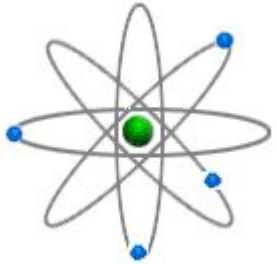
Class 8

H Academy

March 11th, 2021 - By Nathan Landman

Class Agenda



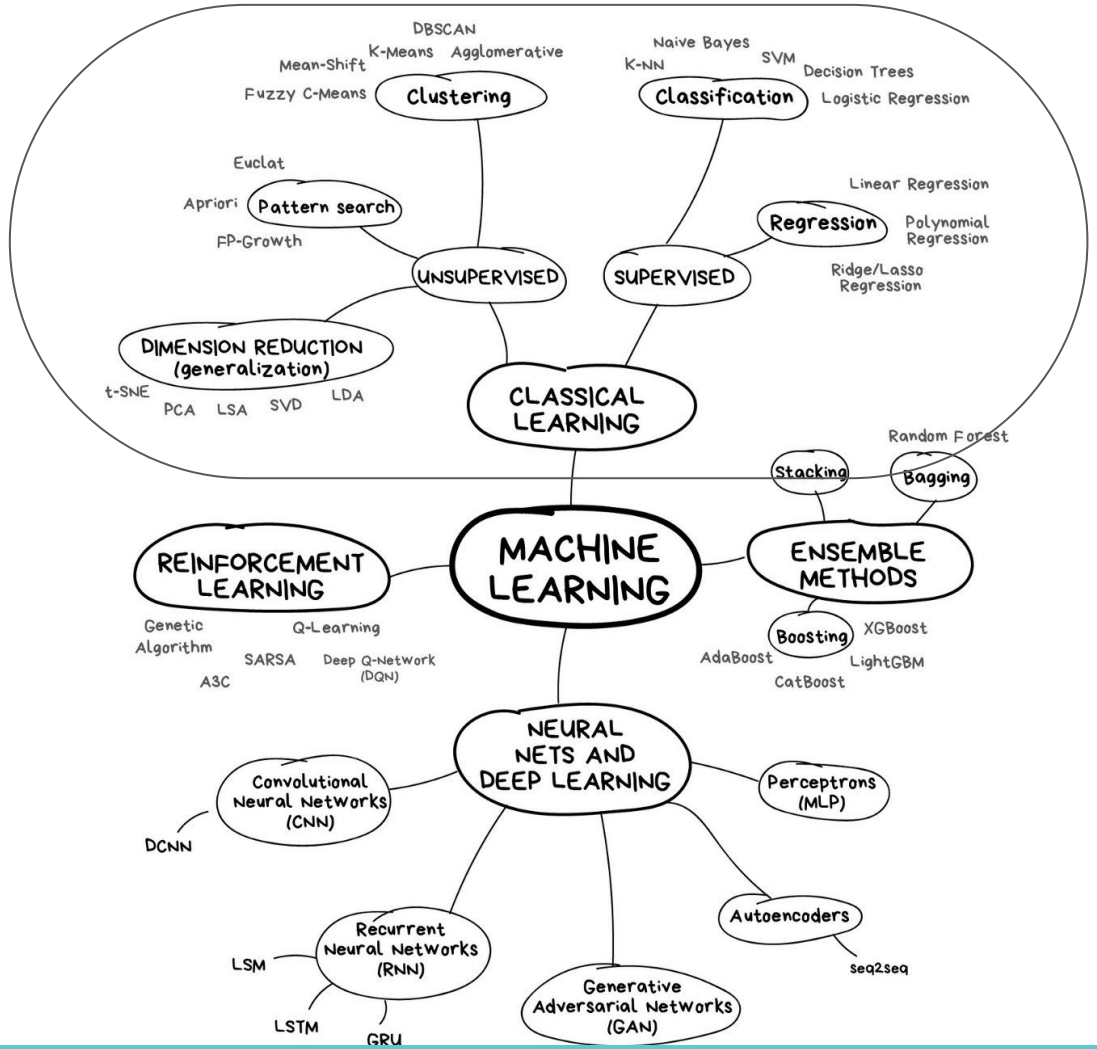
1. Machine Learning Landscape

2. Supervised Learning

3. Unsupervised Learning

4. Traditional ML Problem Set-up

Machine Learning Landscape



Academy

Supervised Machine Learning has data that is labeled or numerical.

Unsupervised Machine Learning takes data that is not labeled in any way and it is up to the machine to find any patterns on its own.

