Intro to Machine Learning

Knowledge Sharing for CPE/SKE students

Sirakorn Lamyai

Student, Kasetsart U.

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Outline

1. Introduction to Machine Learning
   - What is Machine Learning?
     - Traditional programming approach
     - Machine learning approach
2. Machine Learning Problems
   - Supervised learning
   - Unsupervised learning
   - Reinforcement learning
3. Model
   - A good model
     - Overfitting and underfitting

Introduction to Machine Learning

What is Machine Learning?

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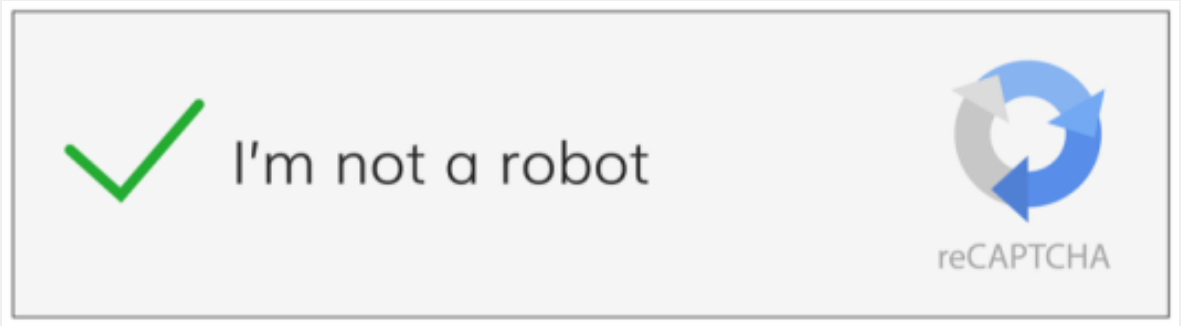

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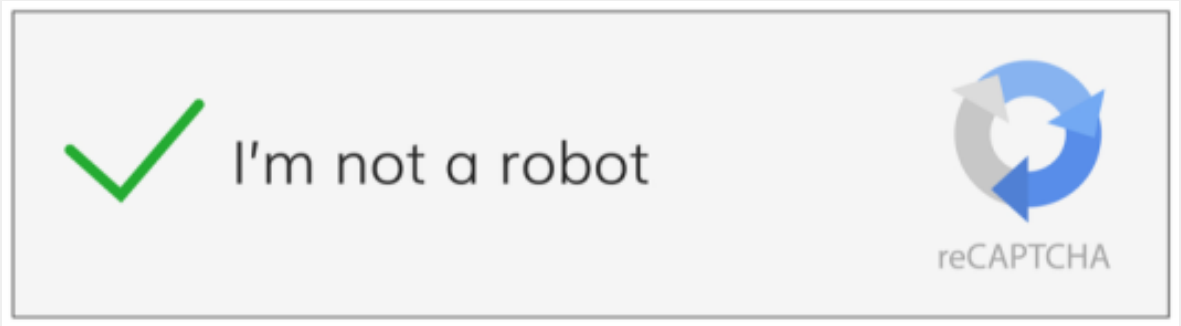

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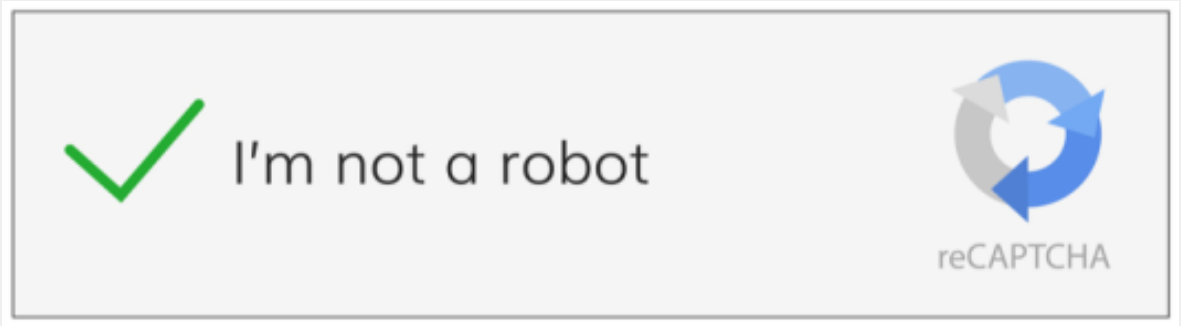

