Machine Learning Techniques

MACHINE LEARNING

UNSUPERVISED LEARNING
Group and interpret data based only on input data

CLUSTERING

SUPERVISED LEARNING
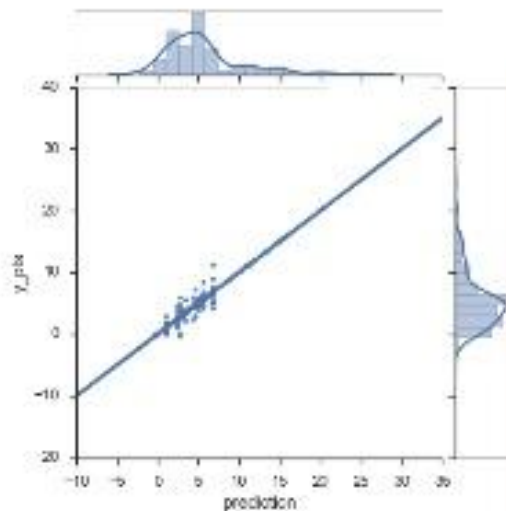Develop predictive model based on both input and output data

CLASSIFICATION

REGRESSION

Unsupervised Learning
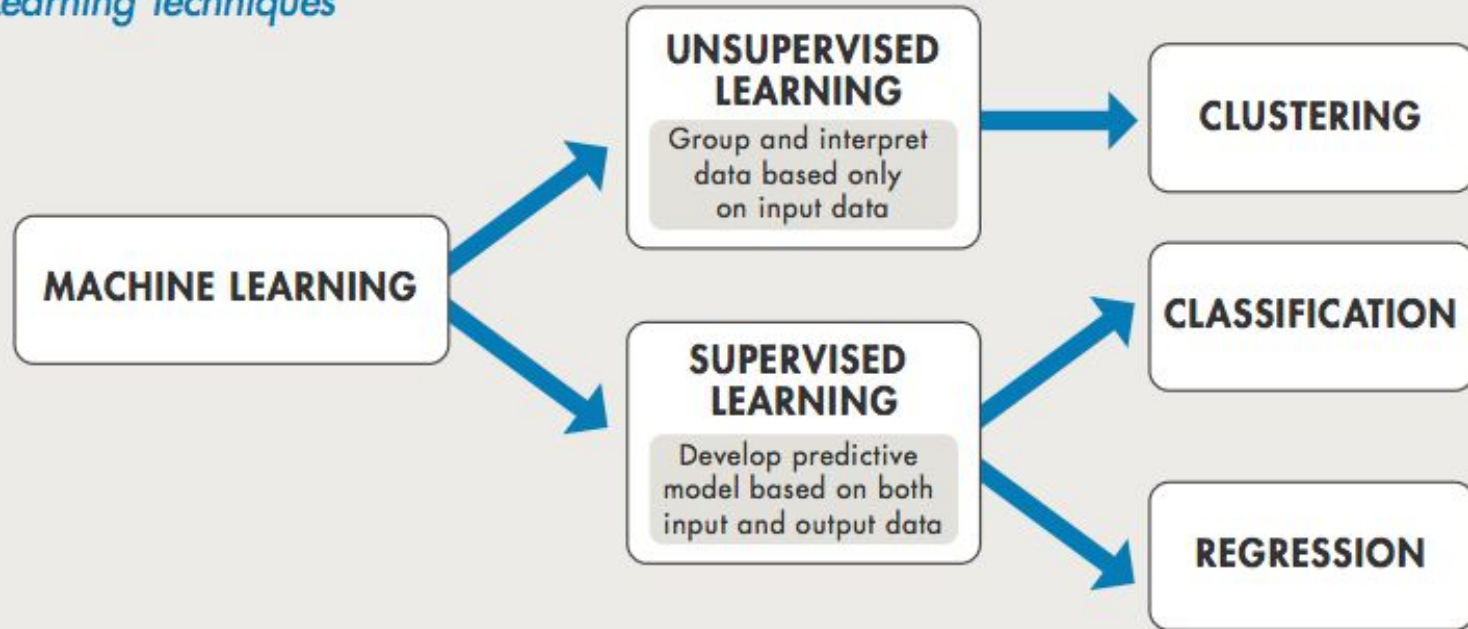
Supervised Learning
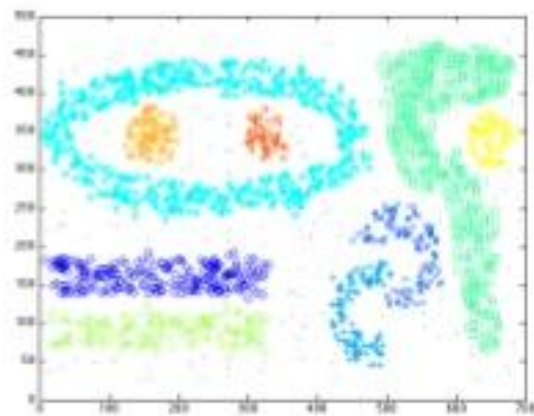
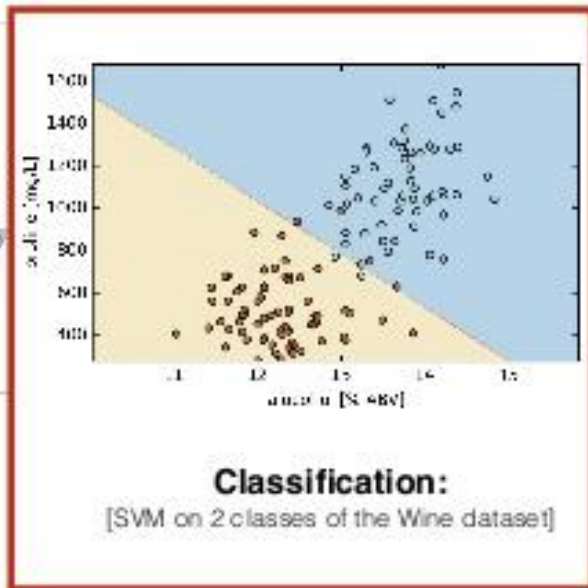**Clustering:**
[DBSCAN on a toy dataset]

