

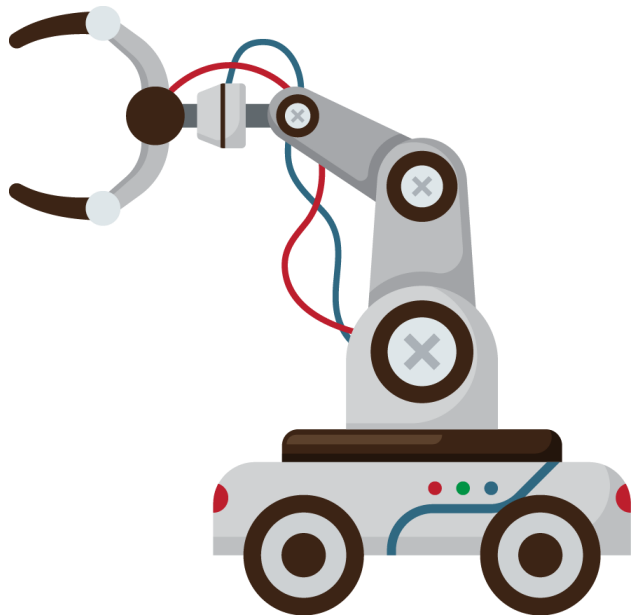
Machine Learning Beginner Course

3. Supervised
Learning
-2-



3. التعليم
المراقب
-2-

دورة تعليم الالة للمبتدئين



Salam again!

We've really done a lot of things in the past lessons, especially when we did Regression Using Math & Sklearn, today we will kick off the second part of the Supervised Learning tasks which consist of Classification



لا تحسبن المجدَ تمرًا أنتَ آكلُه
لن تبلغَ المجدَ حتى تلغى الضِّيرا

Supervised Learning

Its about feeding input and the desired output to the ML algorithm which will find some correlation between the input and the output in order to use it later to do prediction.

$$X \xrightarrow{f(x) = y} Y$$

Example

Country	Age	Salary	Purchased
Algeria	44	72000	0
Tunis	27	48000	1
Morocco	30	54000	0
Tunis	38	61000	0
Morocco	40	60333.33	1
Algeria	35	58000	1
Tunis	37.333	52000	0
Algeria	48	79000	1
Morocco	50	83000	0
Algeria	37	67000	1

X

Y



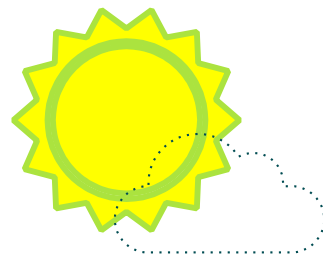
2.

Classification

The Discrete type of the Output.

Examples

Cat or Dog ?

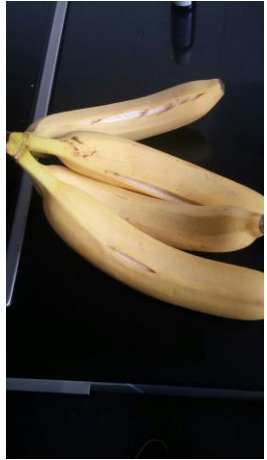


Will it be Cold or Hot tomorrow?

Examples: Type of Species



Examples: Products



Examples: MNIST

No.0 / Answer:7, Predict:[7] No.1 / Answer:2, Predict:[2] No.2 / Answer:1, Predict:[1] No.3 / Answer:0, Predict:[0] No.4 / Answer:4, Predict:[4]



No.5 / Answer:1, Predict:[1] No.6 / Answer:4, Predict:[4] No.7 / Answer:9, Predict:[9] No.8 / Answer:5, Predict:[5] No.9 / Answer:9, Predict:[9]



No.10 / Answer:0, Predict:[0] No.11 / Answer:6, Predict:[6] No.12 / Answer:9, Predict:[9] No.13 / Answer:0, Predict:[0] No.14 / Answer:1, Predict:[1]









No.15 / Answer:5, Predict:[5] No.16 / Answer:9, Predict:[9] No.17 / Answer:7, Predict:[7] No.18 / Answer:3, Predict:[3] No.19 / Answer:4, Predict:[4]