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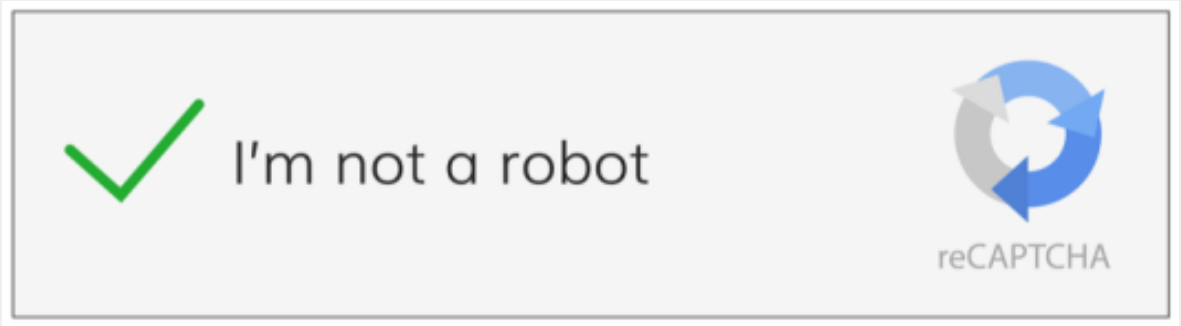

