Machine Learning

Machine learning using scikit-learn

Contents

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- What is ML
- Pipeline steps
- Learning?
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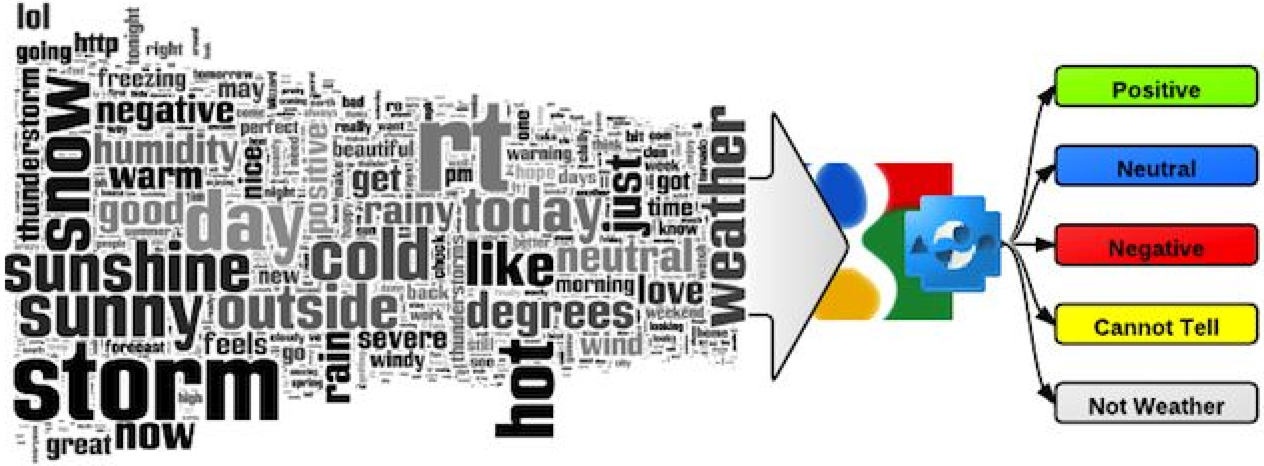
What can machine learning do?

- Automate - Save $$$

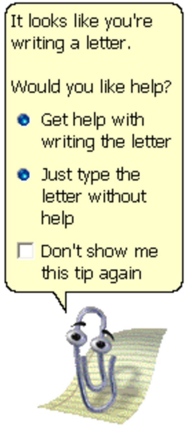


What can machine learning do?

- Detect anomalies (security, fraud, …)

What can machine learning do?

- Healthcare - Save lives
- GeriMedica - Second Opinion



It looks like you're writing a letter.

Would you like help?