Machine Learning Landscape

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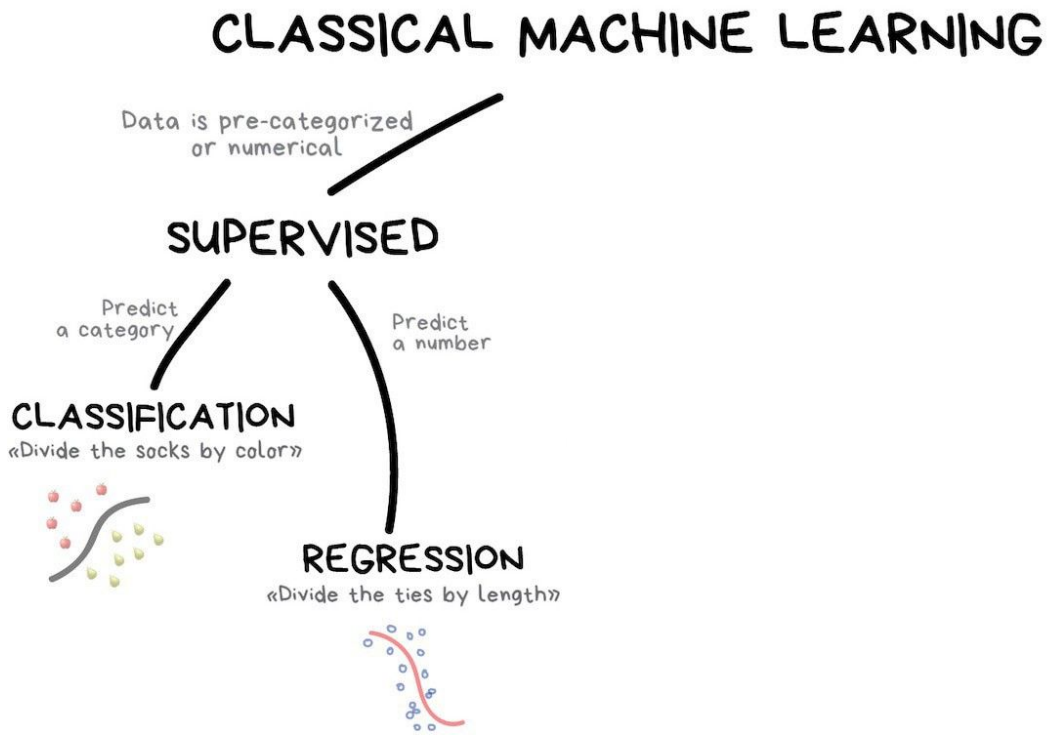
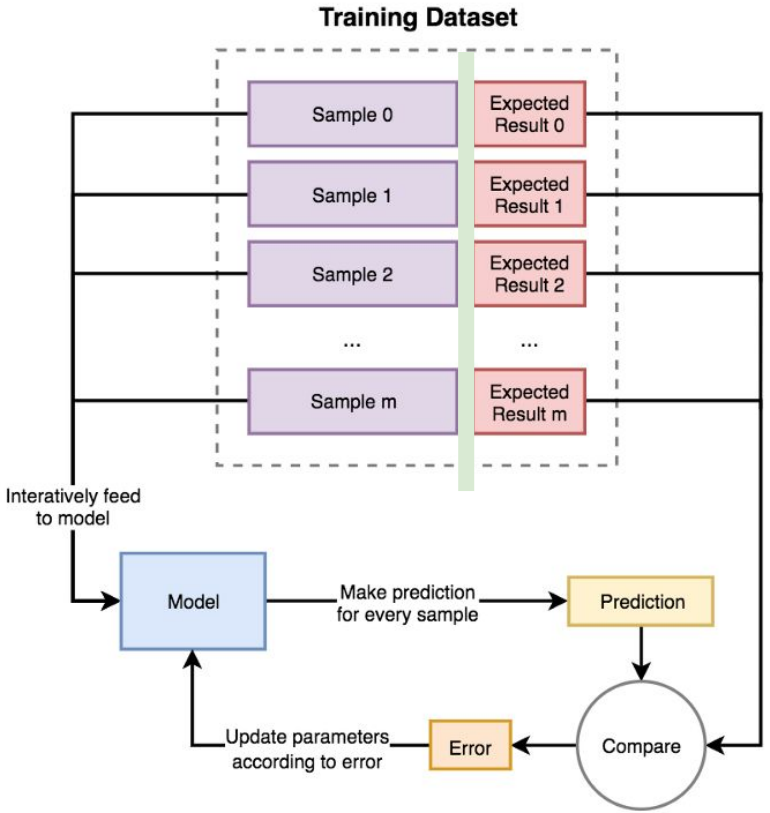


Machine Learning Landscape

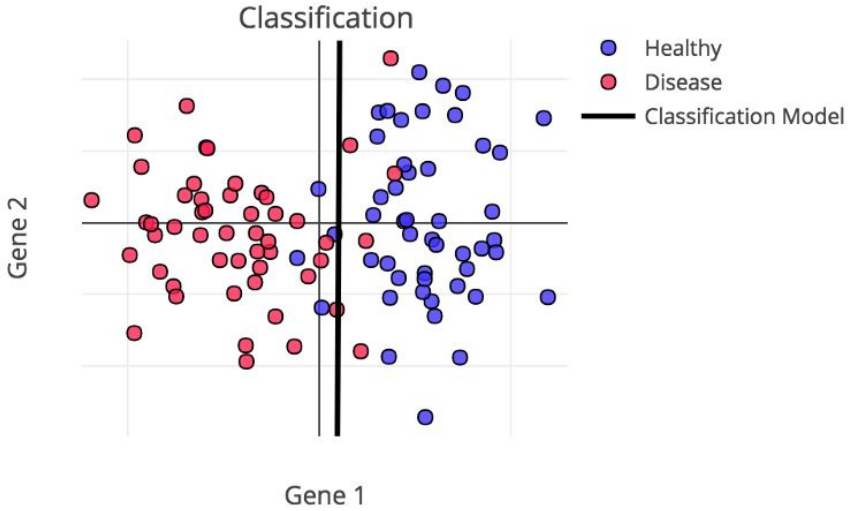
Supervised Learning

Supervised Learning models are **trying to find parameter values that will allow them to perform well on historical data**.

Then they are **used for making predictions on unknown data**, that was not a part of training dataset.



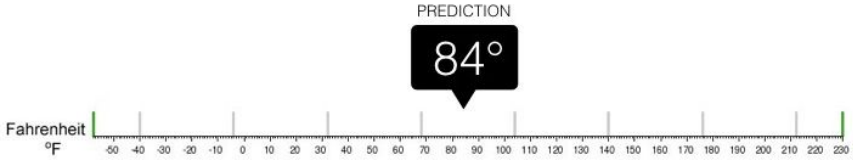
Supervised Learning - Two Main Problems



Supervised Learning - Two Main Problems

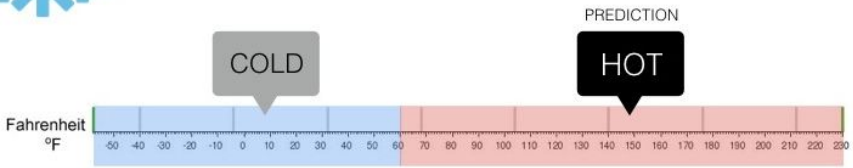
Regression

What is the temperature going to be tomorrow?