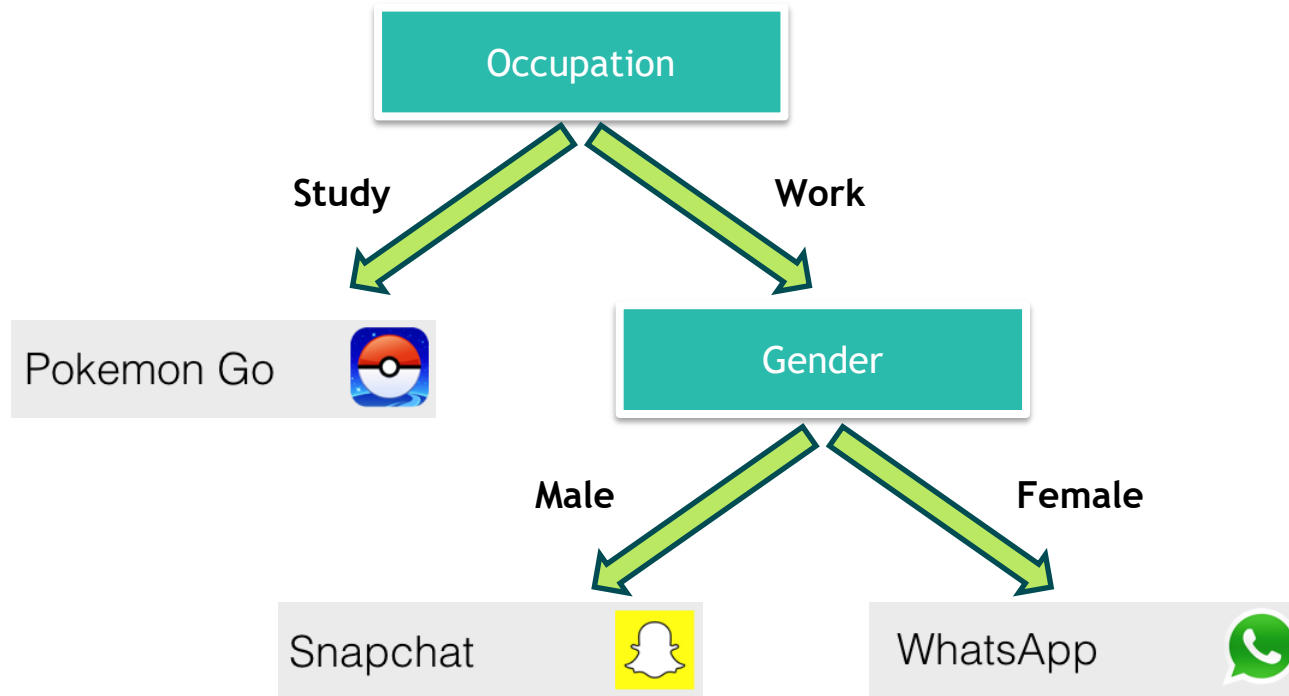


First Example

First Example

Gender	Occupation	App
F	Study	Pokemon Go 
F	Work	WhatsApp 
M	Work	Snapchat 
F	Work	WhatsApp 
M	Study	Pokemon Go 
M	Study	Pokemon Go 

First Example

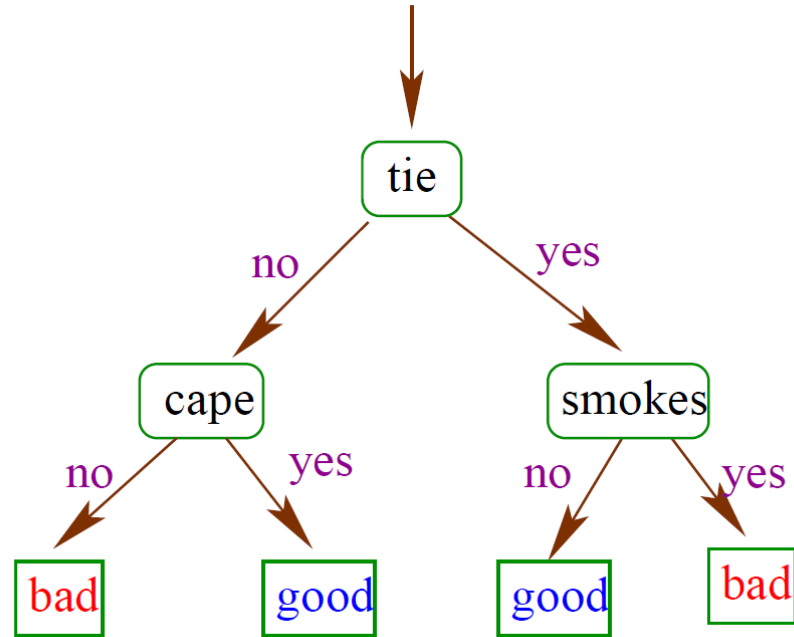


Data

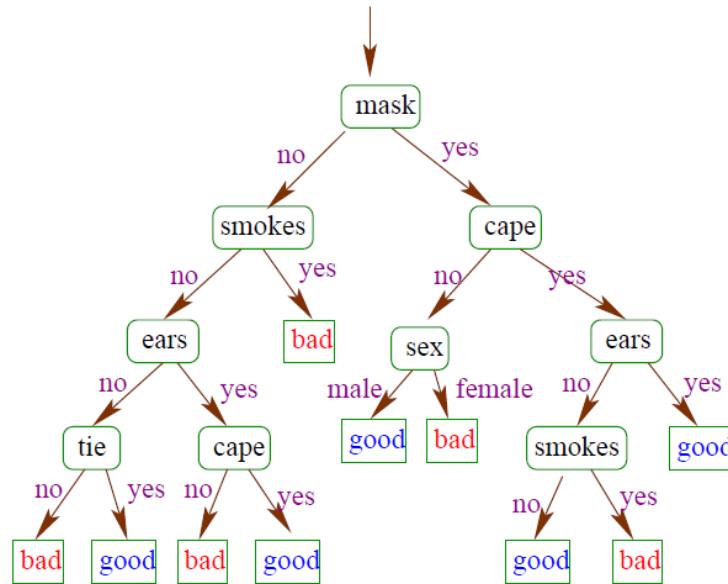
	Sex	Mask	Cape	Tie	Ears	Smokes	Class
Batman	Male	Yes	Yes	No	Yes	No	Good
Robin	Male	Yes	Yes	No	No	No	Good
Alfred	Male	No	No	Yes	No	No	Good
Penguin	Male	No	No	Yes	No	Yes	Bad
Cat woman	Female	Yes	No	No	Yes	No	Bad
Joker	Male	No	No	No	No	No	Bad
Batgirl	Female	Yes	Yes	No	Yes	No	
Riddler	Male	Yes	No	No	No	No	

