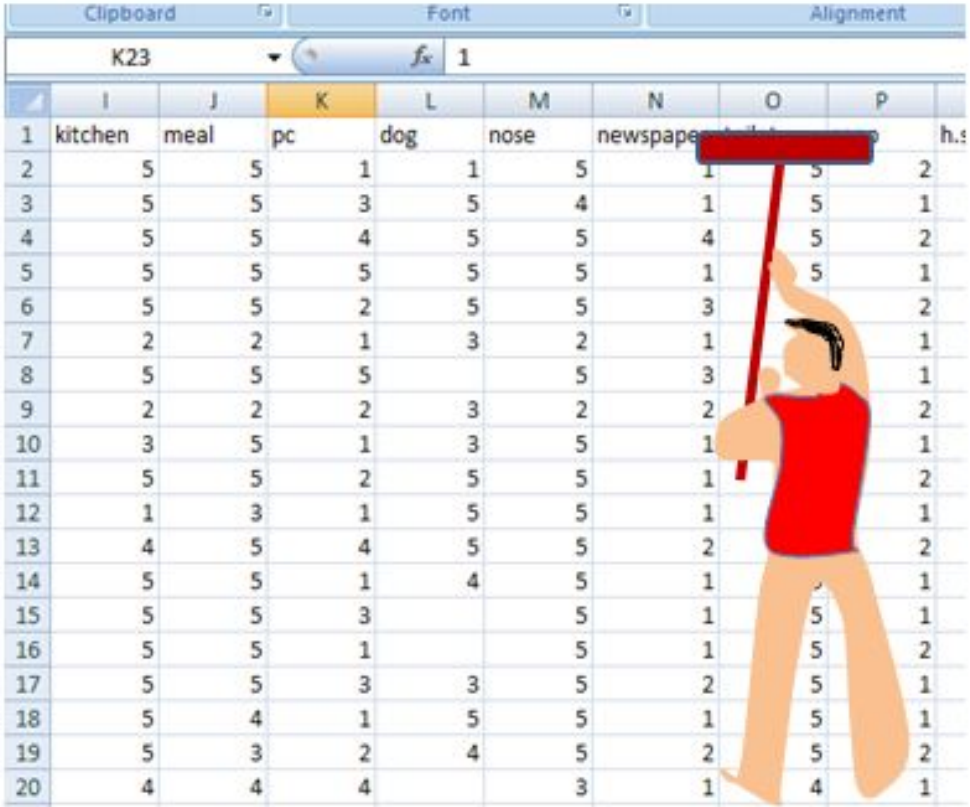


Machine learning pipeline



Cleaning data

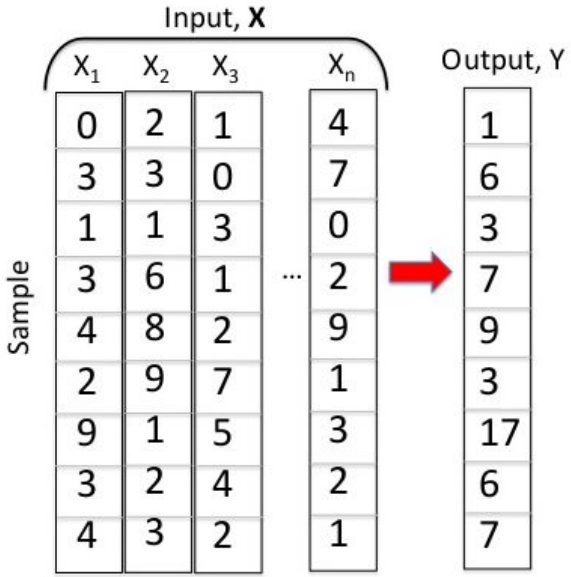
- Clean data

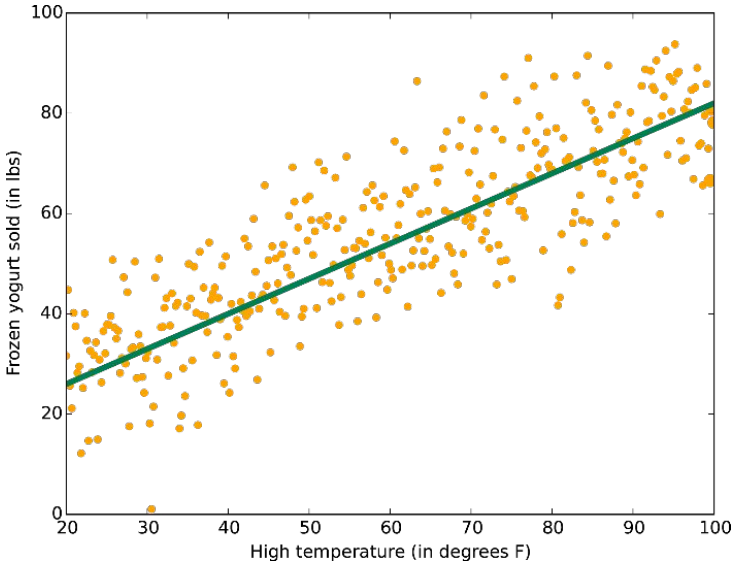


	I	J	K	L	M	N	O	P
1	kitchen	meal	pc	dog	nose	newspape		
2	5	5	1	1	5	1	5	2
3	5	5	3	5	4	1	5	1
4	5	5	4	5	5	4	5	2
5	5	5	5	5	5	1	5	1
6	5	5	2	5	5	3		2
7	2	2	1	3	2	1		1
8	5	5	5		5	3		1
9	2	2	2	3	2	2		2
10	3	5	1	3	5	1		1
11	5	5	2	5	5	1		2
12	1	3	1	5	5	1		1
13	4	5	4	5	5	2		2
14	5	5	1	4	5	1		1
15	5	5	3		5	1	5	1
16	5	5	1		5	1	5	2
17	5	5	3	3	5	2	5	1
18	5	4	1	5	5	1	5	1
19	5	3	2	4	5	2	5	2
20	4	4	4		3	1	4	1