● Get help with writing the letter

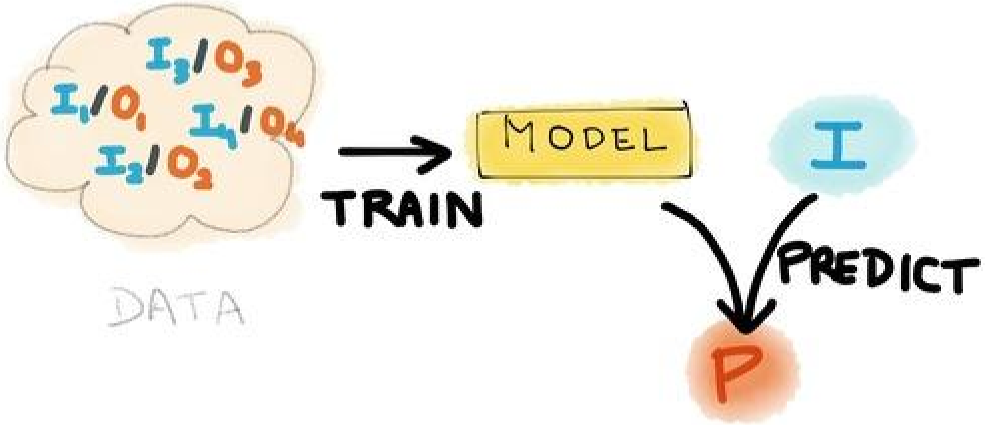
● Just type the letter without help

□ Don't show me this tip again

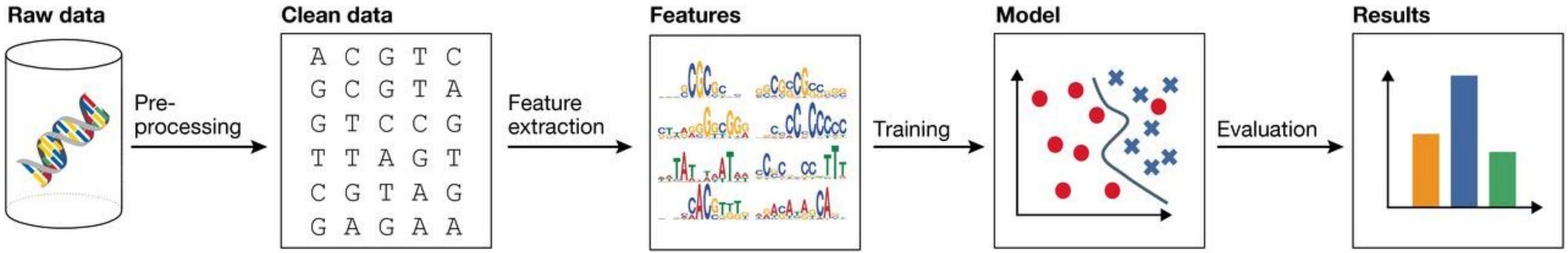
What can machine learning do?

- Customer segmentation - targeted marketing - make more $$$

What is machine learning?