Regression:
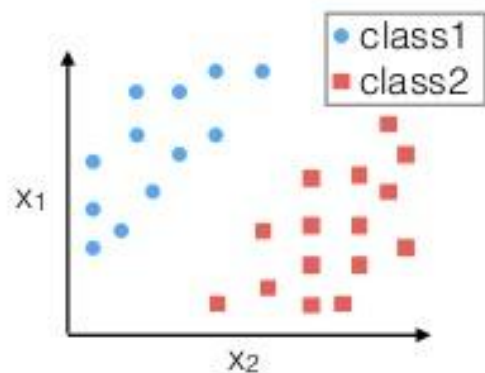[Soccer Fantasy Score prediction]

Classification:
[SVM on 2 classes of the Wine dataset]

Today's topic
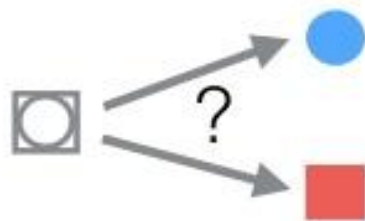
Classification

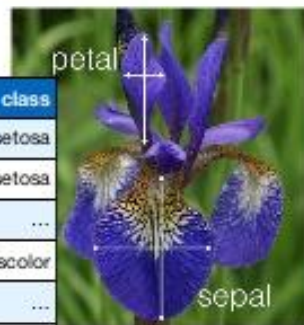**1)** Learn from training data

2) Map unseen (new) data

Nomenclature

Instances (samples, observations)