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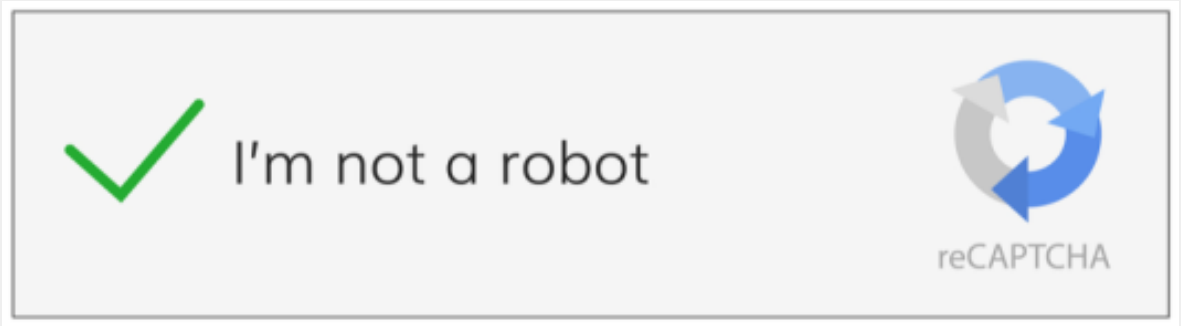
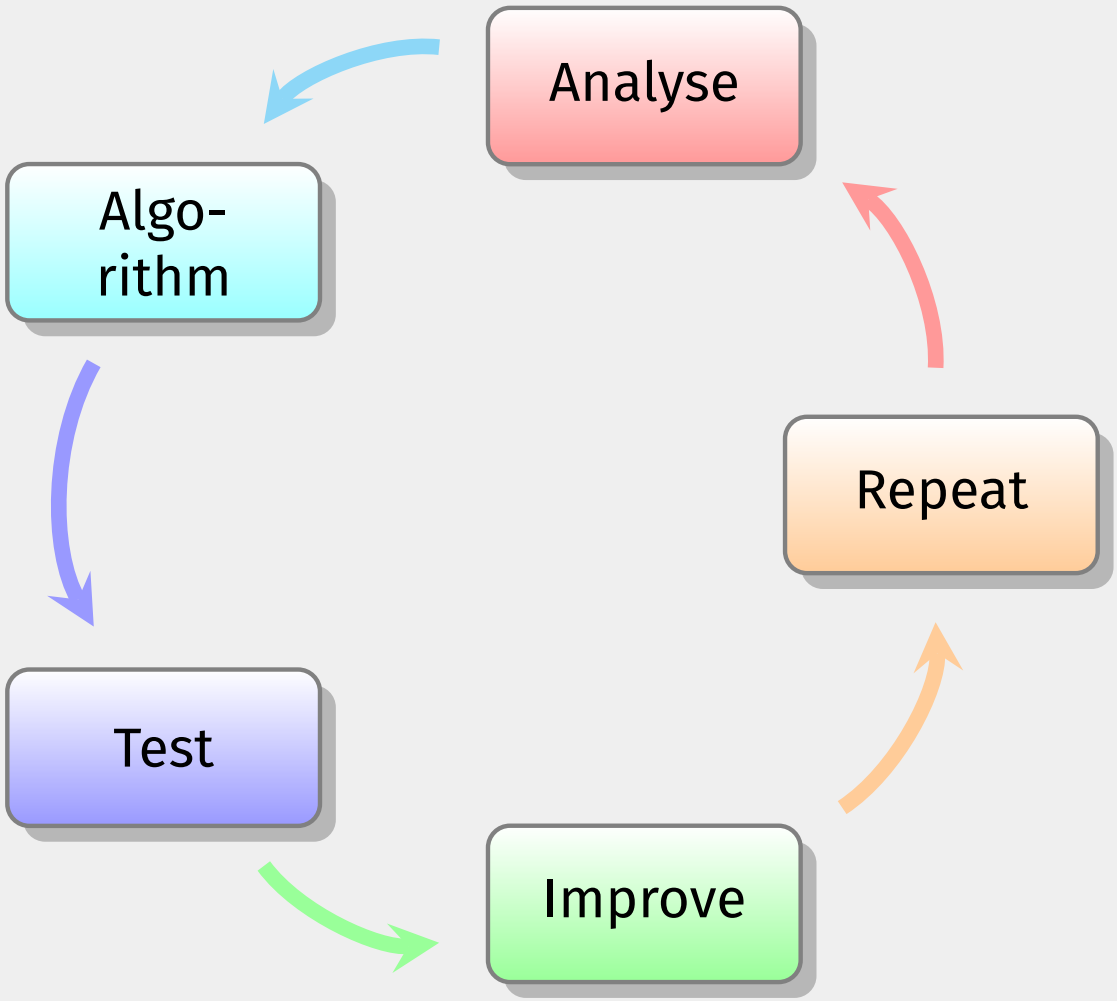
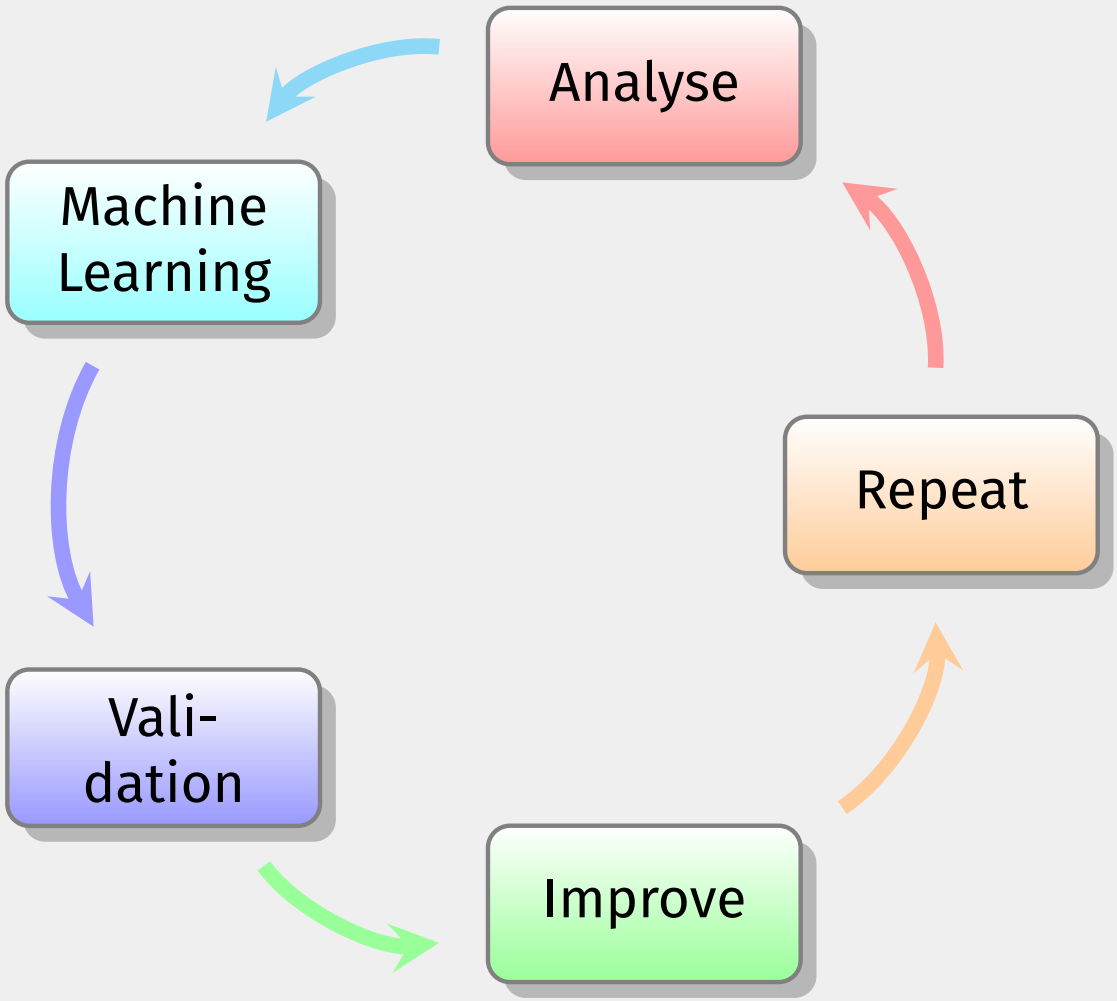


- This is Recaptcha.
  - Recaptcha helps stop millions of spam a day.
  - In some old days, we have to type Captcha texts to distinguish ourself from bots.
  - How is it possible that with a single click, an automated system can distinguish bots from humans?

Traditional programming approach



Machine learning approach



In other words...

