INT104 Artificial Intelligence

Overview

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Xi'an Jiaotong-Liverpool University

22nd Feb 2024

Aims

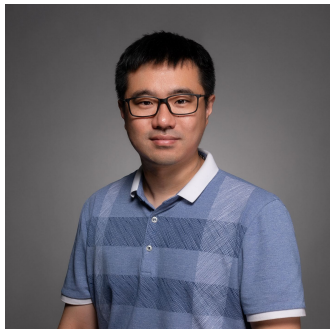
After this lecture, you should be able to

- understand some basic concepts related to AI
- overview the content of the module and assessment of the module

Lecturers

Dr. Shengchen LI

- Module Leader
- Assessments



Dr.Sichen LIU

- Lectures
- Tutorials

Dr. Fang KANG

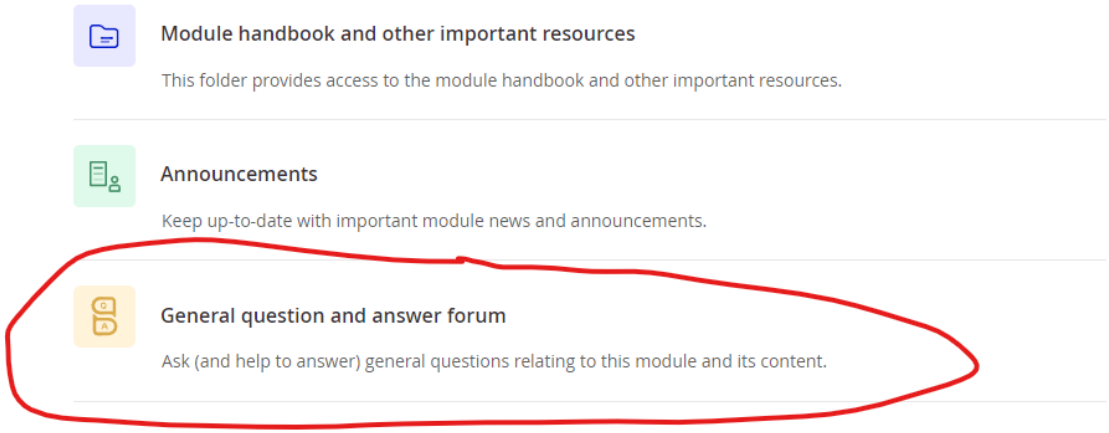
- Lectures

Office Hours

Student should find the lecture taking charge of the relevant duties (no questions for final exam please)

Raise a Question

Please use the Learning Mall to raise your question



Teaching Assistants

We have a large TA team due to the large number of students

- Each student will be assigned to a TA and each TA is response to roughly 30 students
- Questions regarding to programming and implementation should go to your TA over lab sessions
- The assigned TA will track your lab progress
- TA will demonstrate your work over lab sessions

NOTE

Your TA has their own works. You cannot rely on TA to finish your coursework

Dr. Shengchen LI

- Graduated from Queen Mary University of London
- Research in machine listening
  1. Acoustic signal processing
  2. Computational musicology
- Worked in Beijing University of Posts and Telecommunications
- Leaded high ranked teams in DCASE (Detection and Classification of Acoustic Scenes and Events) data challenge

Office Hours

1600-1700 Mondays (Onsite teaching weeks) / appointment

Xi'an Jiaotong-Liverpool University 西交利物浦大學

Welcome to INT104

This is a year 2 module, which means that you are expected to

- be able to learn by yourself with guidance
- attempt to discover the best (most suitable) way to learn
- set your own learning outcome and select the most proper way to learn
- attempt to learn how to learn

Official learning outcomes

- Demonstrate an understanding of AI concepts
- Apply and optimise AI algorithms to solve appropriate problems
- Code and test AI applications using programming languages such as Python
- Demonstrate the ability to address and mitigate potential risks associated with AI technology to promote responsible AI development
- Assess ethical implications of AI solutions and evaluate their potential impact on inclusion and diversity

Learning outcomes in plain language

The general aim of the module is to

- give you a good sense of AI
- understand how AI works
- use AI-like methods to solve simple problems

If you want, you can

- attempt to understand the mathematical operation behind the algorithms
- apply the algorithms to more complex tasks such as multimedia content analysis
- master the way to search AI related methods / findings

Module Assessment

Overview

There are four assessments in this module

- Data Observation: 15%
- Classification: 15%
- Clustering: 10%
- Final exam: 60%

Coursework

Coursework deadlines are set at the end of week 5, week 10 and week 12.

Resit

Resit exam will cover the mark of the whole module.