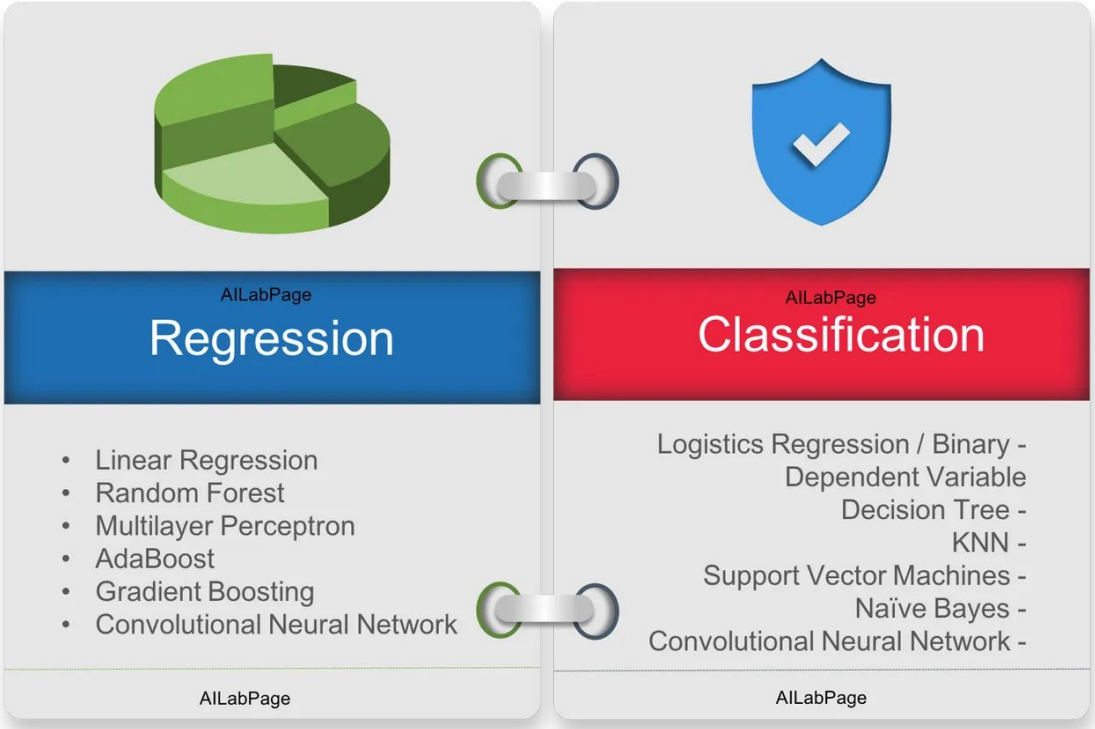


Classification

Will it be Cold or Hot tomorrow?

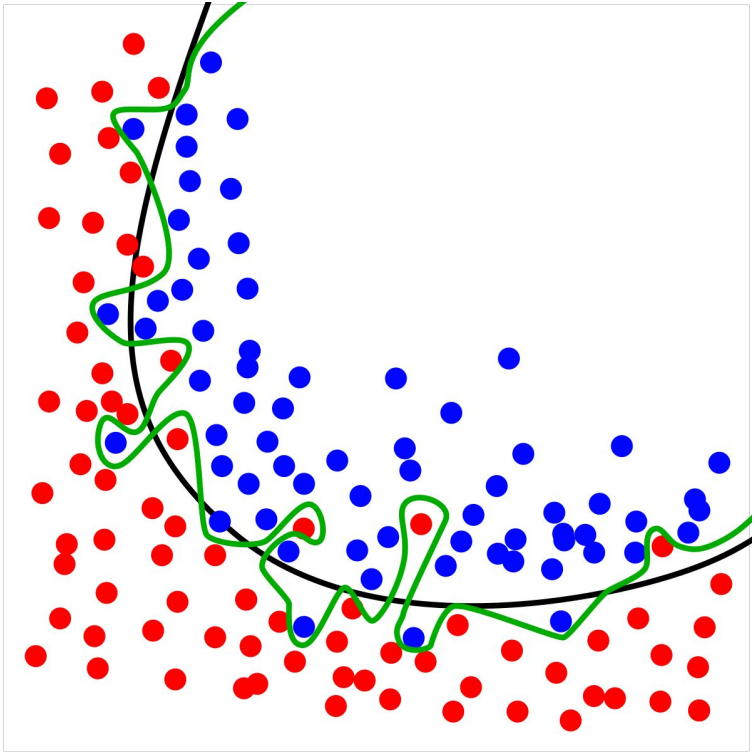


Supervised Learning - Algorithms



Supervised Learning - Problem Setup: training set and testing set

Which is better, the green or black model?

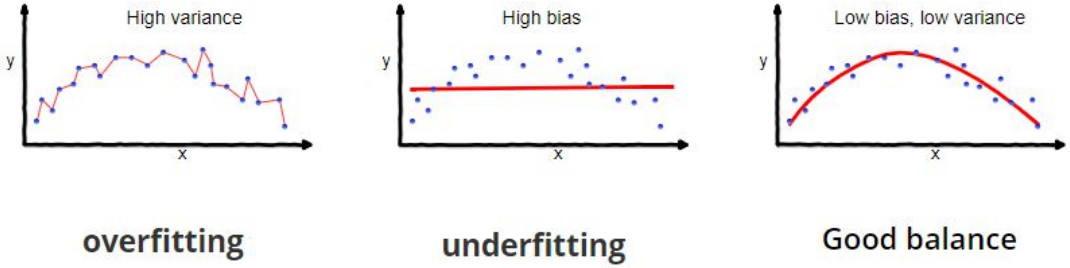


Supervised Learning - Problem Setup: training set and testing set

Bias is the simplifying assumptions made by the model to make the target function easier to approximate.

Variance is the amount that the estimate of the target function will change given different training data.

Trade-off is tension between the error introduced by the **bias and** the **variance**.