Machine Learning

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= Data + Data analysis algorithm

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Machine Learning

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= Adapt to change

Machine Learning Problems

Types of Machine Learning problems

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1. Supervised learning

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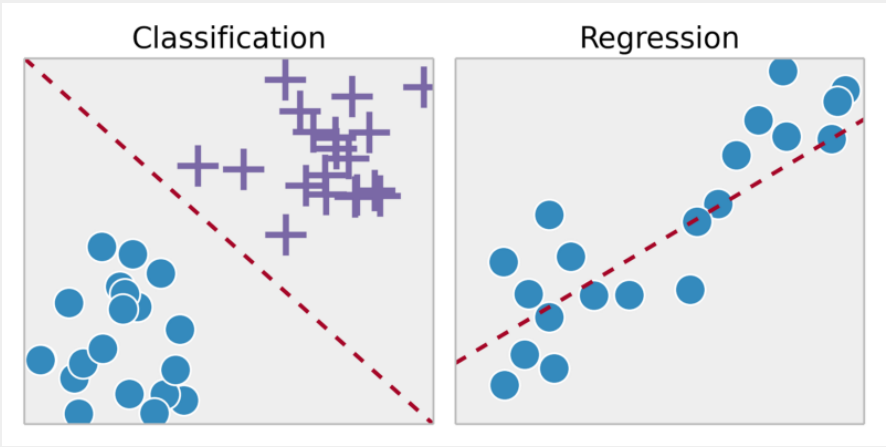
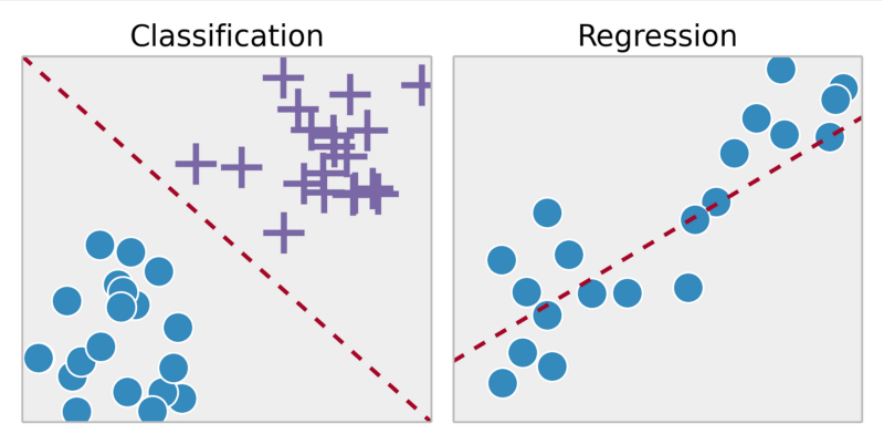
Supervised learning



Supervised learning



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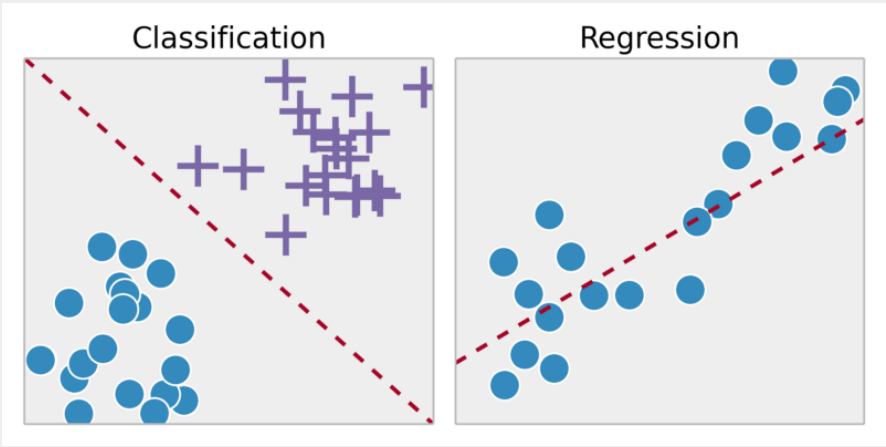
Supervised learning



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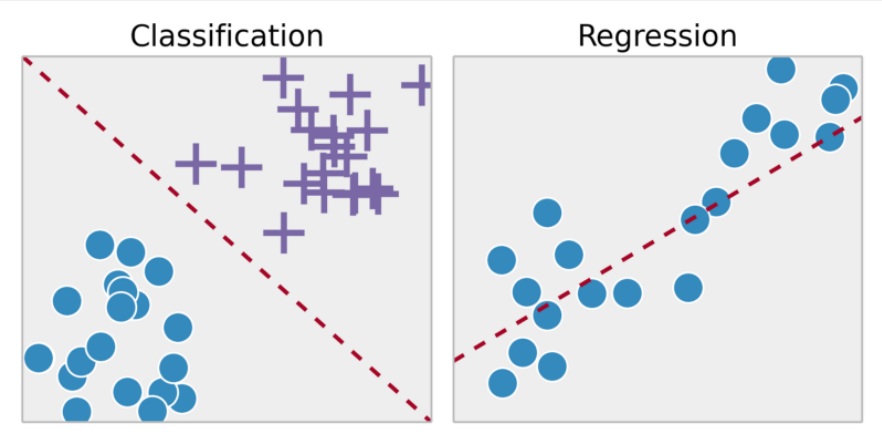
Supervised learning



