Introduction to Machine Learning

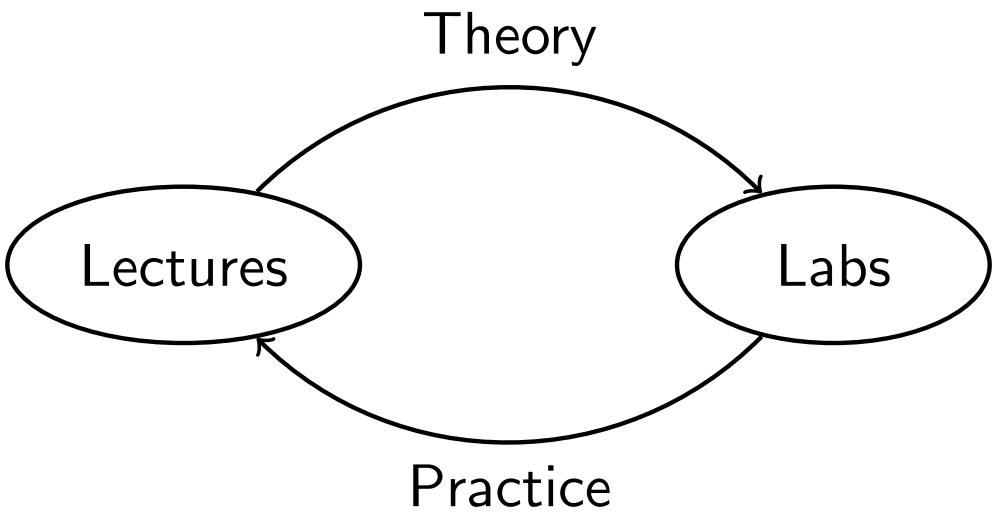
Sample Lecture and Lab

Computer Science

Purpose

- Understand machine learning
  - Basic concepts
  - Working with data
  - k nearest neighbours
  - Neural networks/multilayer perceptrons
  - Measuring performance
- Learn about studying at university

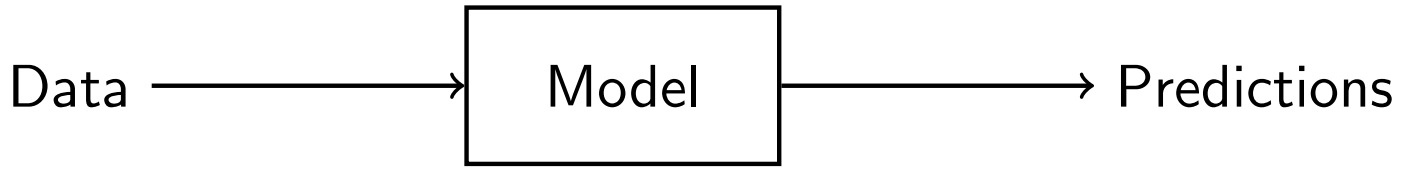
Session Structure



- 50% lecture - exploring machine learning
- 50% lab - applying ML techniques to a dataset

What is Machine Learning?

Getting computers to find patterns in data **without actually telling it what to look for!**