Learning a function

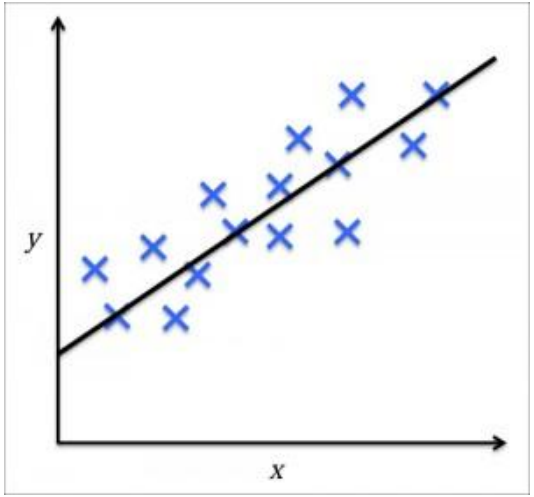
- Learn function *f(x) → y*



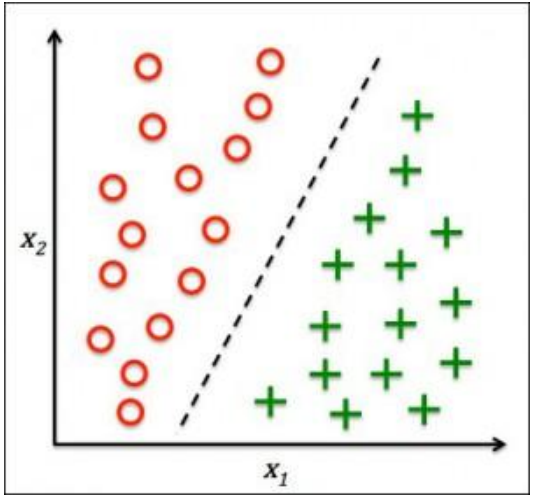


Types of algorithms

Regression

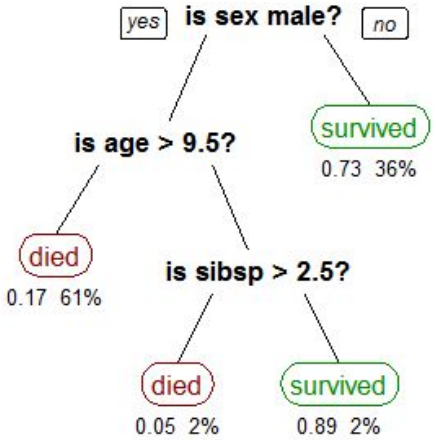


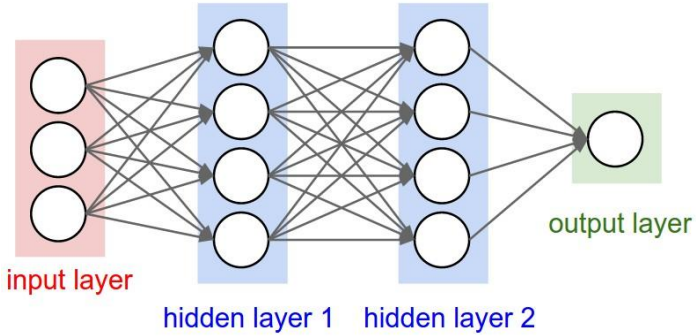
Classification

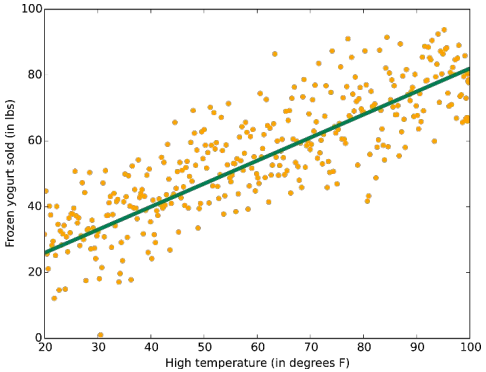


Types of algorithms