A Decision Tree Classifier

- Perfectly classifies training data
- Overly complex

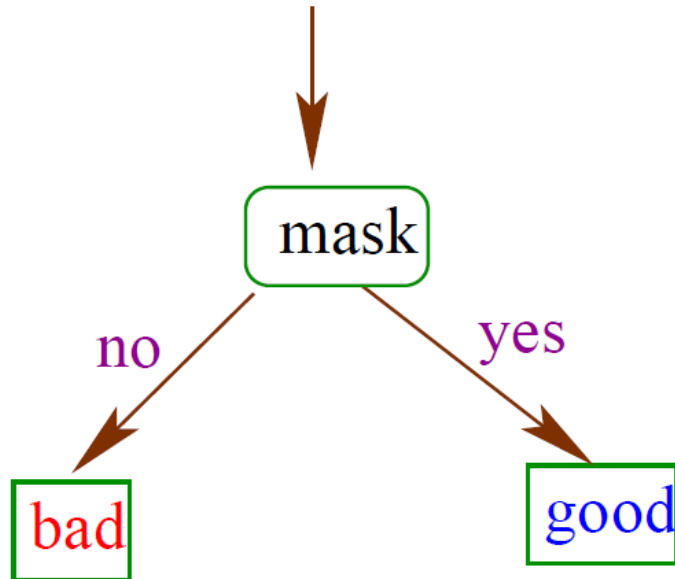


Another Possible Classifier



- Perfectly classifies training data
- Overly complex

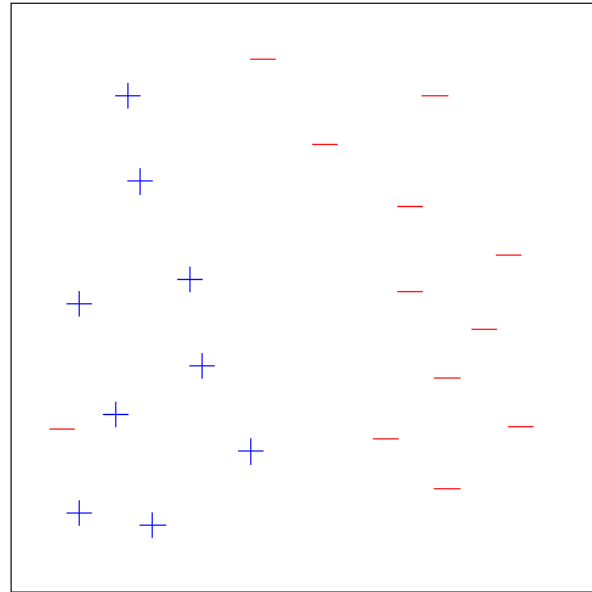
Another Possible Classifier



- Overly simple
- Doesn't even fit available data

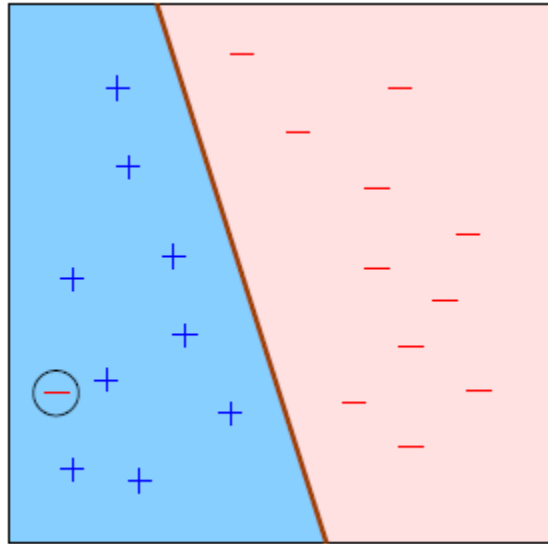
Problem

Training data:



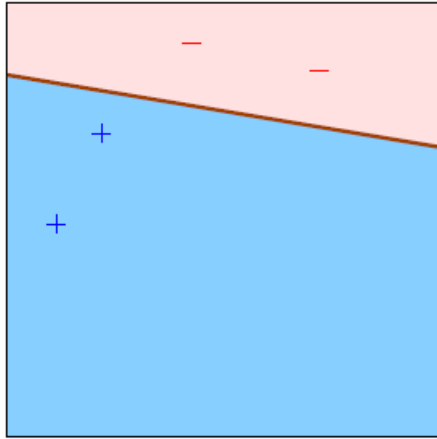
Good Classifier

Good:

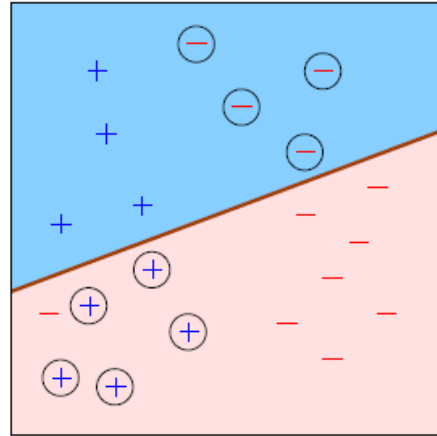


sufficient data
low training error
simple classifier

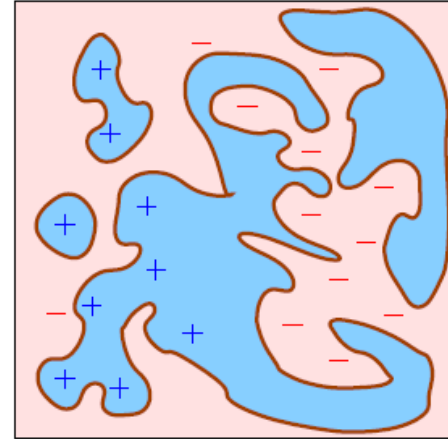
Bad Classifier



insufficient data

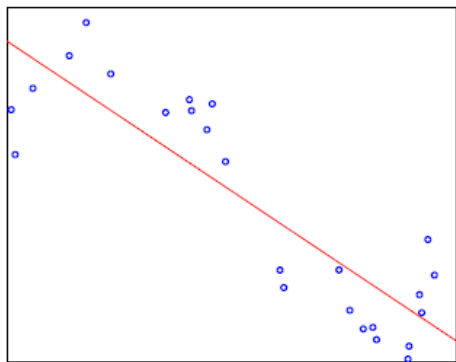


training error
too high

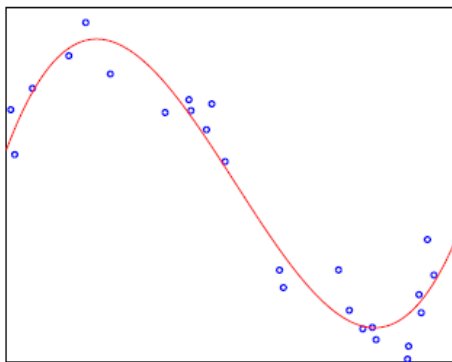


classifier
too complex

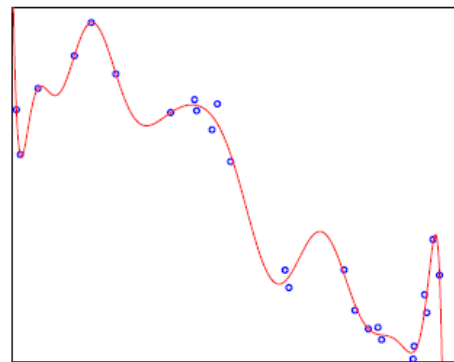
Even In Regression



underfit
(degree = 1)

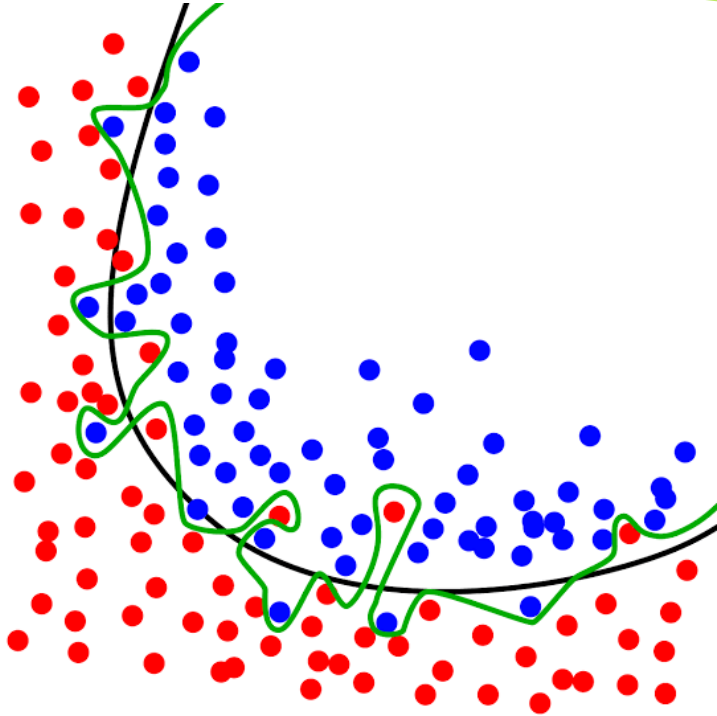


ideal fit
(degree = 3)