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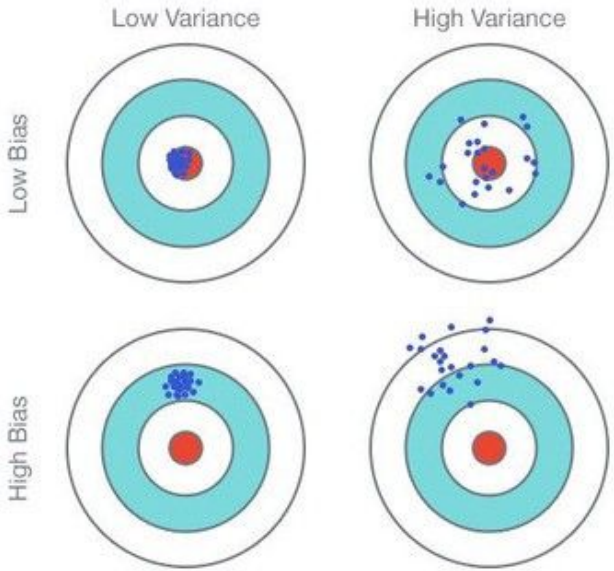
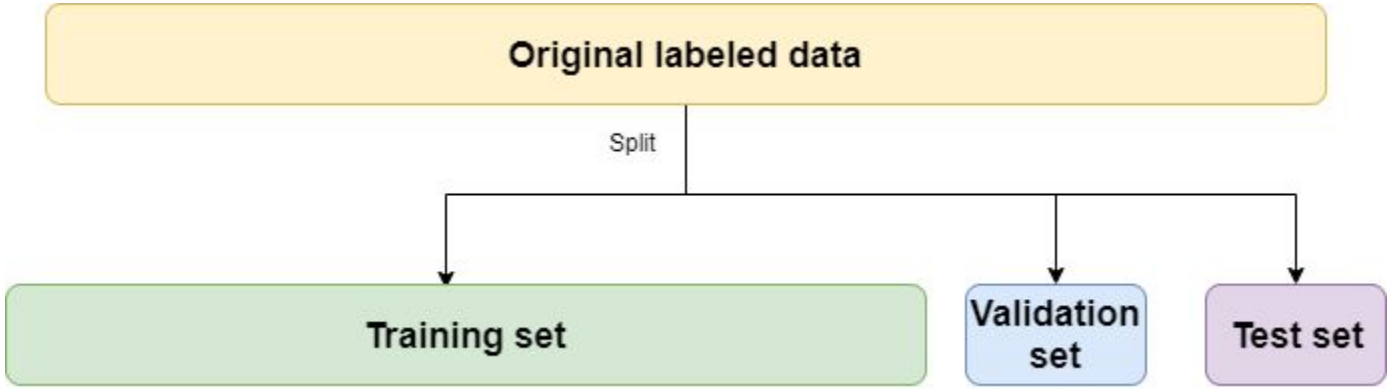


Fig. 1: Graphical Illustration of bias-variance trade-off , Source: Scott Fortmann-Roe., Understanding Bias-Variance Trade-off

Supervised Learning - Problem Setup: training set and testing set



1. Choose a model that does well on the training set.
2. Tweak that model until you get the best accuracy on the validation set.
3. Test your model on the Test Set.
4. If highly inaccurate test set, either:
    a. Explore the difference between your test set and the train/validation set.
    b. Choose a different model and repeat from step 2.

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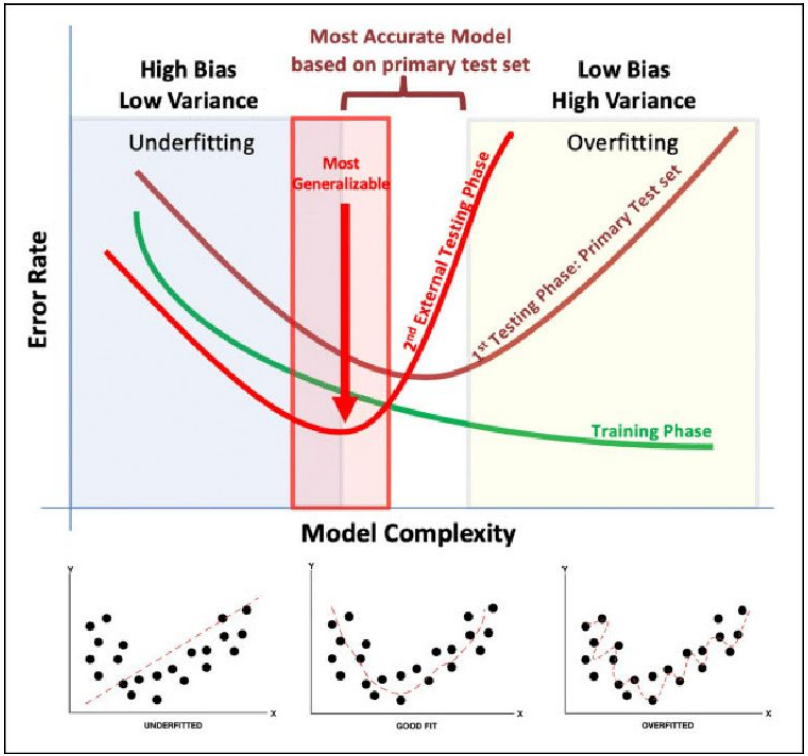