- Different approaches (models)







How does learning work?

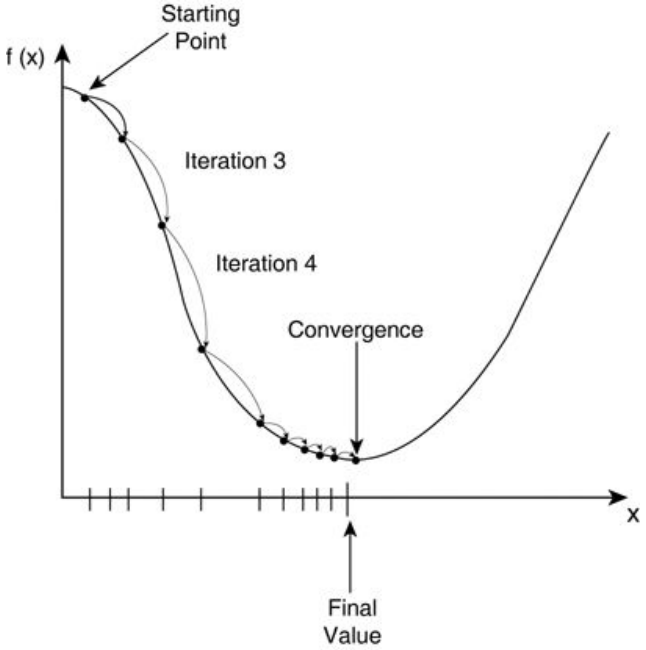
- y = *Intercept* + *Slope**x
  - Learn *Intercept*, *Slope*

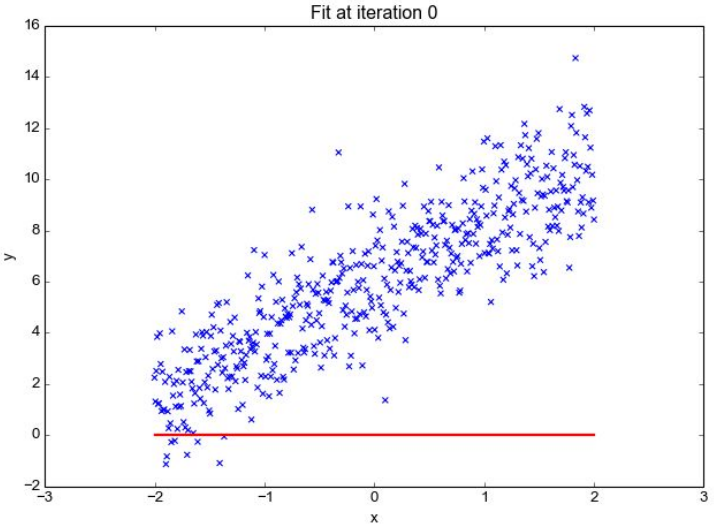
- Loss - e.g. MSE

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(y_i - \tilde{y}_i)^2$$

How does learning work?