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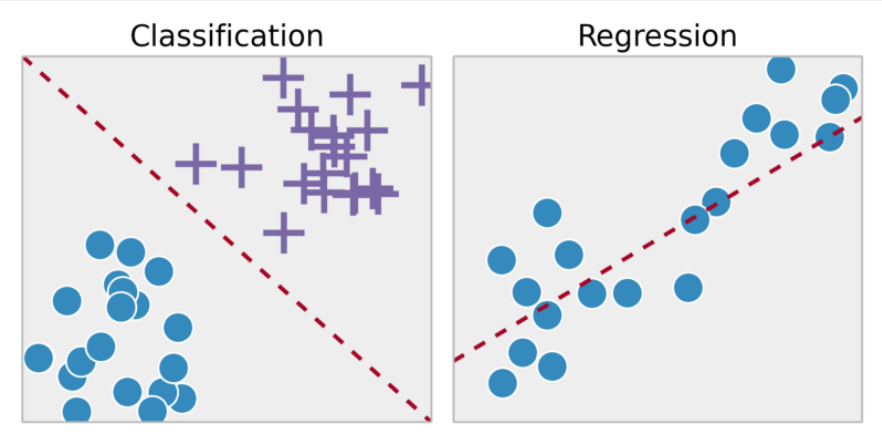
Supervised learning



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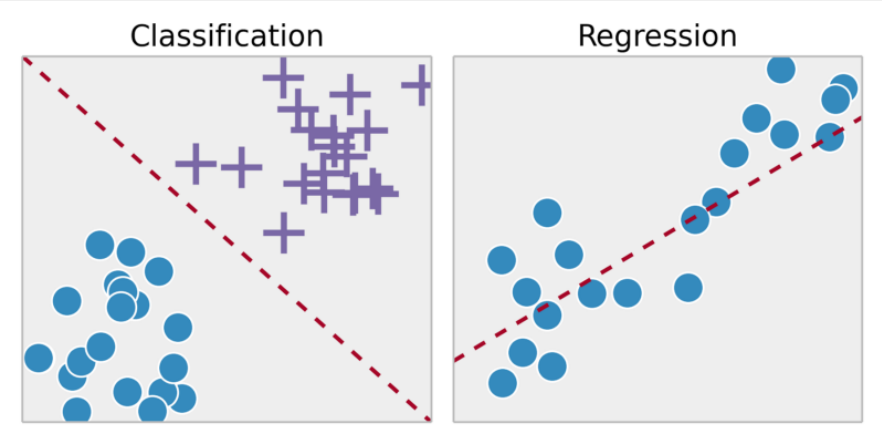

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  - Classification: On the discrete data
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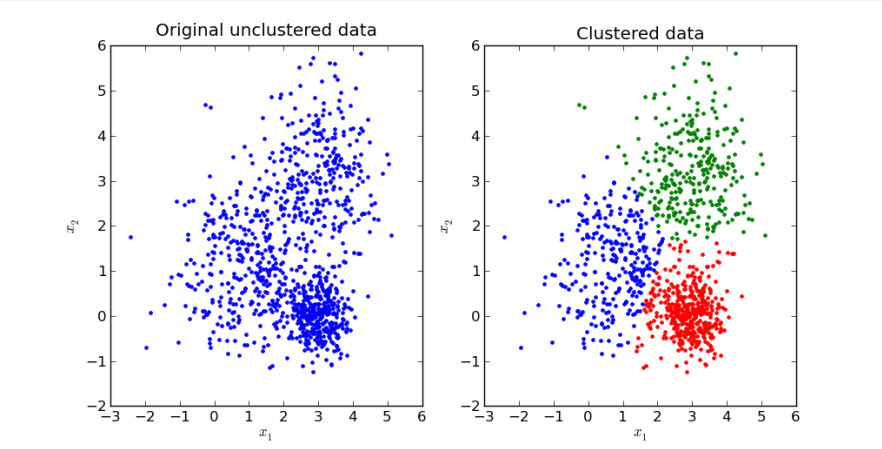
- Example problems: Spam E-mail detection, Facial recognition