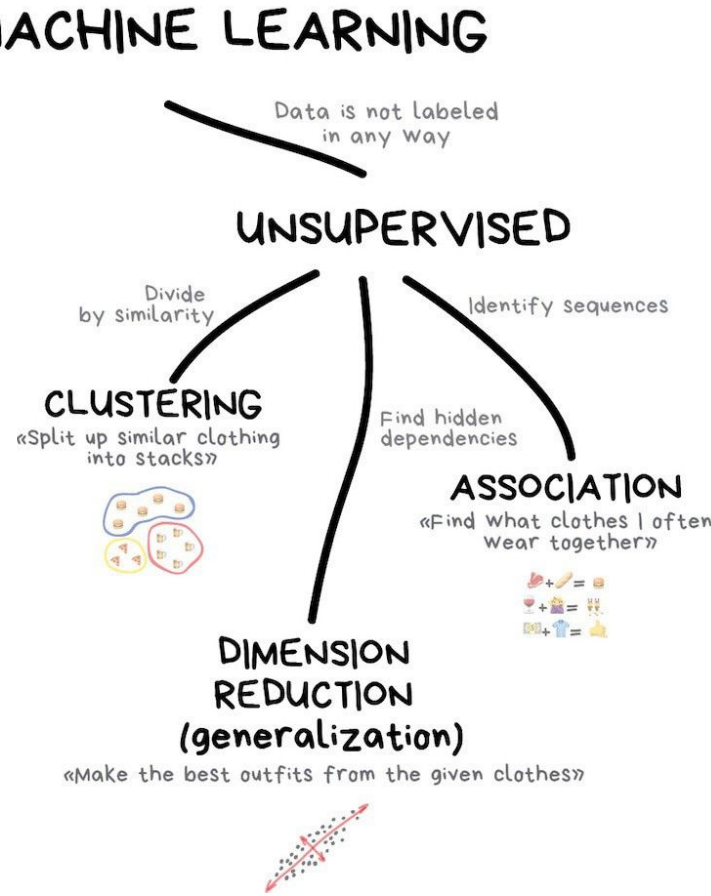
Supervised Learning

Enter Regularization!
Lasso and Ridge - Follow Along with Code

Tutorial
From O'Reilly

Machine Learning Landscape

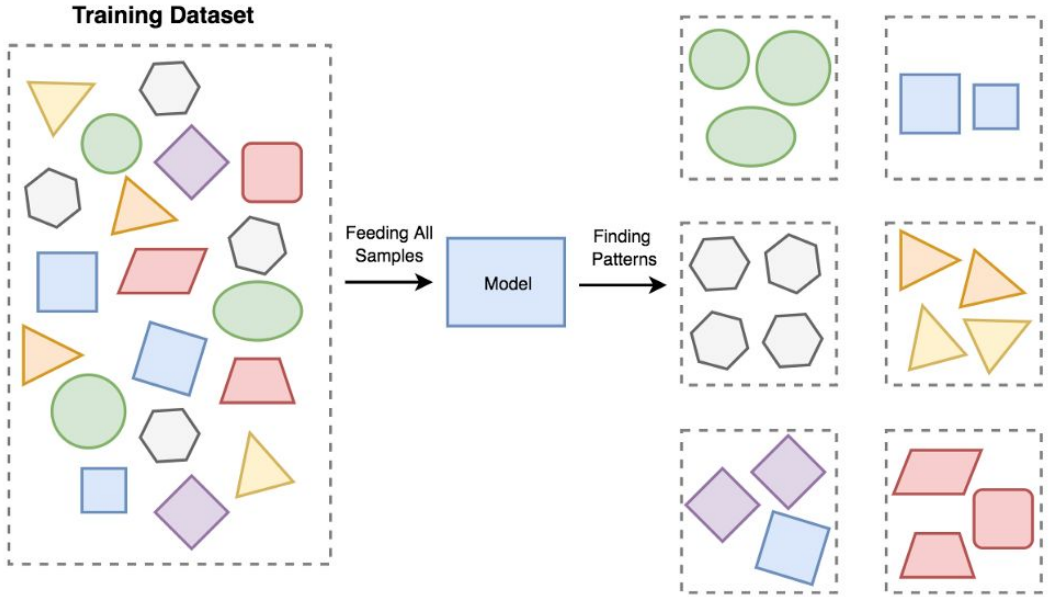
Unsupervised Machine Learning takes data that is not labeled in any way and it is up to the machine to find any patterns on its own.



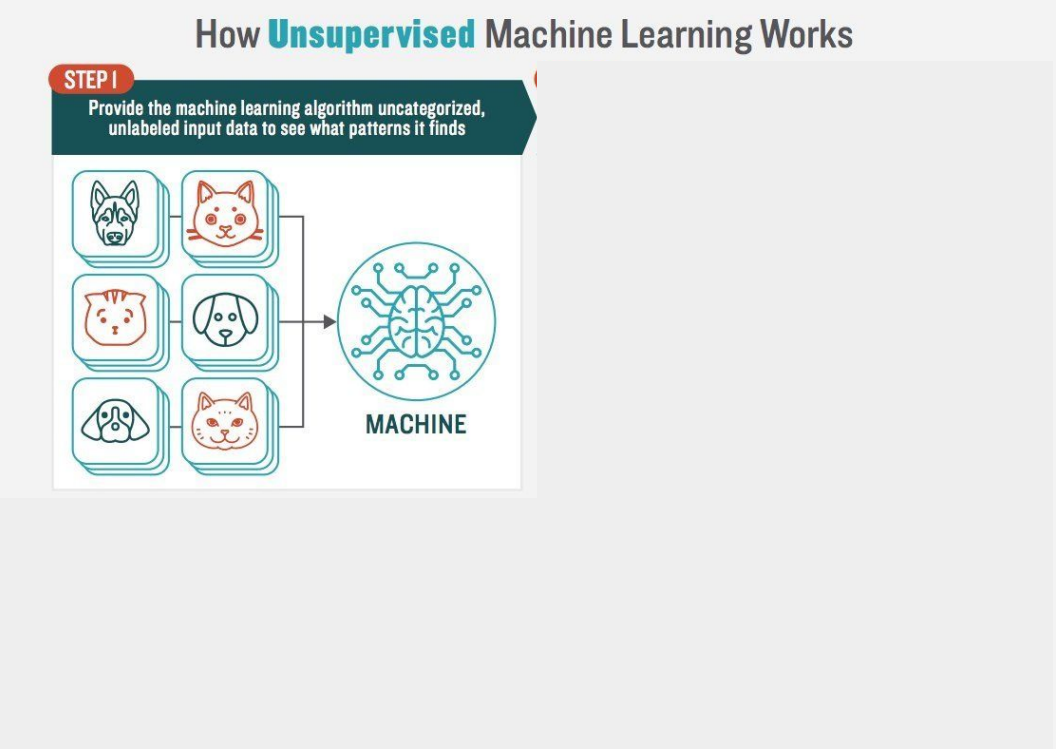
Unsupervised Learning

Group of algorithms that try to **draw inferences from non-labeled data** (without reference to known or labeled outcomes).