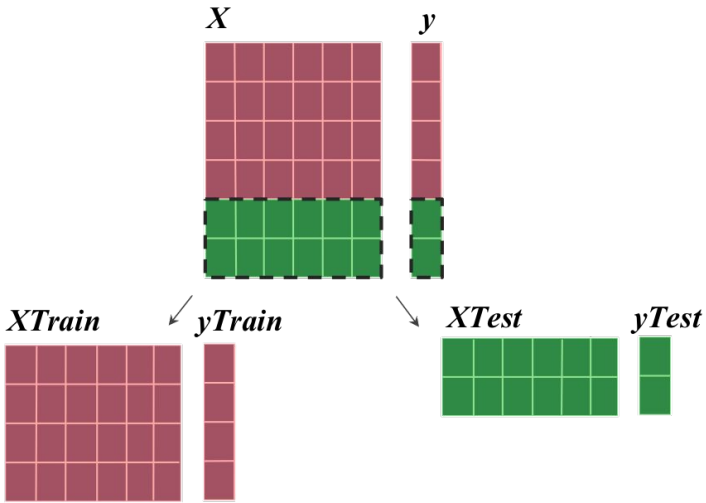
- Training : Gradient descent





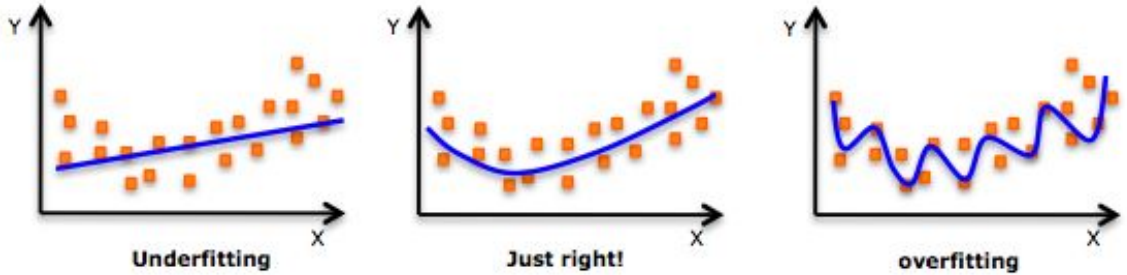
Evaluating

Simple: train/test split

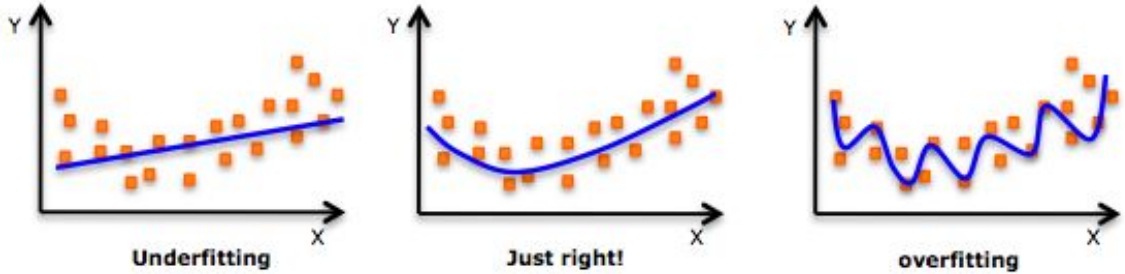


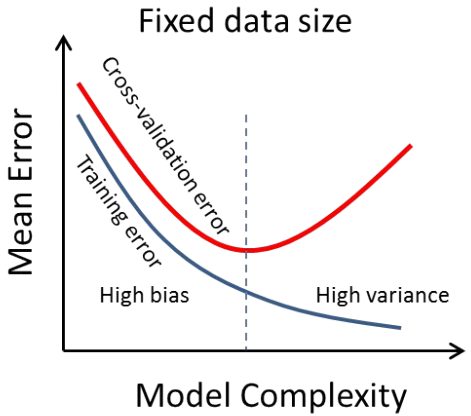
Better: KFold Cross validation

What could possibly go wrong?



What could possibly go wrong?





Python & scikit-learn

```
from sklearn import datasets
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

X,y = datasets.load_iris(return_X_y=True)

X_train, X_test, y_train, y_test = train_test_split(X, y)

model = DecisionTreeClassifier(min_samples_split=8, min_samples_leaf=4)

model.fit(X_train, y_train)

y_predicted = model.predict(X_test)

print("Score: %.4f " % accuracy_score(y_test, y_predicted))
```

Example

- Analysis, features & model NYC taxi trips
- Analysis & model cycle share

Hackathon suggestions

- Find research questions / hypotheses
  - Predict number of trips (weather?)
  - Predict trip duration (weather, sex, age, …)
  - Predict popular routes (week/weekend, …)
- Prepare data
- Train, evaluate & improve models
- Interpret results

Ready ?

- Let’s start hacking !