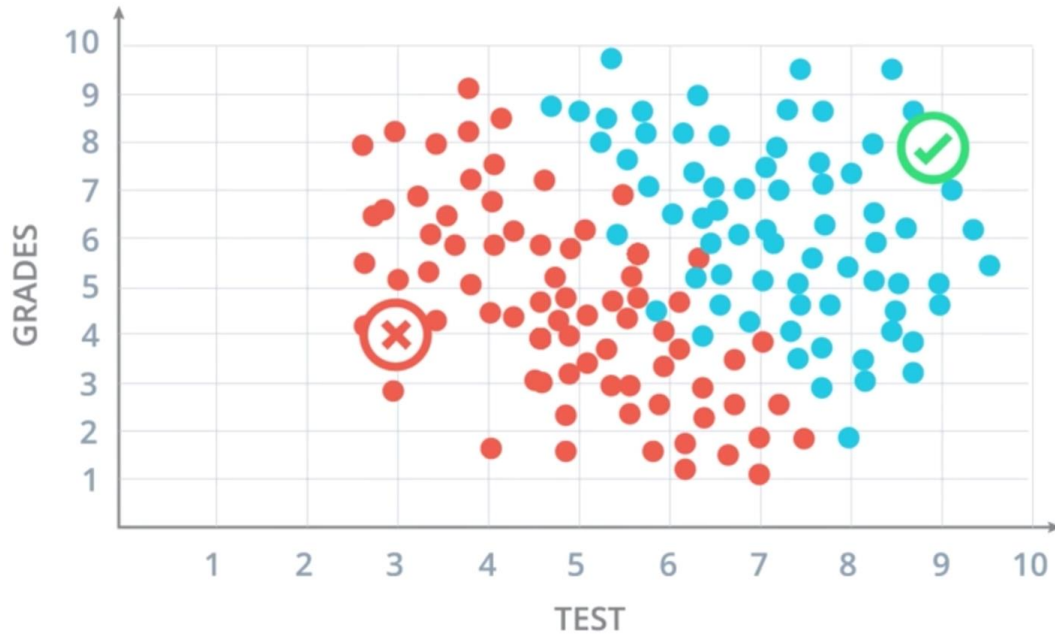
overfit
(degree = 20)

Overfitting Again



Overfitting is a modeling error that occurs when a function is too closely fit to a limited set of data points

What about That ?



Student with:

Test: 07/10

Grades: 6/10

The background features a series of overlapping, semi-transparent geometric shapes in various shades of green and teal. These shapes create a layered, mountain-like effect, with some areas appearing darker due to the overlap. The overall composition is modern and minimalist.

Algorithms



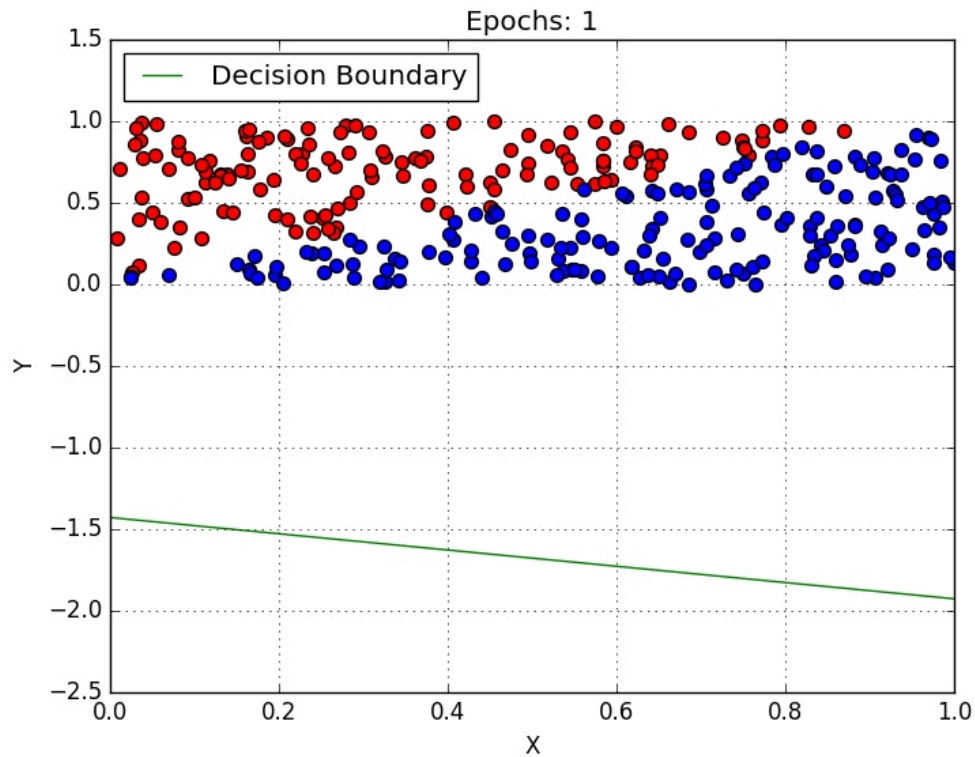
Logistic Regression

Definition

Logistic regression is a classification algorithm used to assign observations to a discrete set of classes. Unlike linear regression which outputs continuous number values, logistic regression transforms its output using the logistic sigmoid function to return a probability value which can then be mapped to two or more discrete classes.