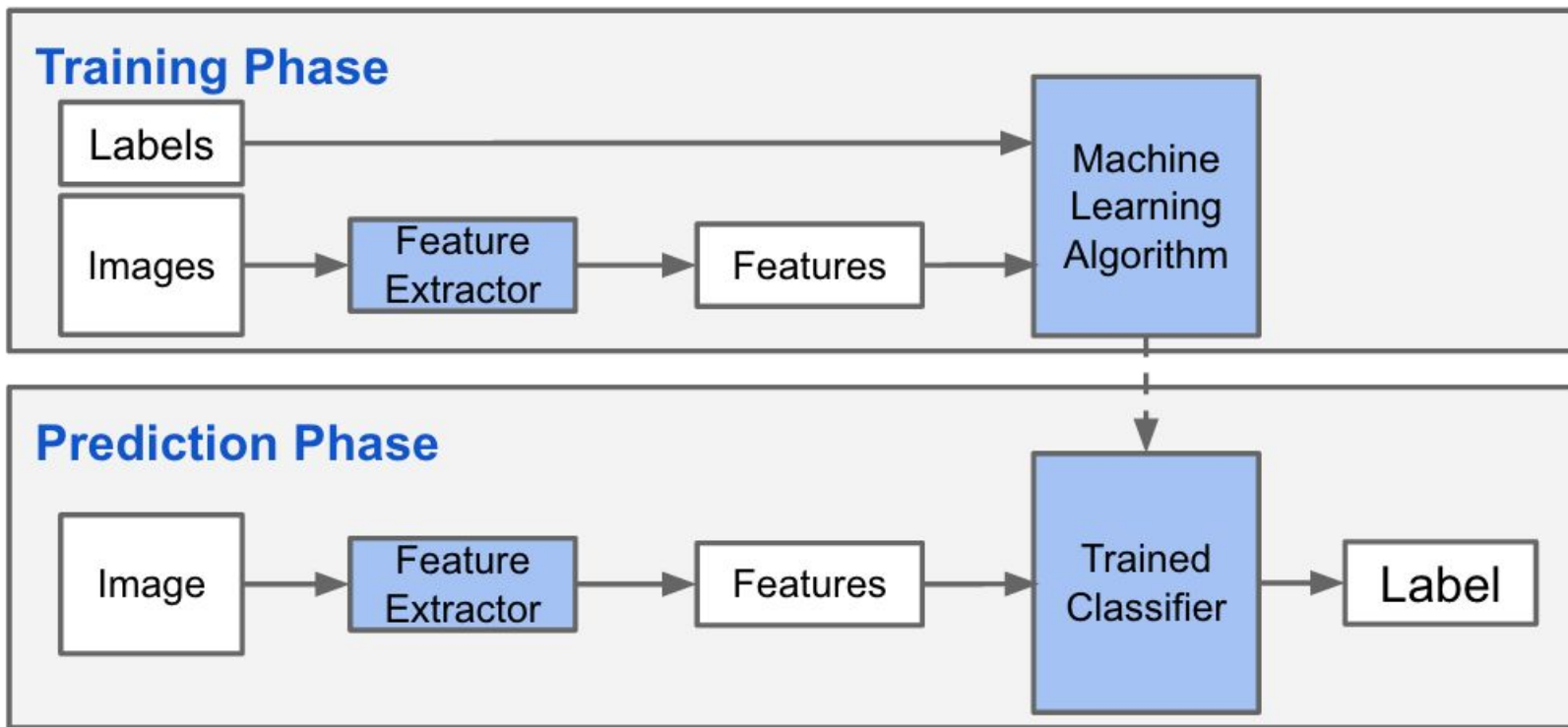|	sepal_length	sepal_width	petal_length	petal_width	class
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
...	...	...	...	...	...
50	6.4	3.2	4.5	1.5	veriscolor
...	...	...	...	...	...
150	5.9	3.0	5.1	1.8	virginica

Features (attributes, dimensions)

Classes (targets)

$$\mathbf{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1D} \\ x_{21} & x_{22} & \cdots & x_{2D} \\ x_{31} & x_{32} & \cdots & x_{3D} \\ \vdots & \vdots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ x_{N1} & x_{N2} & \cdots & x_{ND} \end{bmatrix}$$
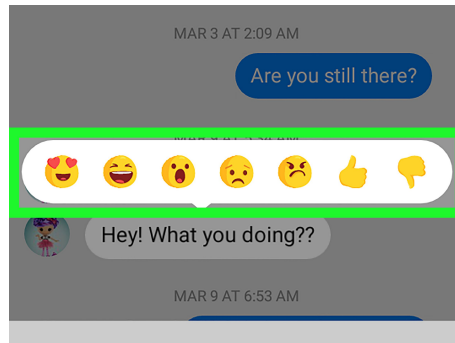
$$\mathbf{y} = [y_1, y_2, y_3, \cdots y_N]$$
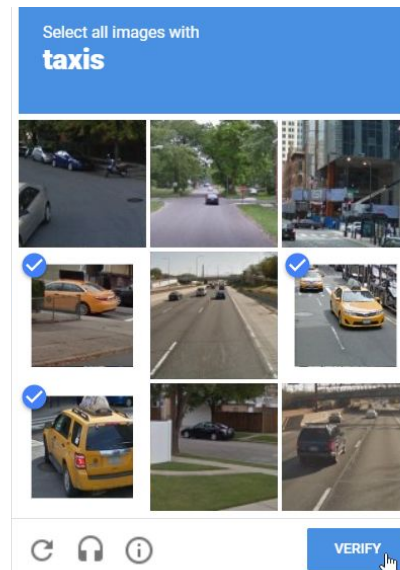
Machine Learning Phases

Get data !

Automated (cheap, fast):

- Web crawling (Voice, text, video)
- Think about Facebook, Google, Amazon

Manual (expensive, slow):

- Performing a chemical experiments
- Tasting a pancake
- Annotating a video by hand

Get data !

