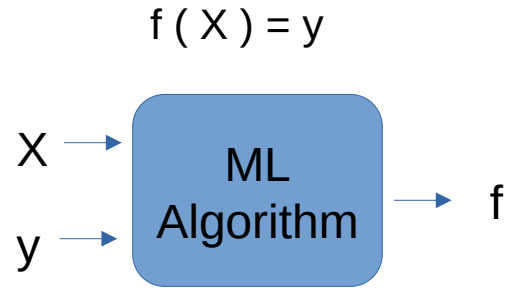# Machine Learning

Main Concepts, Terminology, Examples

What is Machine Learning (ML)?

- ML is the study of computer algorithms that <u>improve automatically</u> through <u>experience</u>

- ML algorithms build a <u>model</u> based on <u>sample data</u>, known as "training data"

- In order to make <u>predictions or decisions</u> without being explicitly programmed to do so.

An alternative view:

- Learning a target function (f) that <u>best</u> maps input variables (X) to an output variable (Y).
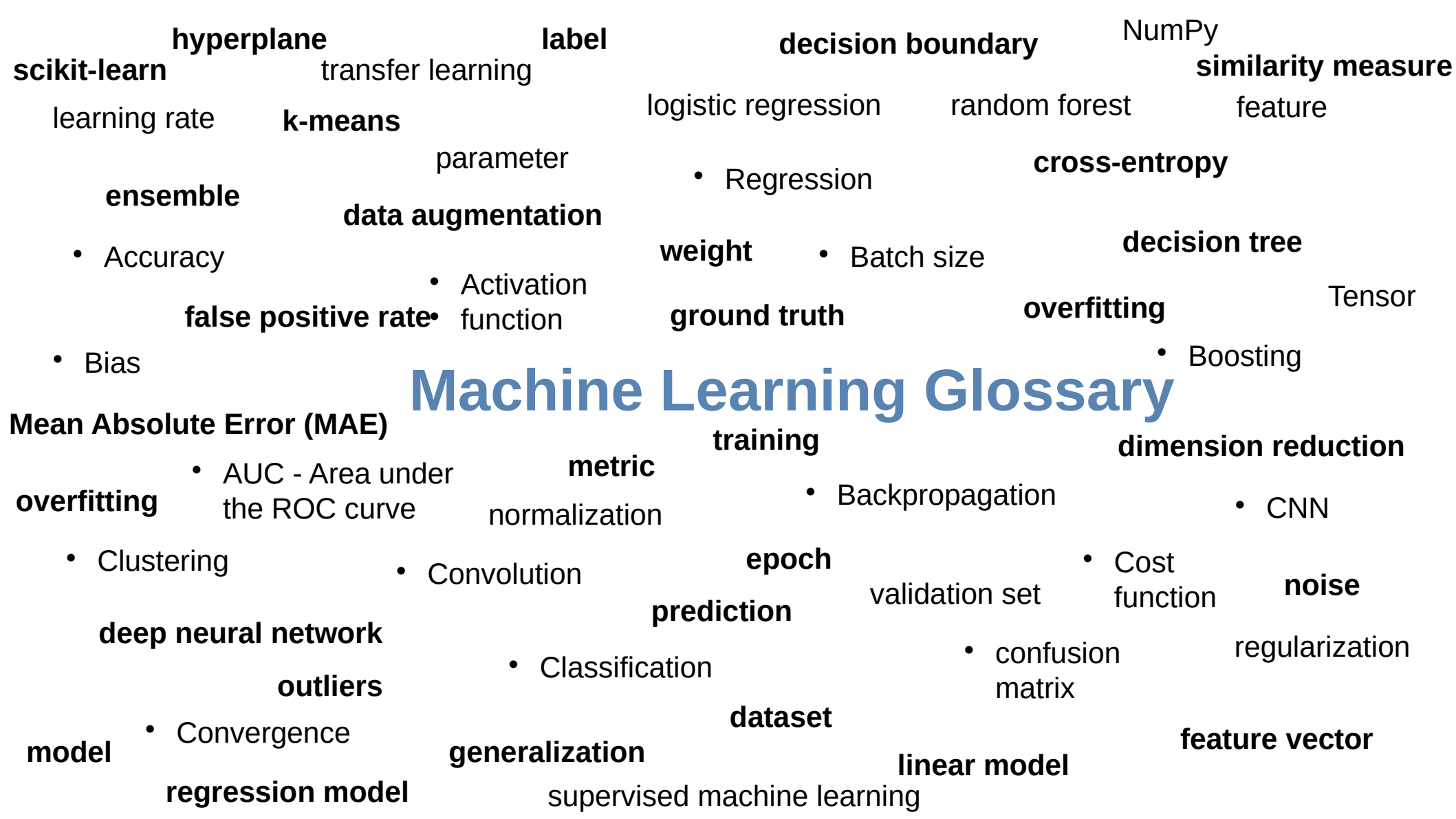
$$f(X) = y$$