Unsupervised learning



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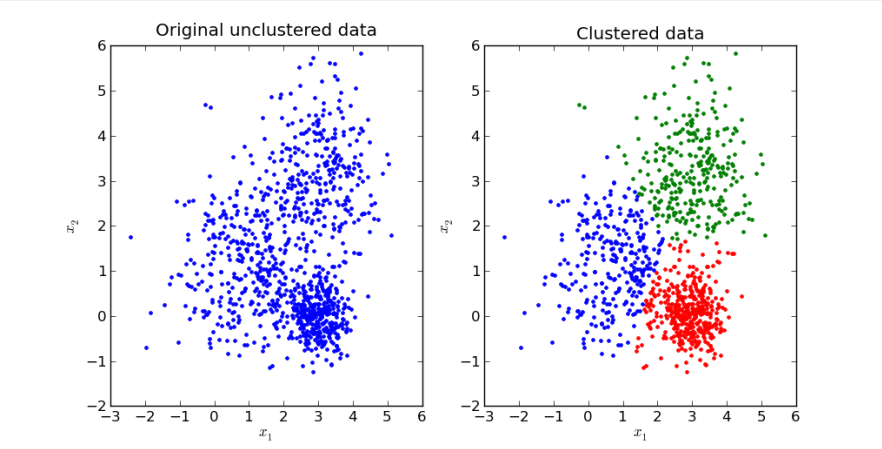
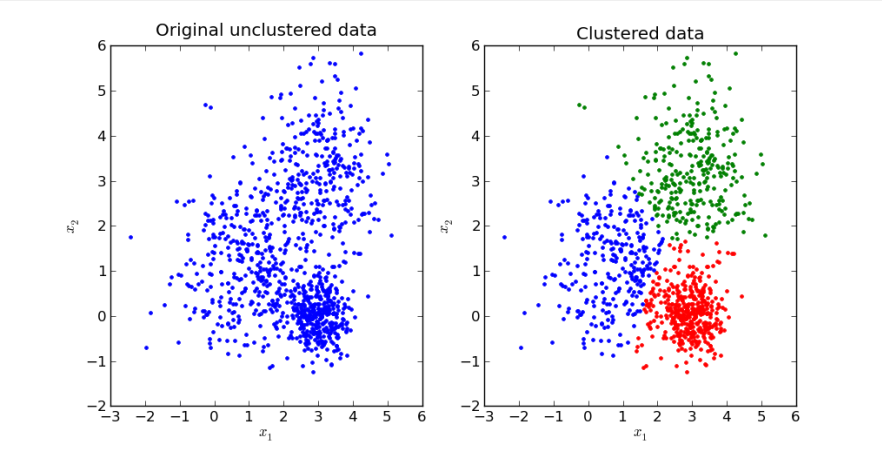


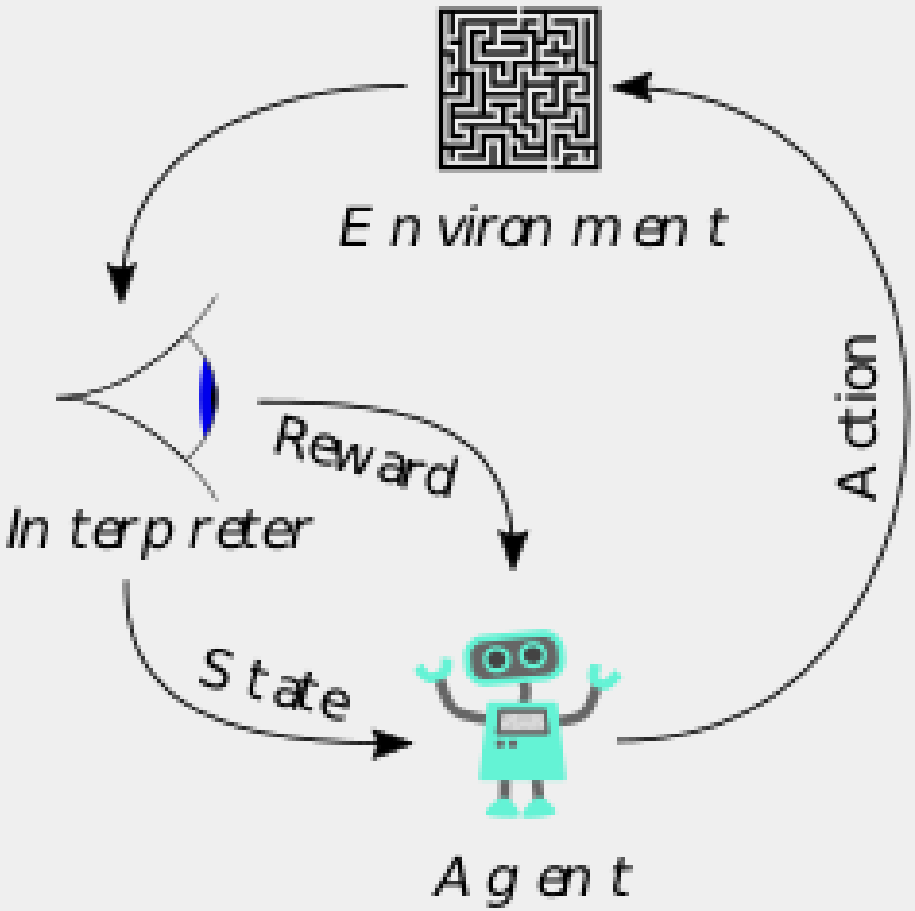
- Discover **hidden** structure in **non-labelled** data.