In Unsupervised Learning, **there are no correct answers**. Models based on this type of algorithms can be used for discovering unknown data patterns and data structure itself.



Unsupervised Learning



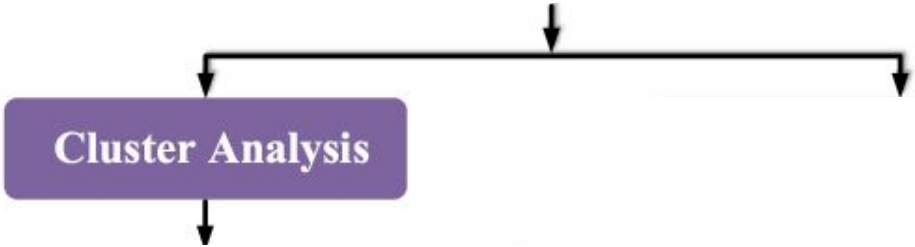
Unsupervised Learning - Common Applications

1. Reducing Data Dimensionality - *the process of compressing features into so-called principal values* which conveys similar information concisely.

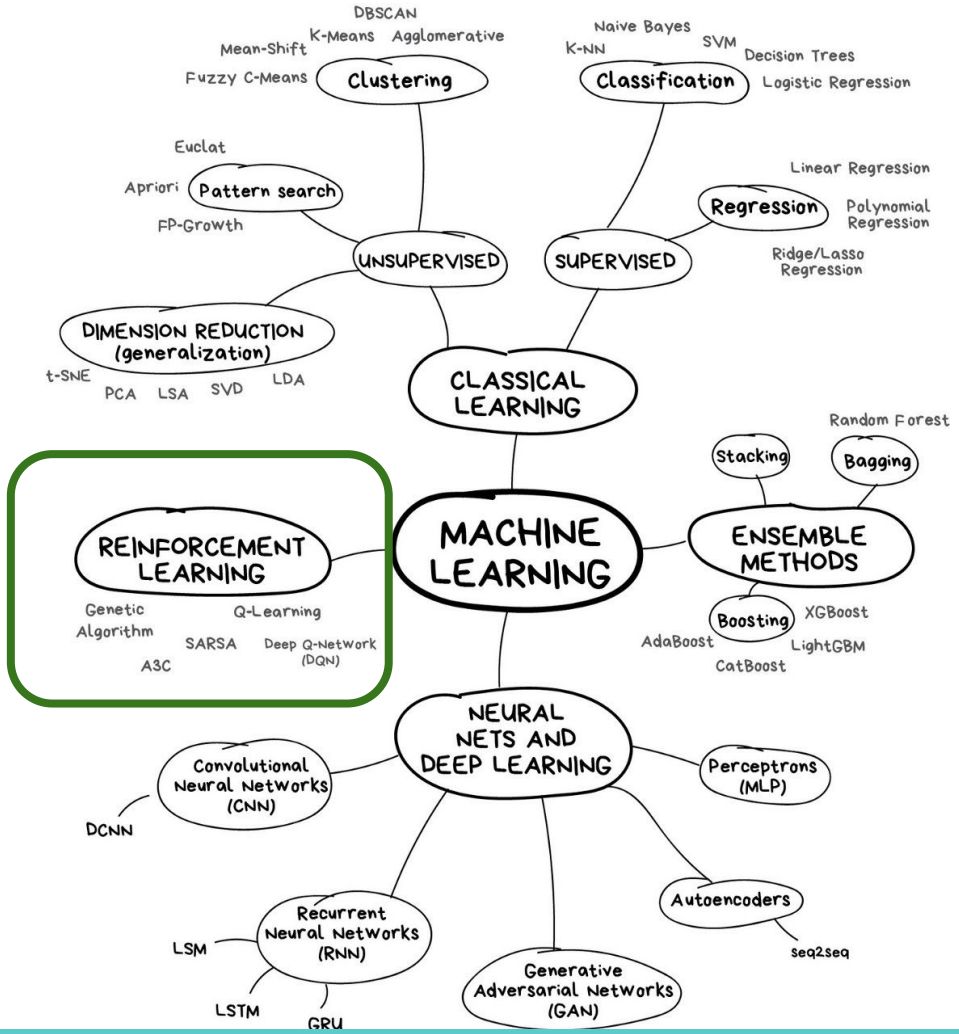
Unsupervised Learning - Common Applications

2. Pattern recognition and data clustering.

Unsupervised Learning - Algorithms



Machine Learning Landscape



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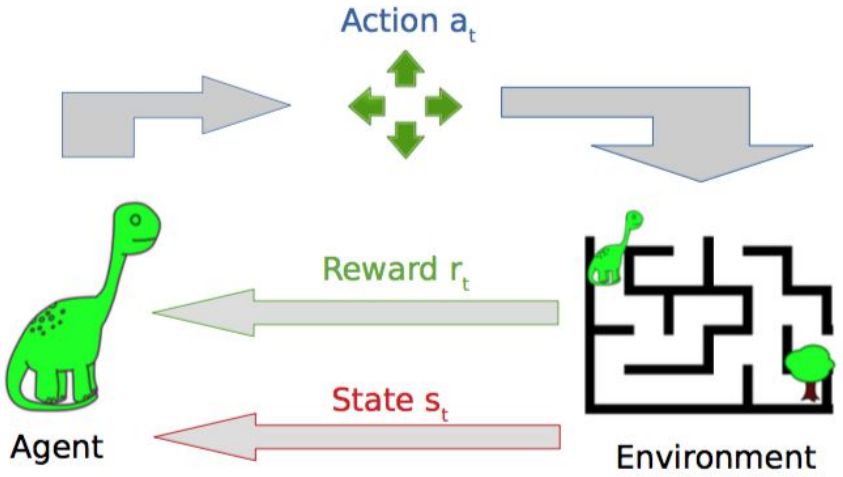
Reinforcement Learning - Training an Agent, not a Model

An **agent** receives information from the environment (a **state**) and react to it by performing an **action**, ultimately obtaining a **reward** and **reflecting** on its action. Training of an agent is a process of **trial and error**. It needs to find itself in various situations and get punished every time it takes the wrong action in order to learn.