Machine learning pipeline



Raw data

Pre-processing

Clean data

A C G T C
G C G T A
G T C C G
T T A G T
C G T A G
G A G A A

Feature extraction

Features

Training

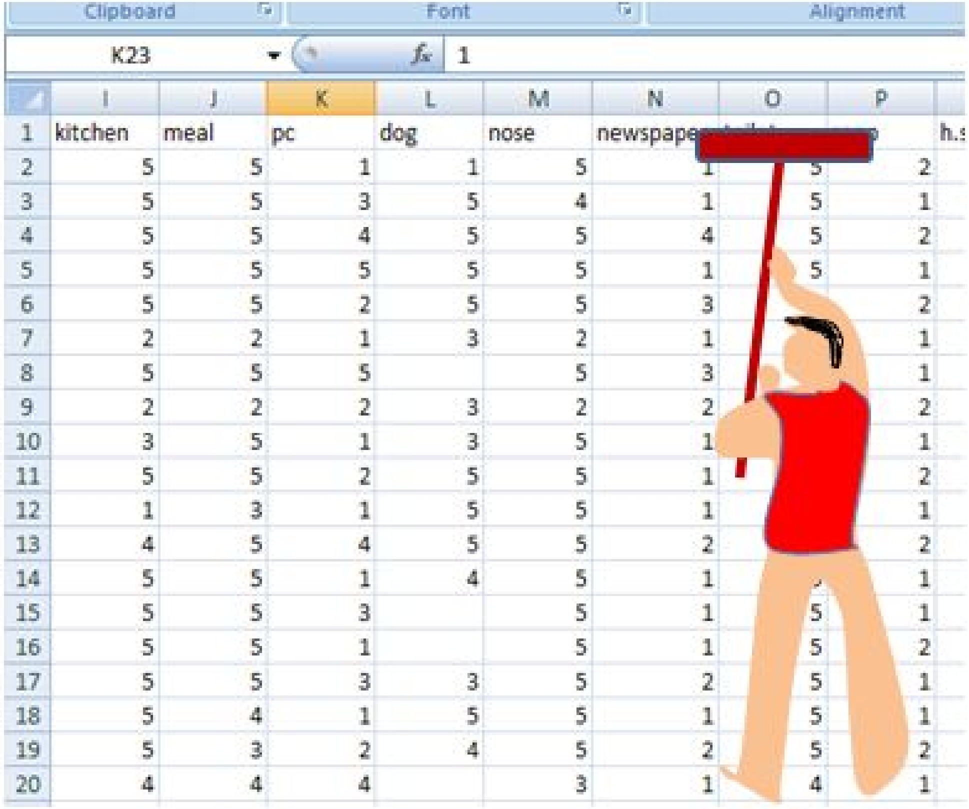
Model

Evaluation

Results

Cleaning data

- Clean data
  - Fill missing values
  - Drop incomplete rows

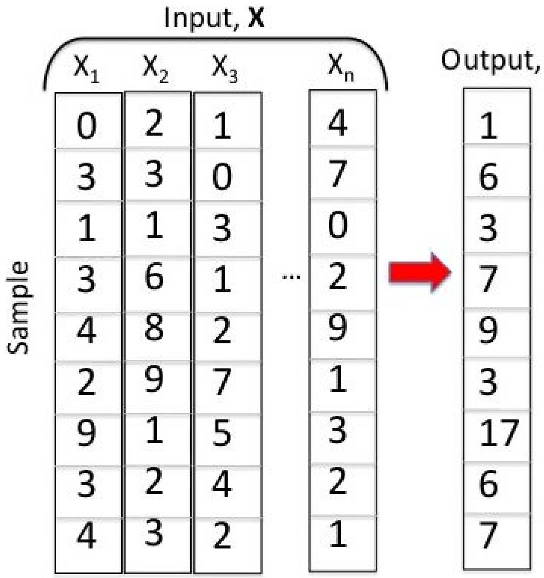


K23 f_x 1

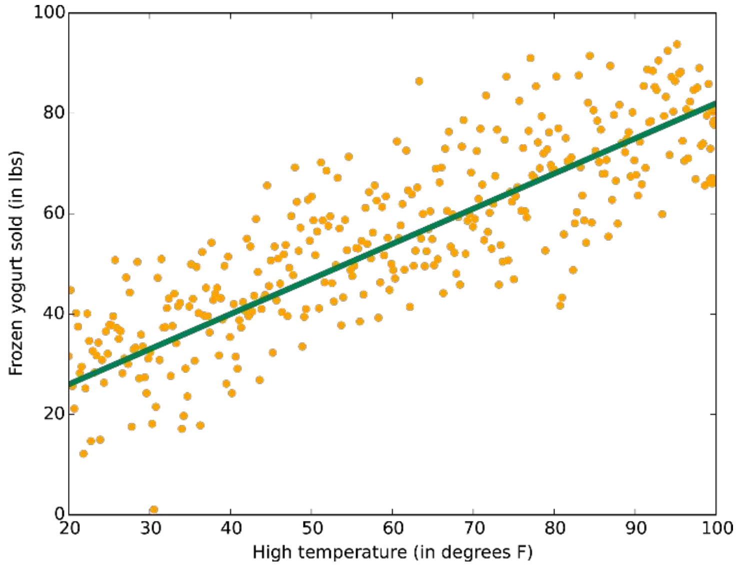
	I	J	K	L	M	N	O	P	
1	kitchen	meal	pc	dog	nose	newspape	[illegible]	[illegible]	h.s
2	5	5	1	1	5	1	5	2	
3	5	5	3	5	4	1	5	1	
4	5	5	4	5	5	4	5	2	
5	5	5	5	5	5	1	5	1	
6	5	5	2	5	5	3	[illegible]	2	
7	2	2	1	3	2	1	[illegible]	1	
8	5	5	5		5	3	[illegible]	1	
9	2	2	2	3	2	2	[illegible]	2	
10	3	5	1	3	5	1	[illegible]	1	
11	5	5	2	5	5	1	[illegible]	2	
12	1	3	1	5	5	1	[illegible]	1	
13	4	5	4	5	5	2	[illegible]	2	
14	5	5	1	4	5	1	[illegible]	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*