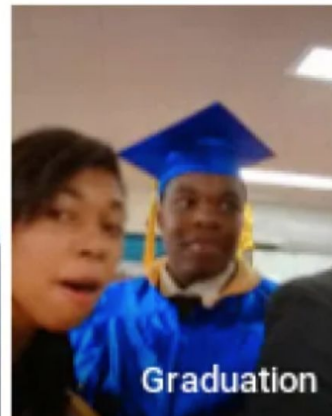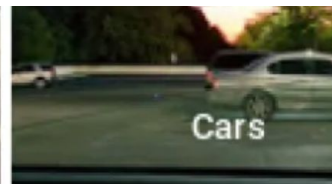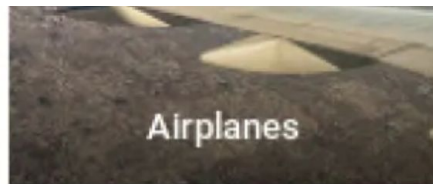**Why Big Tech pays poor Kenyans to teach self-driving cars**
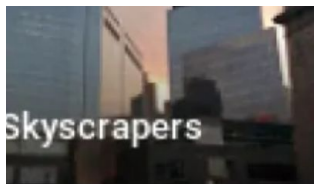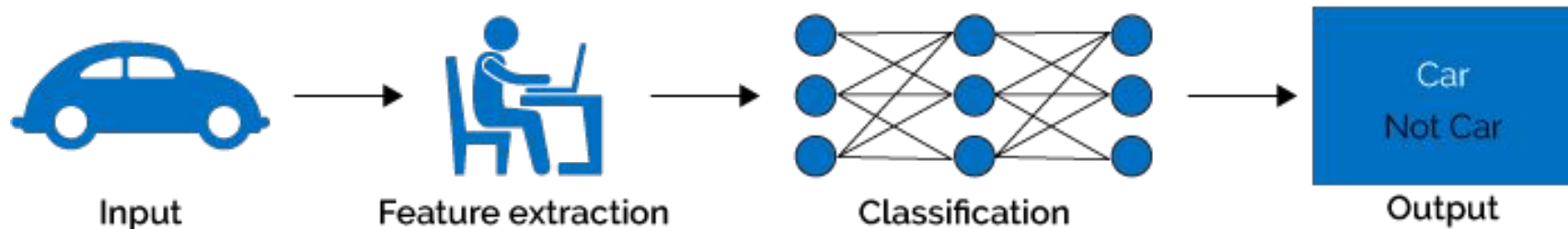
https://www.bbc.com/news/technology-46055595

Biases

Real life consequences:
- Credit rating
- Jail sentences
- Insurance rates
- Job opportunities
- …
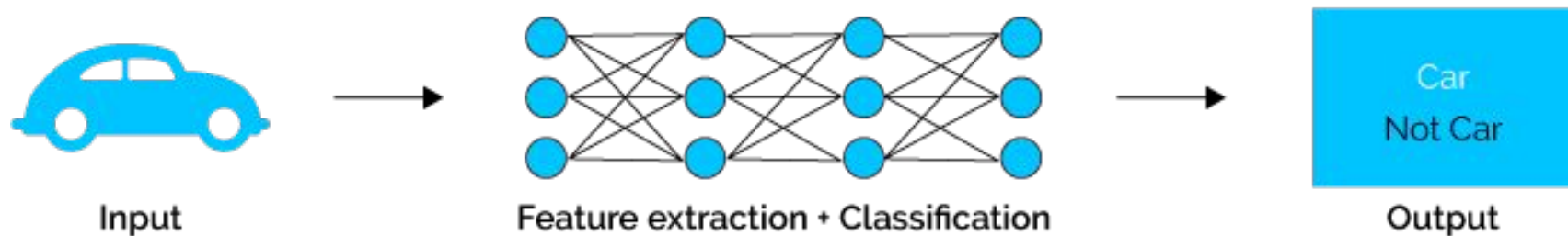
AI experts are rarely train to detect such biases, they are trained to maximize performance on a dataset

Machine Learning

Input — Feature extraction — Classification — Output

Car
Not Car

Deep Learning

Input — Feature extraction + Classification — Output

Car
Not Car

Interactive Demos

https://playground.tensorflow.org

https://cs.stanford.edu/people/karpathy/convnetjs/

https://cs.stanford.edu/~karpathy/svmjs/demo/

https://cs.stanford.edu/~karpathy/svmjs/demo/demoforest.html

https://cs.stanford.edu/~karpathy/svmjs/demo/demonn.html

http://vision.stanford.edu/teaching/cs231n-demos/knn/