X → | ML Algorithm | → f

y →

| What is X? | What is y? | What is f? | What does "best" mean? | How we learn the "best" f? |

Machine Learning Glossary

hyperplane

label

decision boundary

NumPy

scikit-learn

transfer learning

similarity measure

learning rate

k-means

logistic regression

random forest

feature

parameter

- Regression

cross-entropy

ensemble

data augmentation

decision tree

- Accuracy

weight

- Batch size

- Activation function

false positive rate

ground truth

overfitting

Tensor

- Bias

- Boosting

Mean Absolute Error (MAE)

training

dimension reduction

- AUC - Area under the ROC curve

metric

overfitting

normalization

- Backpropagation

- CNN

- Clustering

- Convolution

epoch

- Cost function

noise

deep neural network

prediction

validation set

regularization

outliers

- Classification

- confusion matrix

- Convergence

dataset

feature vector

model

generalization

linear model

regression model

supervised machine learning

Machine Learning Categories

- Supervised learning:
  - Learning a function that maps an input to an output using example input-output samples ("labeled" training data)

- Unsupervised learning:
  - Drawing inferences and find patterns from input data without using labeled output data
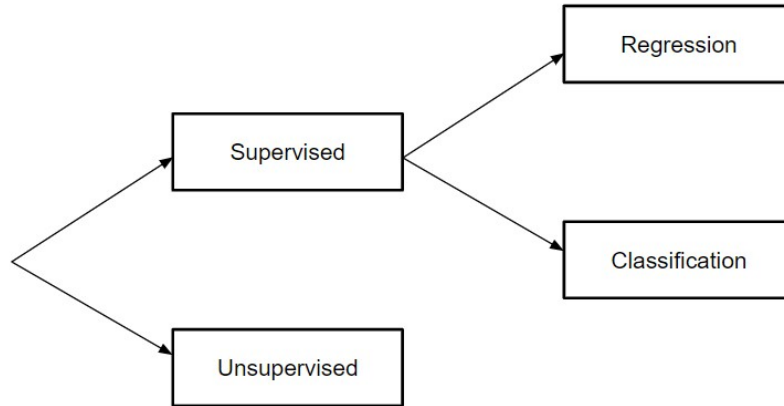
Why do We Use Machine Learning?

- Replace manual work in repetitive tasks

  - *Example: Image segmentation, character recognition (post office sorting of mail)*

- Develop systems that can automatically adapt to different users and environments

  - *Example: Self-driving cars*

- Discover new information from large sets of data (data mining)

  - *Example: E-commerce, marketing, fraud detection, medical image analysis research*

- Develop systems that are too difficult or expensive to build manually

  - *Example: Manual data entry*

well-known

amazon alexa
NETFLIX
amazon
Google
TESLA
ourBANK
facebook
BLUE RIVER TECHNOLOGY
DARKTRACE
clarifai
Atomwise
Better medicines faster.
:) Affectiva
TESSIAN
alphasense
ORCAM
SwiftKey
Digital Genius
BenevolentAI
zebra MEDICAL VISION
textio
X.

(maybe) less well-known

https://www.sebastian-mantey.com/theory-blog/examples-and-applications-of-machine-learning

Machine Learning is essential for research & industry!

https://www.youtube.com/watch?v=DOwDIHzN5bs&ab_channel=UberEngineering

https://www.youtube.com/watch?v=al8VjHVd7TM&ab_channel=UberEngineering

https://www.descarteslabs.com/company/geovisual/

https://www.youtube.com/watch?v=9Mz84cwVmS0&ab_channel=Google

https://www.youtube.com/watch?v=al8VjHVd7TM&ab_channel=UberEngineering

https://www.youtube.com/watch?v=nLy3OQYsXWA&ab_channel=UberEngineering