Module Assessment

Three coursework in lab

- 40% of the final mark in total
- Each coursework requires a live demonstration by your TA
- Write a report to summarise your observation

Lab Sessions

Provided to finish coursework with the support of TA, each coursework has two sessions

Live Demonstration

Standardised process of Q&A and code modification

Module Assessment

Final Exam

- 60% of the final mark
- Four questions (subject to changes)
  1. MCQ: 54 Marks
  2. Filling blanks: 24 Marks
  3. Computation: 14 Marks
  4. Essay Question: 8 Marks
- Open book exam (2 hours)

Aims of exam

- Makes sure you have mastered enough knowledge to meet the learning outcomes
- You can only pass a module (towards graduation) by participating an exam

Module Assessment

Resit Exam

- 100% of the final mark
- Five questions (subject to changes)
  1. MCQ: 36 Marks
  2. Filling blanks: 12 Marks
  3. Computation: 10 Marks
  4. Essay Question: 6 Marks
  5. Programming Questions: 36 Marks
- Open book exam (3.5 hours)

Aims of exam

- Resit exam will be tough
- Coursework makes you feeling easier

Module overview

Lectures

There are 6 units of lectures

- Overview & Review: Week 1 & 14
- Coursework Guidance & Feedback: Week 4, 9, 12
- Python Basics (Tutorial): Week 1-3
- Data Feature: Week 2, 3
- Supervised Learning: Weak 5, 6, 8
- Unsupervised Learning: Weak 10, 11
- AI Application: Week 13

Attendance

You will not be punished for low attendance rate

Definition of Machine Learning

Arthur Samuel, 1959

[Machine Learning is the] field of study that gives computers the ability to learn without being explicitly programmed.