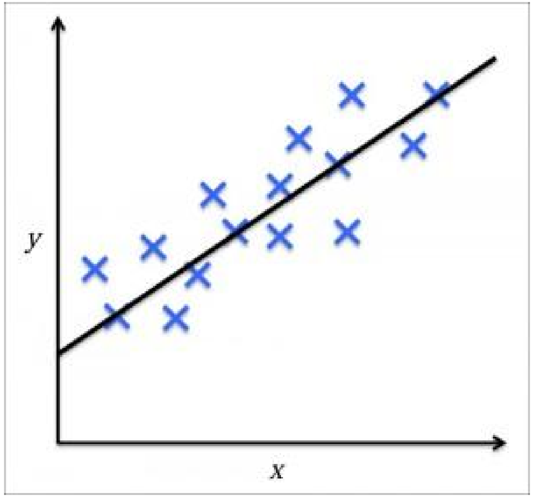


	Input, **X**					Output, Y
	X_1	X_2	X_3		X_n	
Sample	0	2	1		4	1
	3	3	0		7	6
	1	1	3		0	3
	3	6	1	…	2	7
	4	8	2		9	9
	2	9	7		1	3
	9	1	5		3	17
	3	2	4		2	6
	4	3	2		1	7

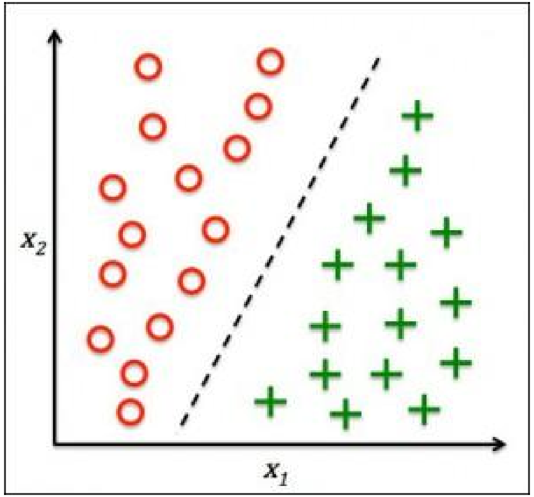


Types of algorithms

Regression

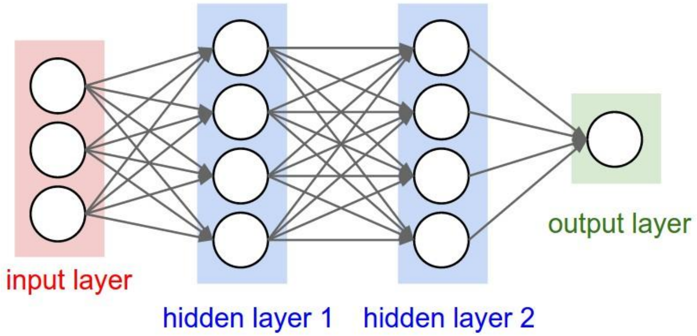


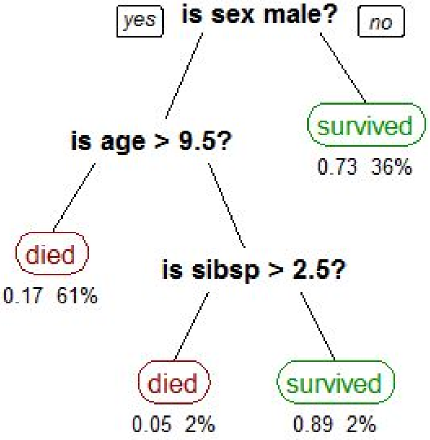
Classification

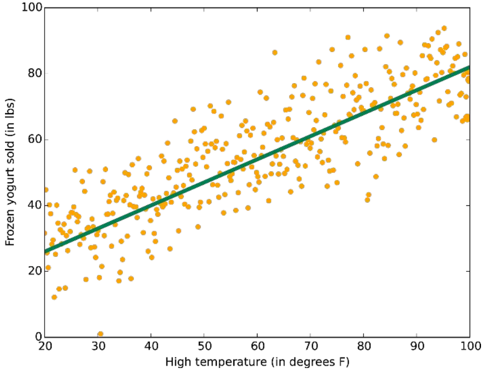


Types of algorithms

- Different approaches (models)