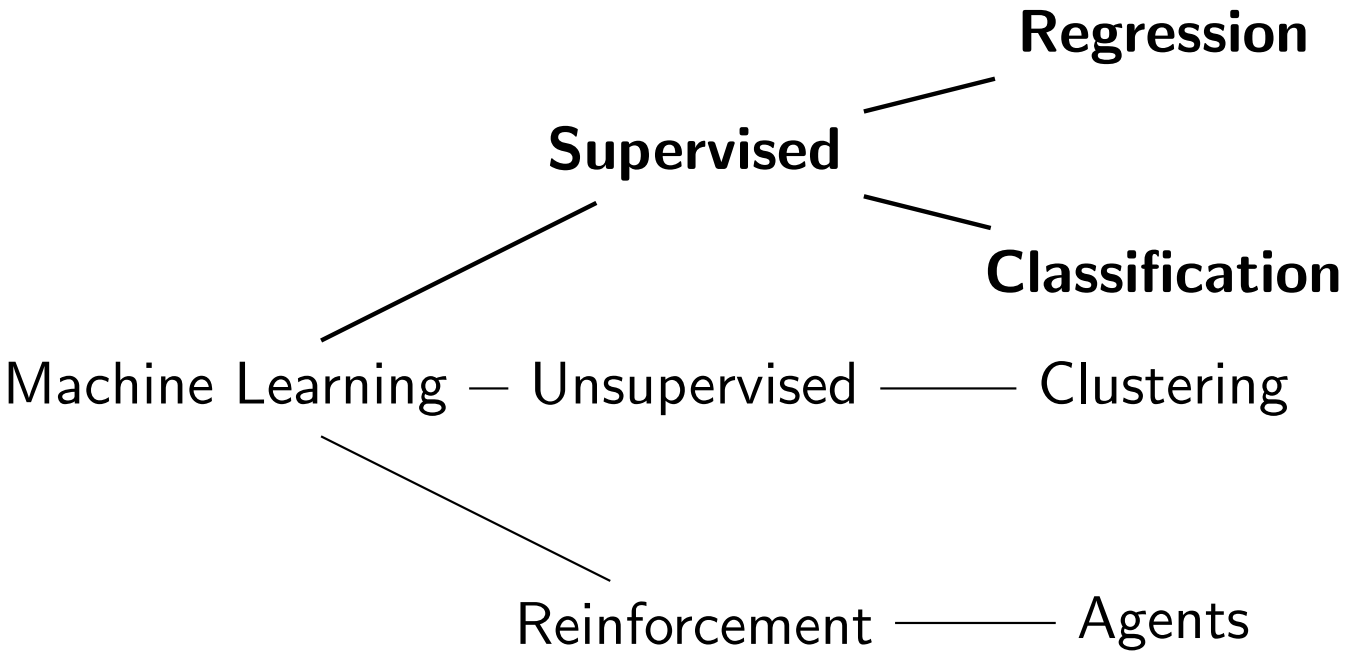
Consists of feeding some *training data* to a computer to create a *model* which can make *predictions*.

- Predictions can be on new/unseen data
- Predictions can be about data itself
- Predictions can be next action to take

Why use Machine Learning?

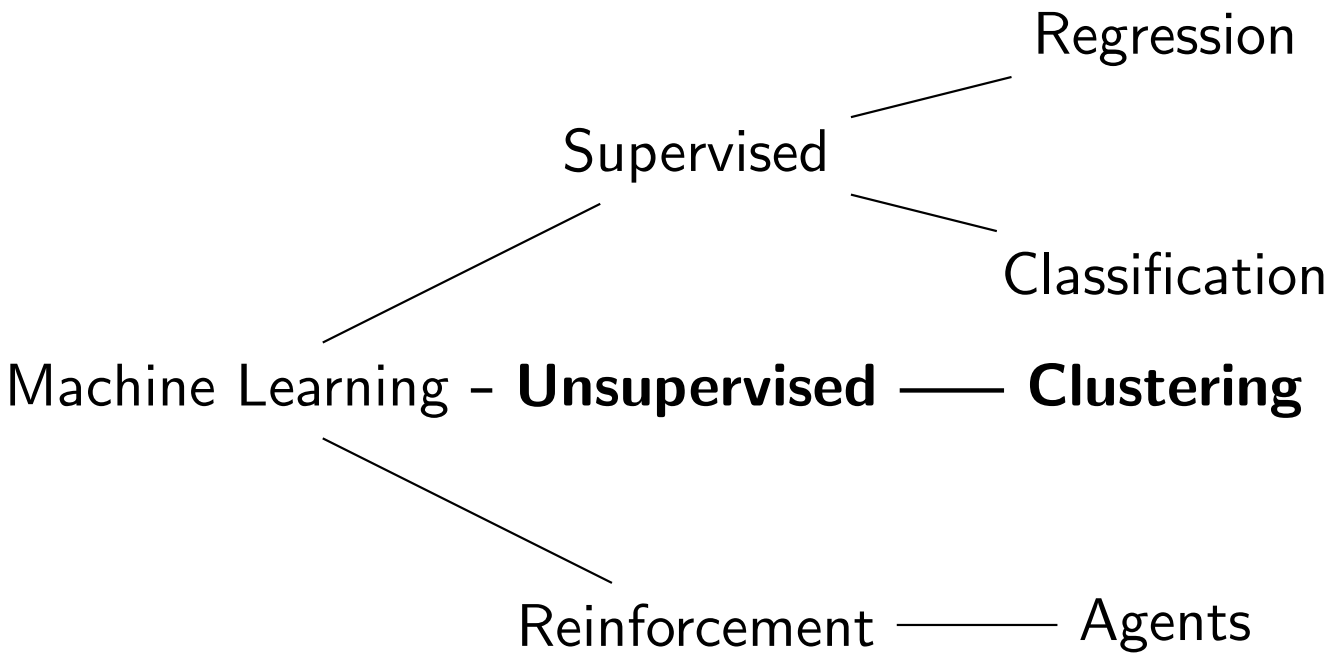
Some problems are difficult to solve using conventional algorithms. For these, it is better to let machines find their own solutions instead of manually specifying how to solve them manually.