$$\textit{sigmoid}(x) = \frac{1}{1 + e^{-x}}$$

Example Animation

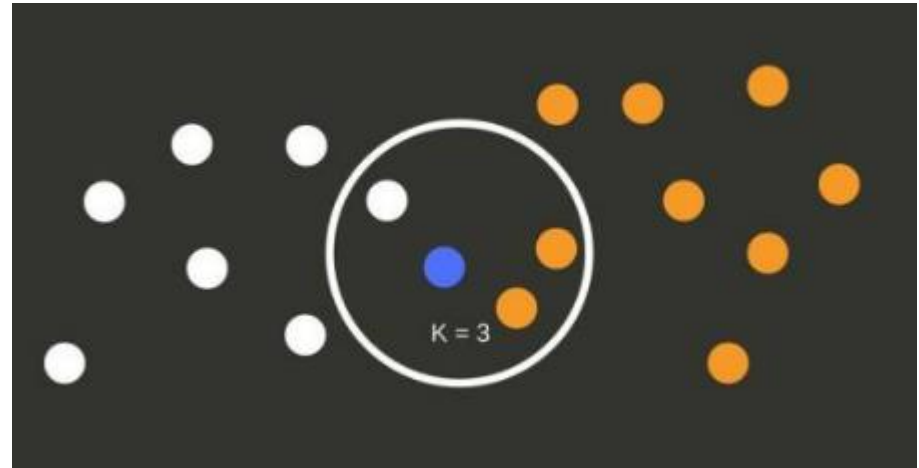




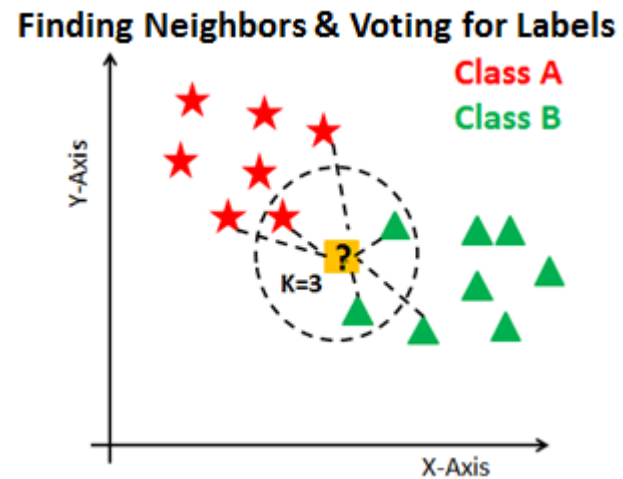
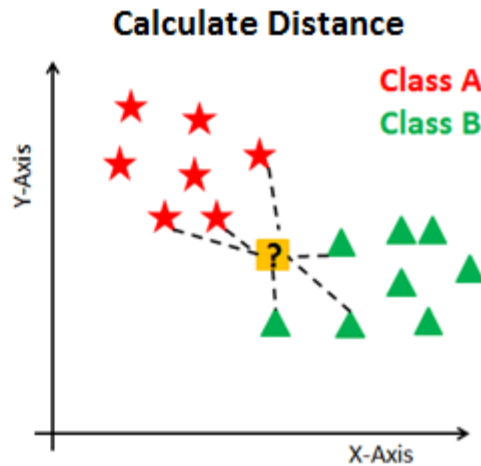
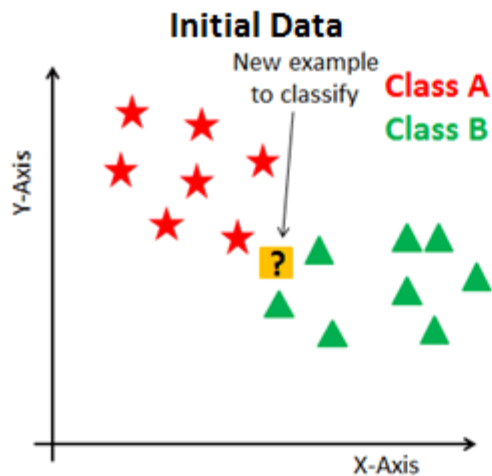
K-Nearest Neighbors