Reinforcement Learning - Why is it special?

Old Machine Learning was ***Greedy*.**

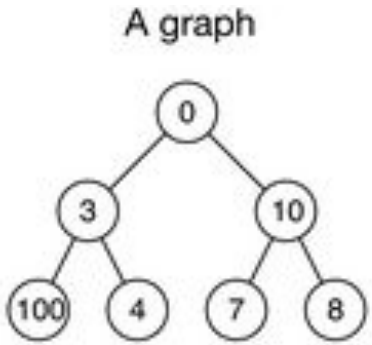
Imagine you're walking to the store.

The hope is that some locally optimal choice will lead to a globally optimal solution.

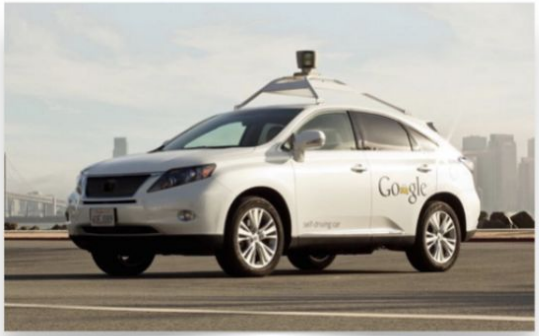
a. You see a shortcut on Google Maps, so you take it. (**Greedy Choice**).
b. You then realize this shortcut is crowded - taking a long amount of time to traverse.
c. Next time, you'll drive a longer distance to the highway so you can go at a faster pace.

Reinforcement Learning - Why is it special?

Problem: Maximize the sum of nodes.

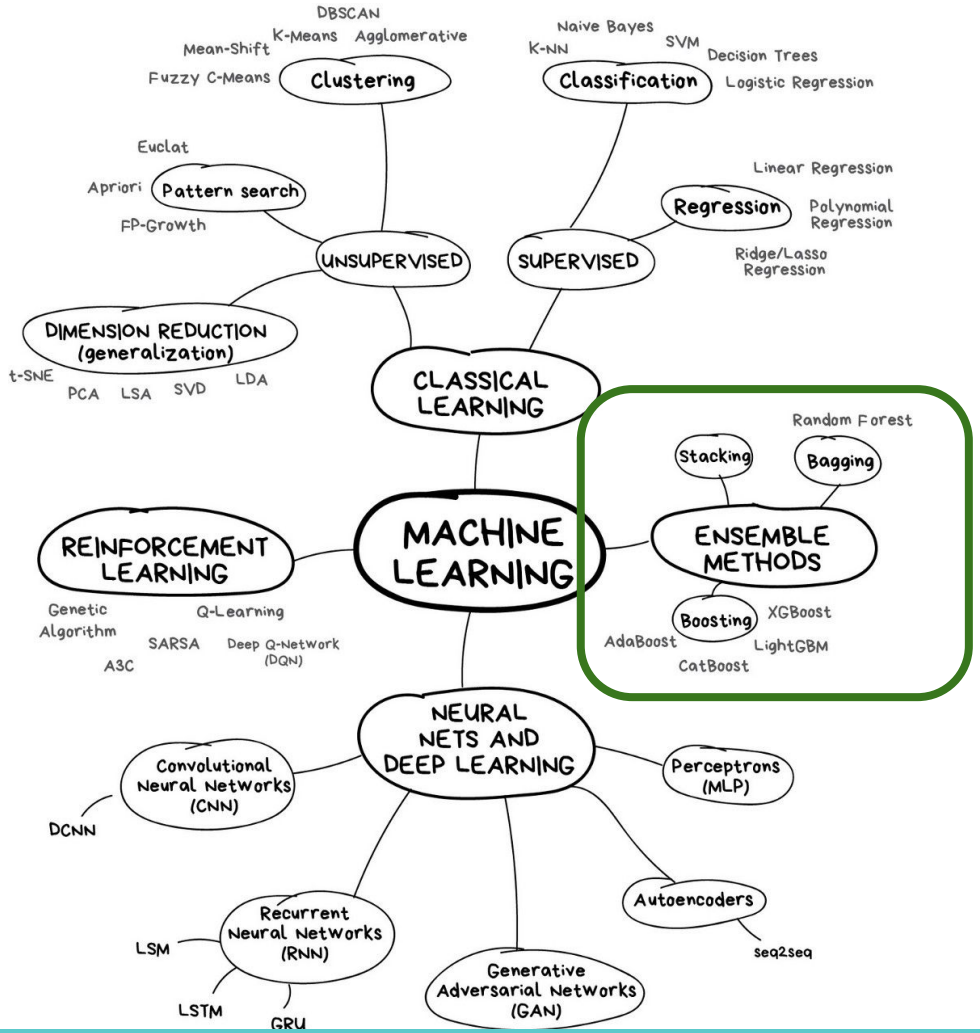


Reinforcement Learning - Example Problems



Example of solutions where Reinforcement Learning is used. From self-driving cars through various games such as Go, Chess, Poker or computer ones — Dota or Starcraft, to manufacturing.

Machine Learning Landscape



Next class….