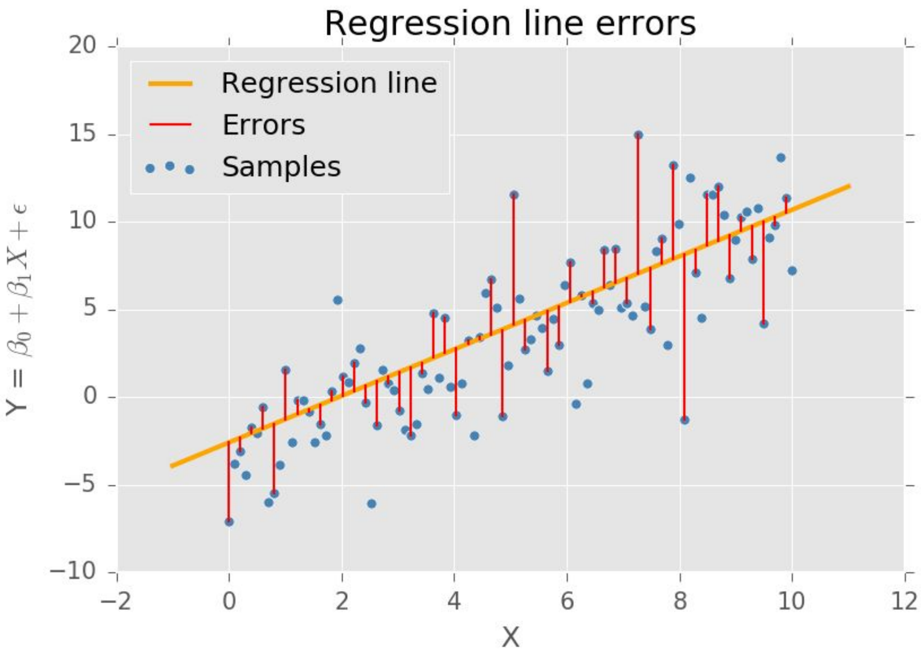


How does learning work?