Unsupervised learning



- Discover **hidden** structure in **non-labelled** data.
- Example: Clustering, Generative models

Reinforcement learning



Model

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- A result of the combination between...

Model

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  - a **method** to recognise the data, and

Model

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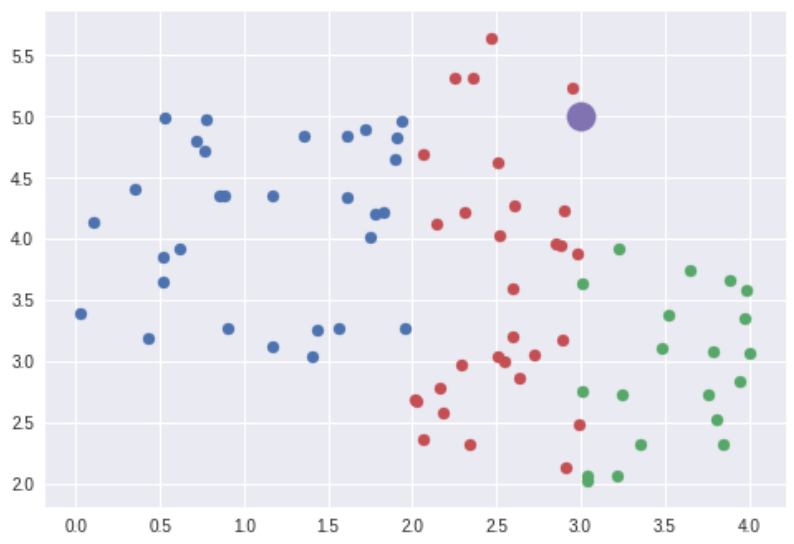
  - a **method** to recognise the data, and
  - **sample datas** for such the method

Model

Data

Method

Model



Data

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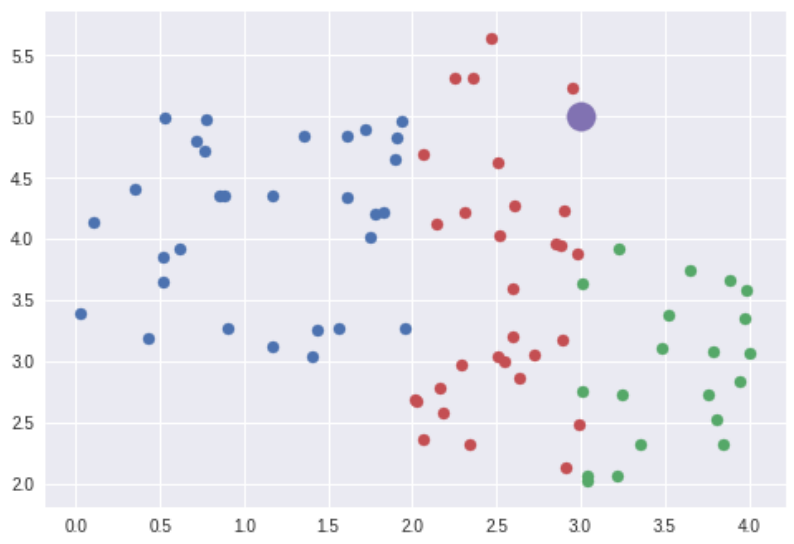

Data

Determine which group should the purple dot be in (red/green/blue) by **checking the colour of its nearest dot.**

Method

Beginning with our first model

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- We're going to write our **first own** machine learning algorithm called *k*-**Nearest Neighbour** (*k*NN)