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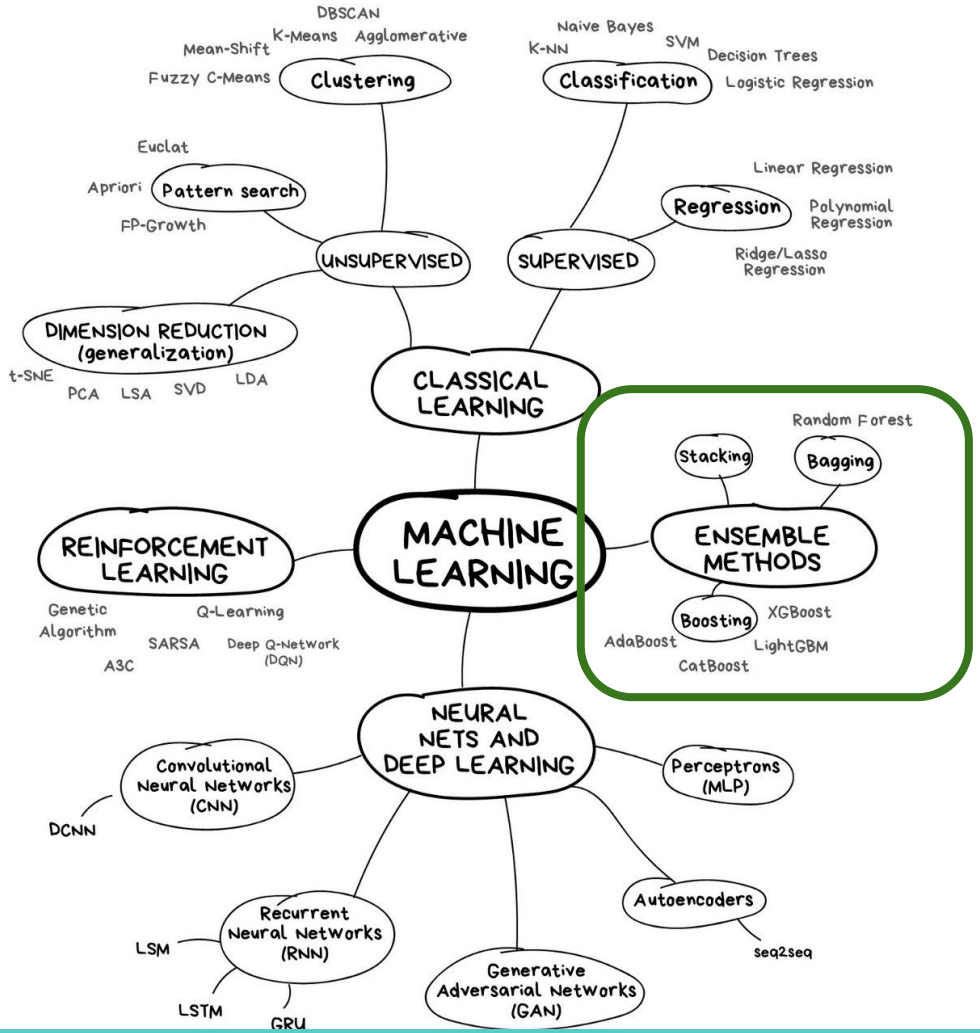

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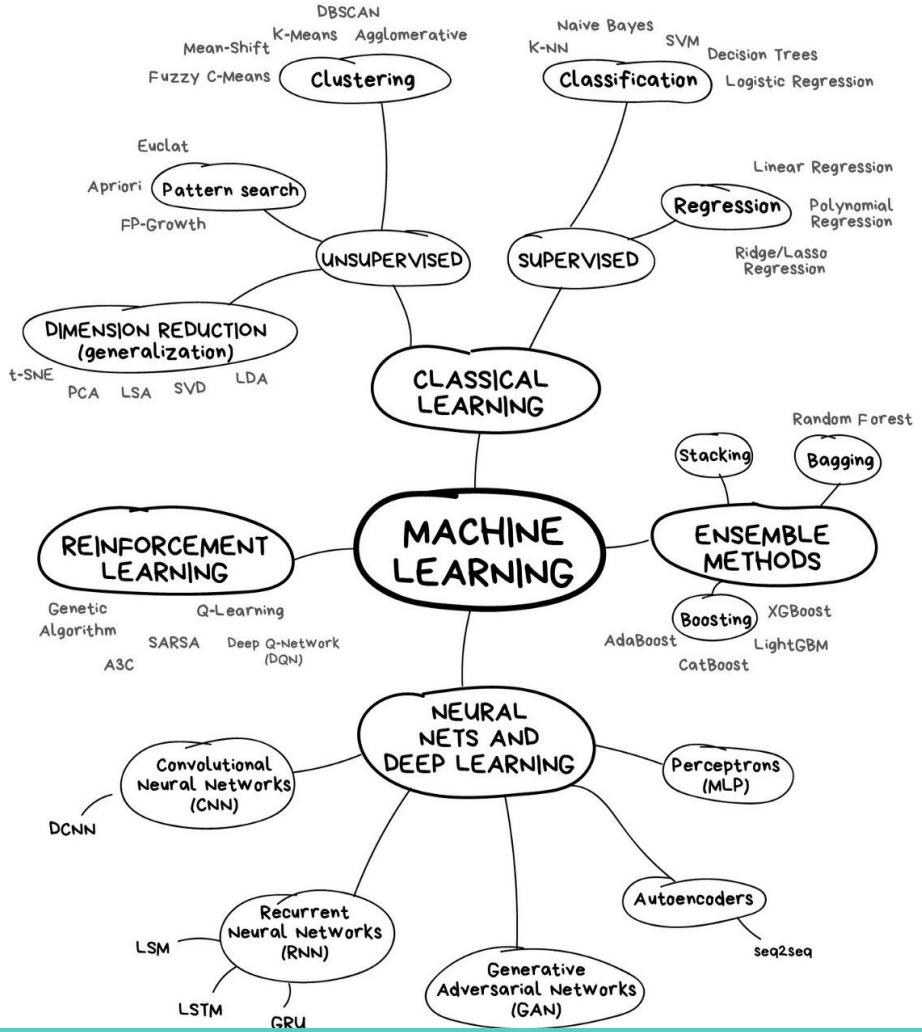

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