A brief introduction to machine learning

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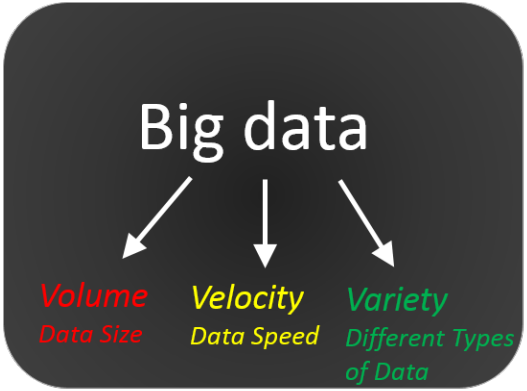
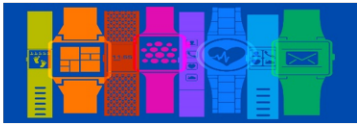
Big Data Era


Big data
Volume
Data Size
Velocity
Data Speed
Variety
Different Types
of Data



Machine Learning "learn" from data, without being explicitly programmed. Use as much data as possible with as little structure as possible.

Machine learning *is ideal for exploiting the opportunities hidden in* ***big data***.

Categories of Machine Learning Problems

- Supervised learning
  - Learn from examples
  - Training data comprises both features and outputs
  - Examples: function representation (regression), classification.
- Unsupervised learning
  - The model makes sense of the data itself
  - Training data does not feature outputs
  - Examples: clustering, dimensionality reduction, density estimation.

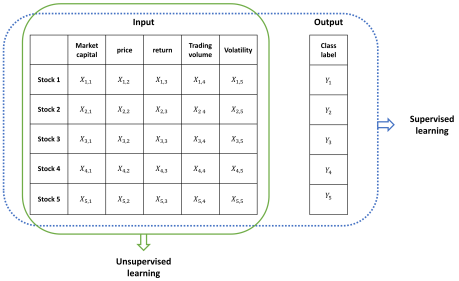


Figure: Supervised v.s. Unsupervised Learning

Categories of Machine Learning Problems (ii)

- Reinforcement learning
  - Learn to operate in a (possibly changing) environment
  - Connected to control theory
  - Examples: control of an agent, game-type problems

More complex tasks might combine some of the above categories.

Machine learning models

Machine learning tasks can be tackled using different types of models. Here are some examples:

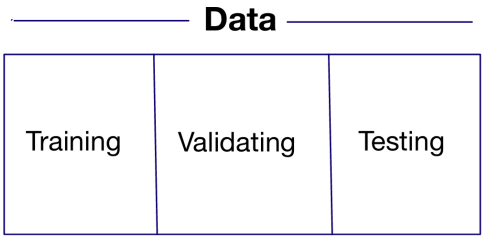
- Linear and non-linear regression
- Classification and Regression Trees (CART)
- Neural Networks (Deep and Shallow)

In this course, we will focus mainly on Linear Regression and Neural Networks.

Typical stages in ML modelling

Once an ML task has been identified and a model selected we need to:

1. Data acquisition and feature selection
2. Training (optimisation methods e.g. gradient descend)
3. Validation and hyper-parameter optimisation (repeat 2 with different parameters)
4. Testing



Thanks for your attention!

References I