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

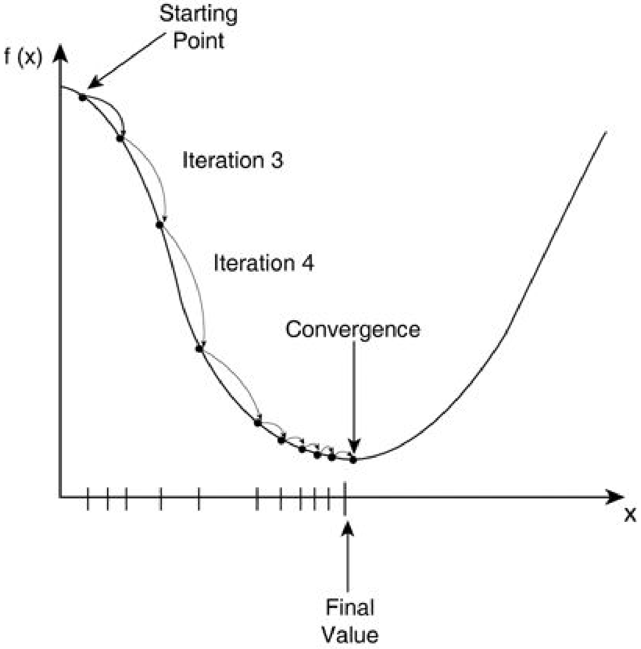
- Loss - e.g. MSE

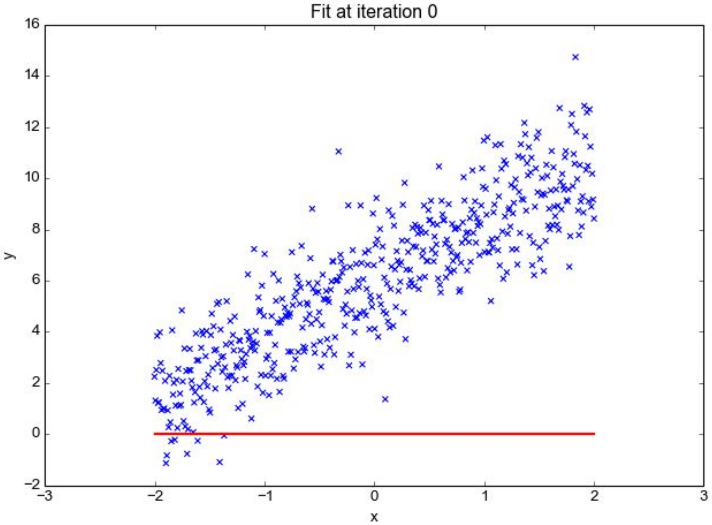
$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}(y_i - \tilde{y}_i)^2$$



How does learning work?