Types of Machine Learning Problems



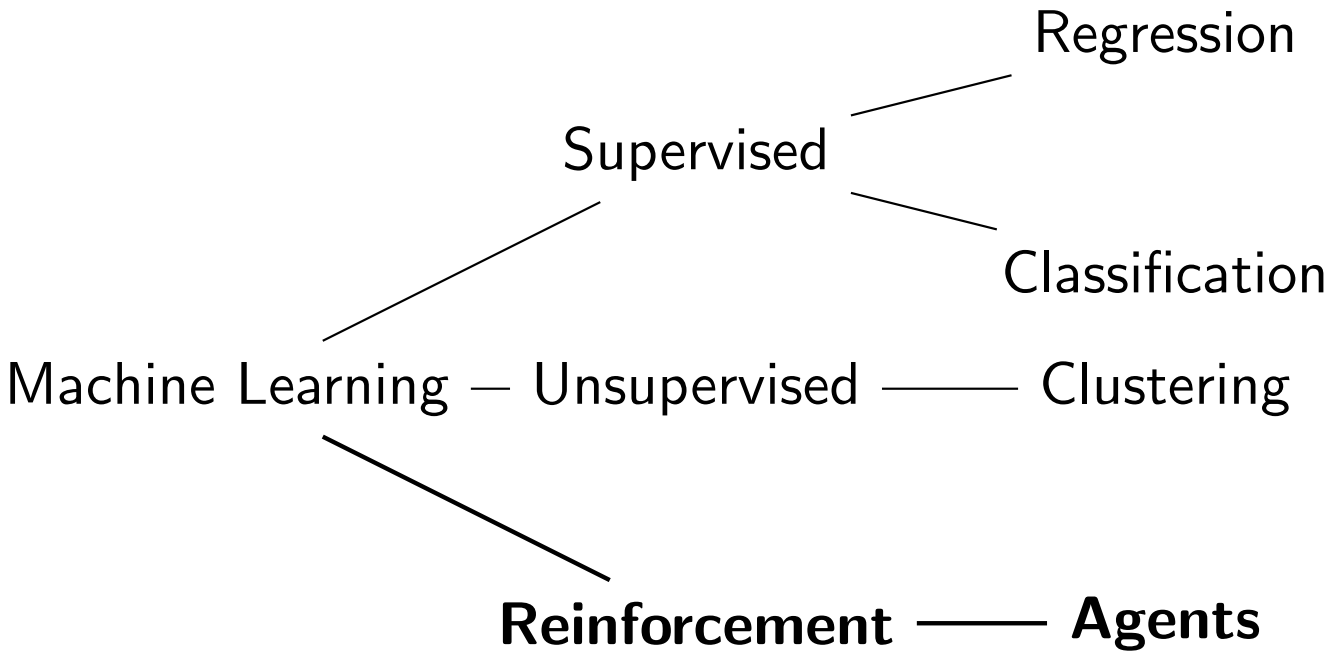
- Supervised learning: using data with labelled outcomes
  - Regression: predicting a continuous value
  - Classification: predicting a discrete value