Definition

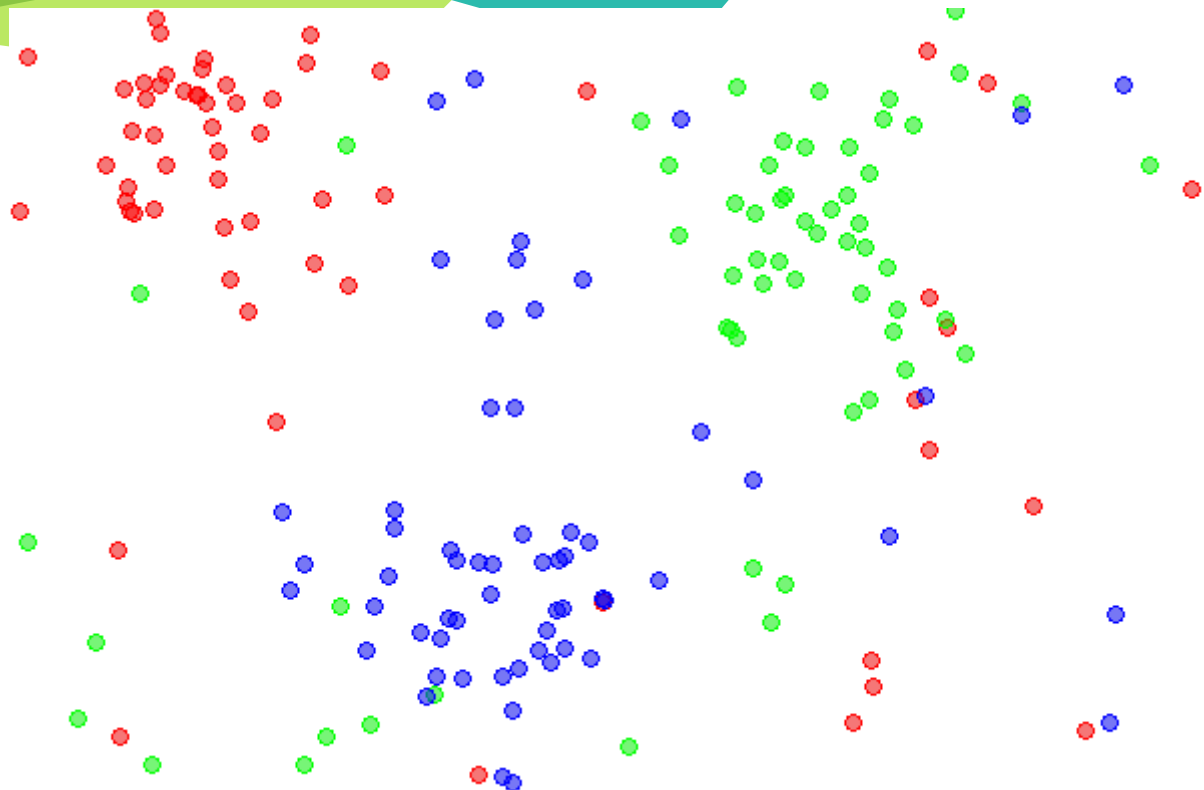
In k-NN classification, the output is a class membership. An object is classified by a plurality vote of its neighbours