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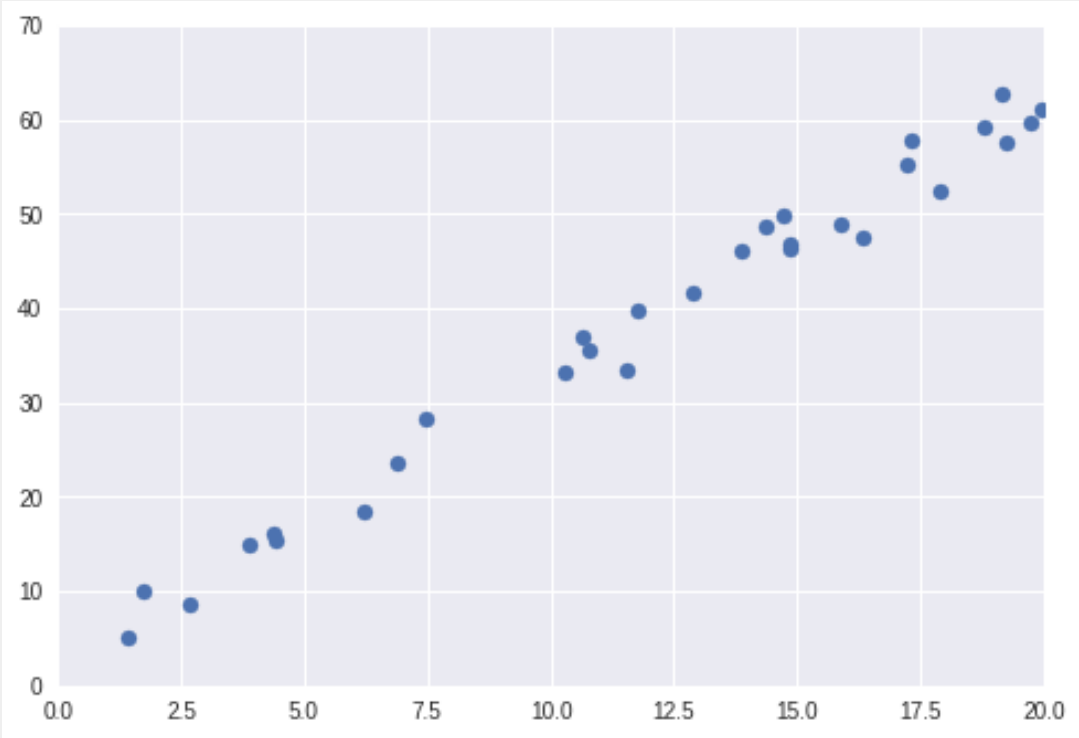
_k_-NN algorithm

To classify label of a data point, get *k* nearest data points to the data point, and select the major label among those data points.

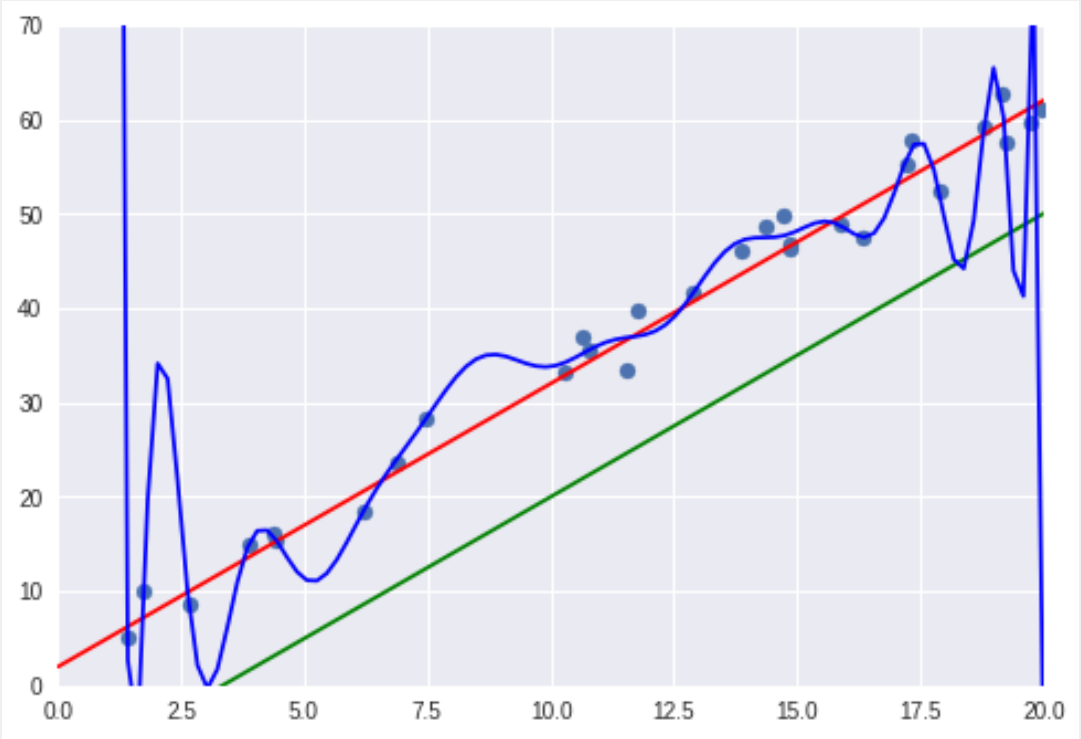
Good model?

Good model



How should we *draw* the line to predict this data?

Good model



Blue, red, or green line?

Overfitting and underfitting

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   - Our model **memorise instead of generalise**
   - Resulting in failure to catch the trend

Good model must **generalise**