Types of Machine Learning Problems



- Unsupervised learning: using data without labelled outcomes
  - Clustering: finding clusters of data within dataset to discover patterns

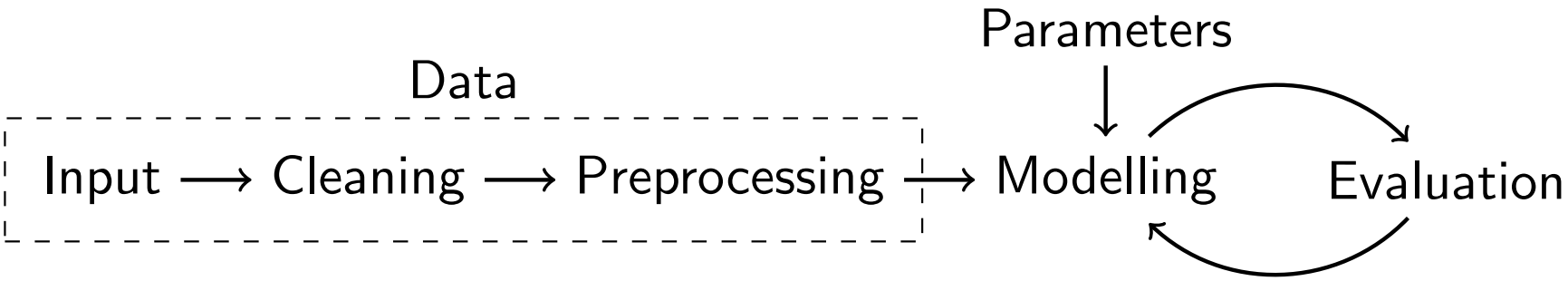
Types of Machine Learning Problems



- Reinforcement learning: using feedback to learn a policy
  - Agent based modelling: using state/environment and rewards to decide next action

Machine Learning Pipeline

Sequential process for creating machine learning models:



Significant portion dedicated to working with data – machine learning techniques rely on **high quality data**!

Working with Data - Input

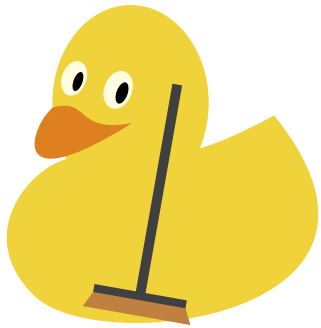
Multiple *types* of data:

Type	**Description**	**Examples**
Structured	Data which strictly adheres to a model	DBs, CSV files
Semi-structured	Data which doesn't adhere to a model	Log/JSON files
Unstructured	Data without a structure	Media files

When using different types of data, considerations need to be made as to how the data will be "fed" to ML algorithm:

- Structured data can be usually be used directly
- Semi/unstructured data may need to undergo extra processing to extract features

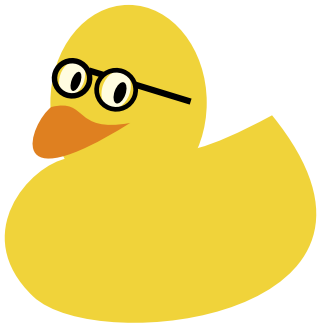
Working with Data - Cleaning



Fixing or removing data which is:

- Incomplete
- Incorrect
  - Logically - invalid data
  - Syntactically - bad formatting
- Duplicated
- Corrupted

Working with Data - Preprocessing



- Converting between different types
- Ordinality - ordering of values