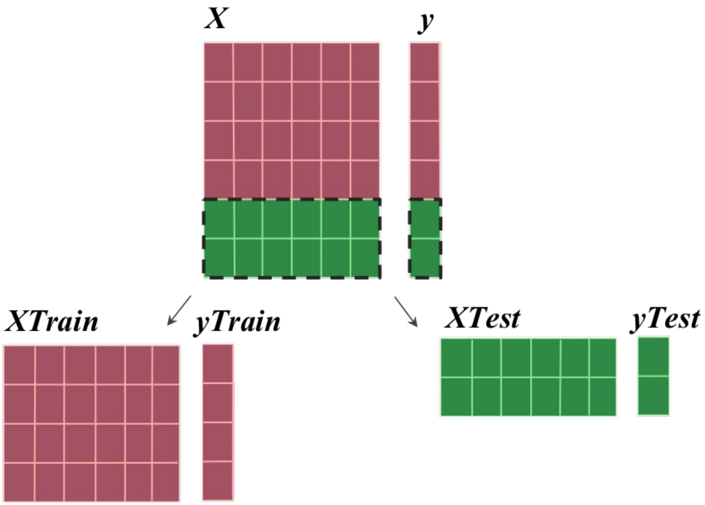
- Training : Gradient descent



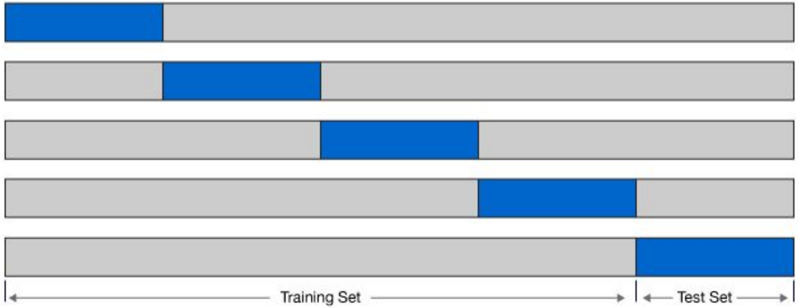


Evaluating

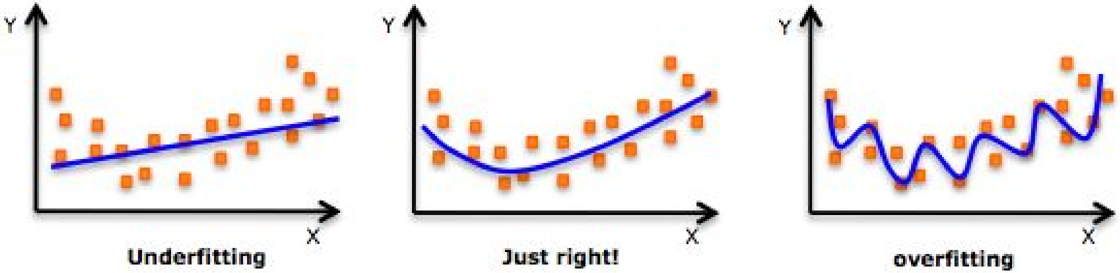
Simple: train/test split

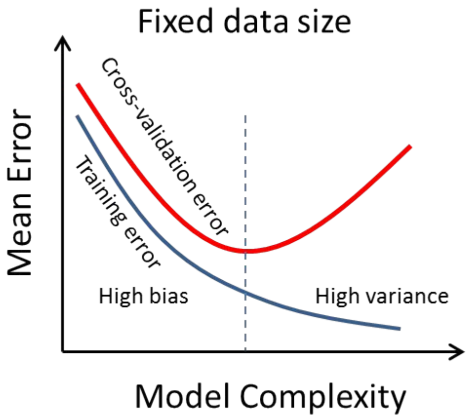


Better: KFold Cross validation

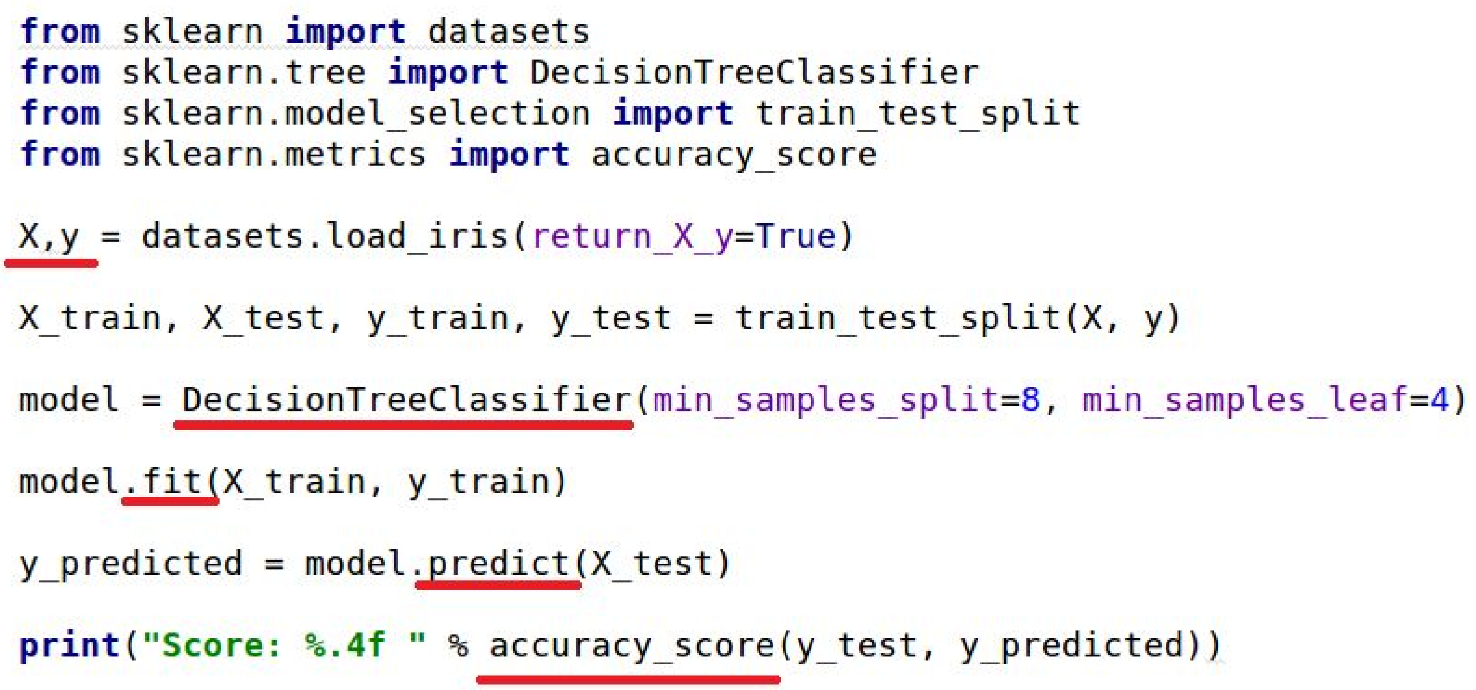


What could possibly go wrong?





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 models
- Try, learn & improve !
- Interpret results

Ready ?

- Let’s start hacking !