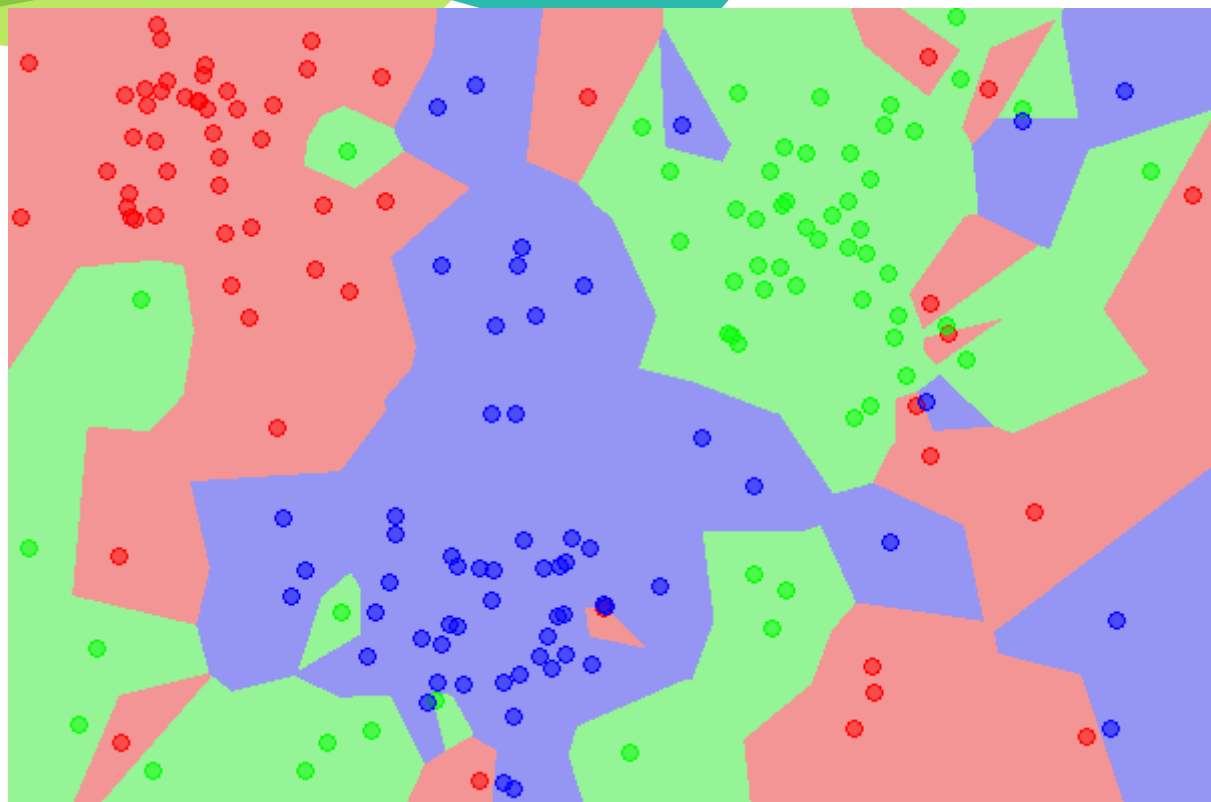
Example



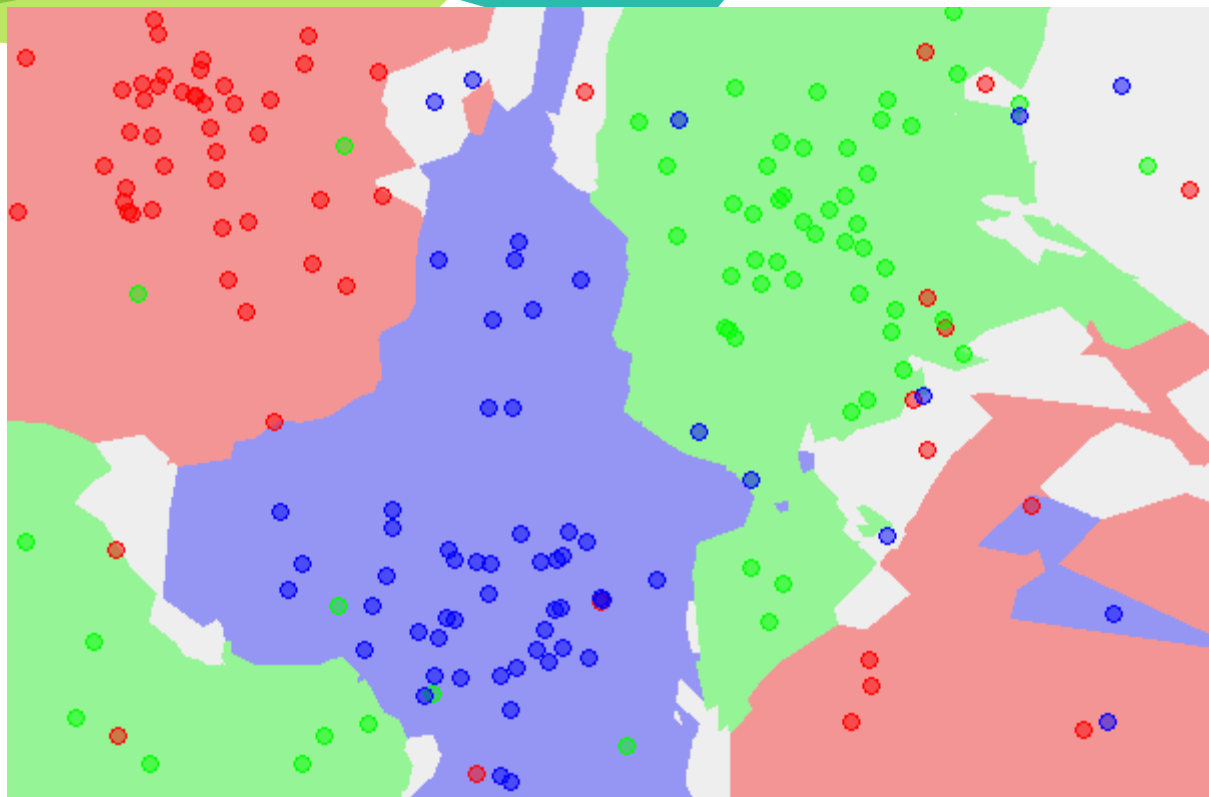
Example



Example 1NN



Example 5NN





Other Algorithms

Definition

List of Common Algorithms

- ◆ Naive Bayes
- ◆ Random Forest
- ◆ Support Vector Machines (SVM)
- ◆ Neural Networks
- ◆ AdaBoost, XGBoost , Catboost

Practical Time

Open up your PC, launch your anaconda and let's create some regression model.



Coding Interview

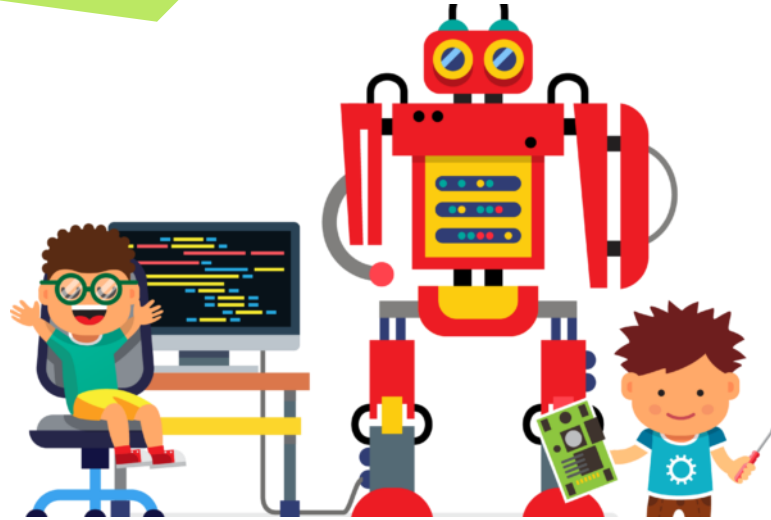


Given a list of integers, write a function that returns the largest sum of non-adjacent numbers. Numbers can be 0 or negative.

For example, `[2, 4, 6, 2, 5]` should return 13, since we pick 2, 6, and 5.

`[5, 1, 1, 5]` should return 10, since we pick 5 and 5.

Can you do this in $O(N)$ time and constant space?



شكرا لحضوركم

Thanks for Assisting!