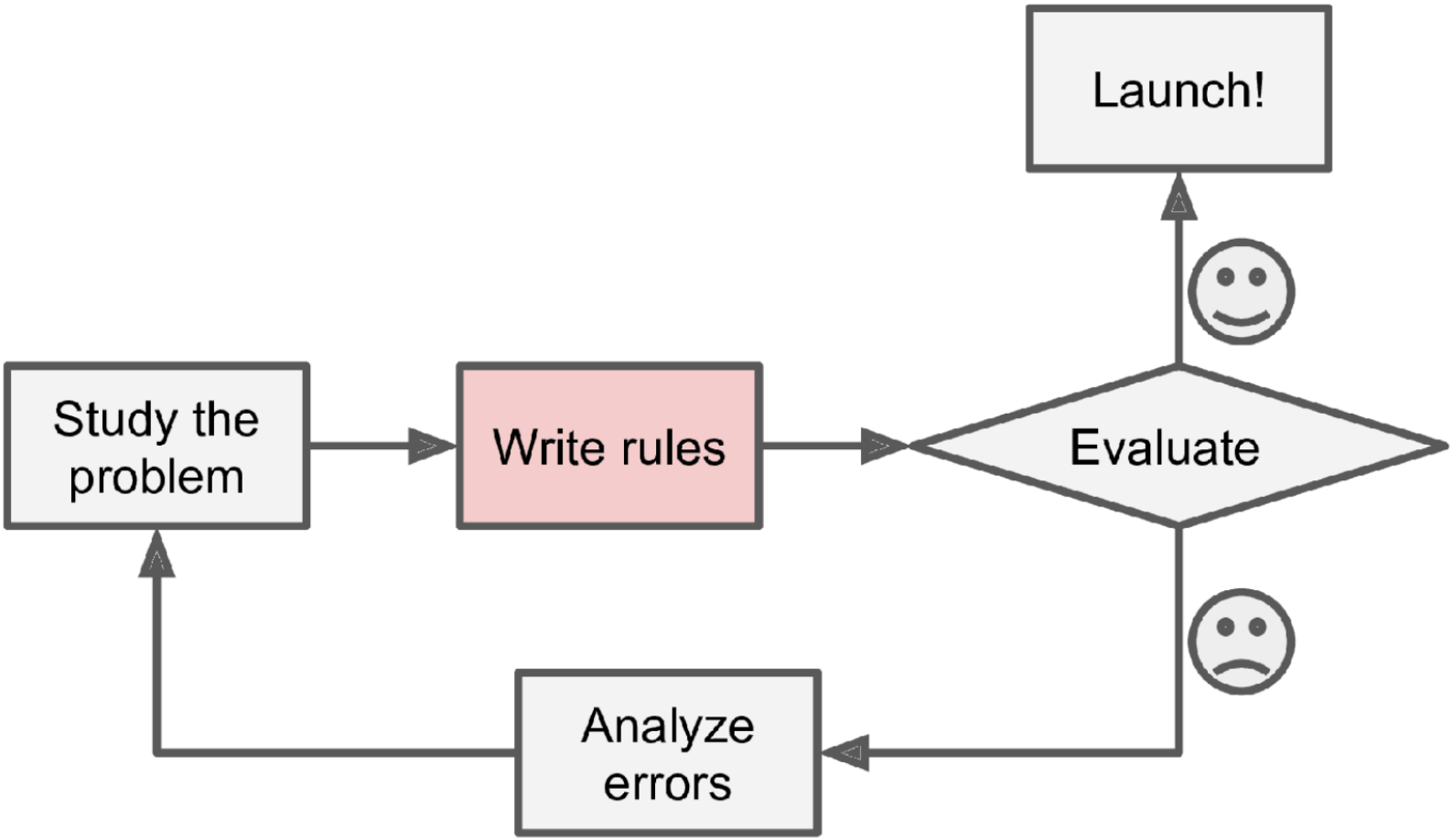
Tom Mitchell, 1997

A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E.

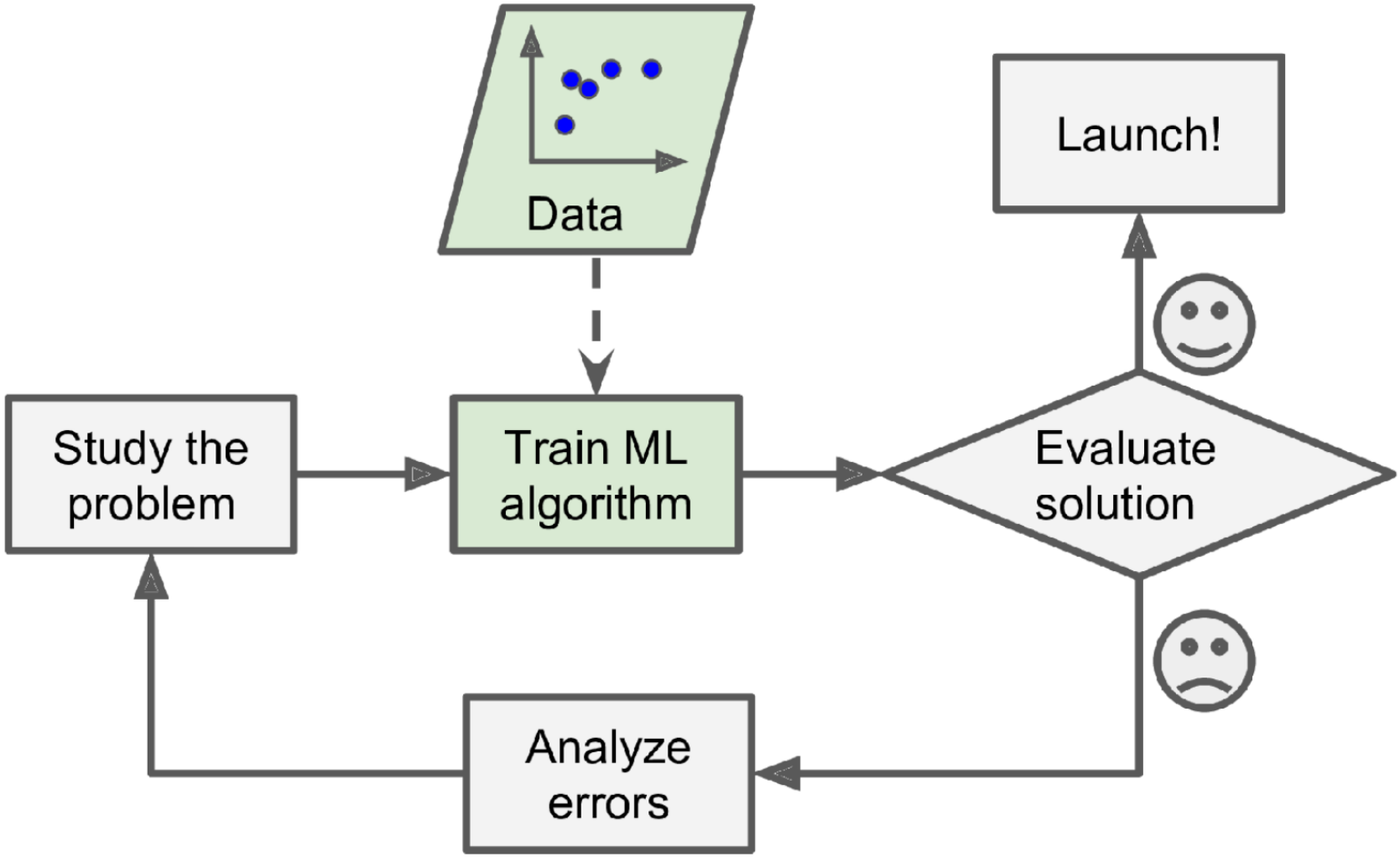
Your Module Leader, 2024

Modern Statistics

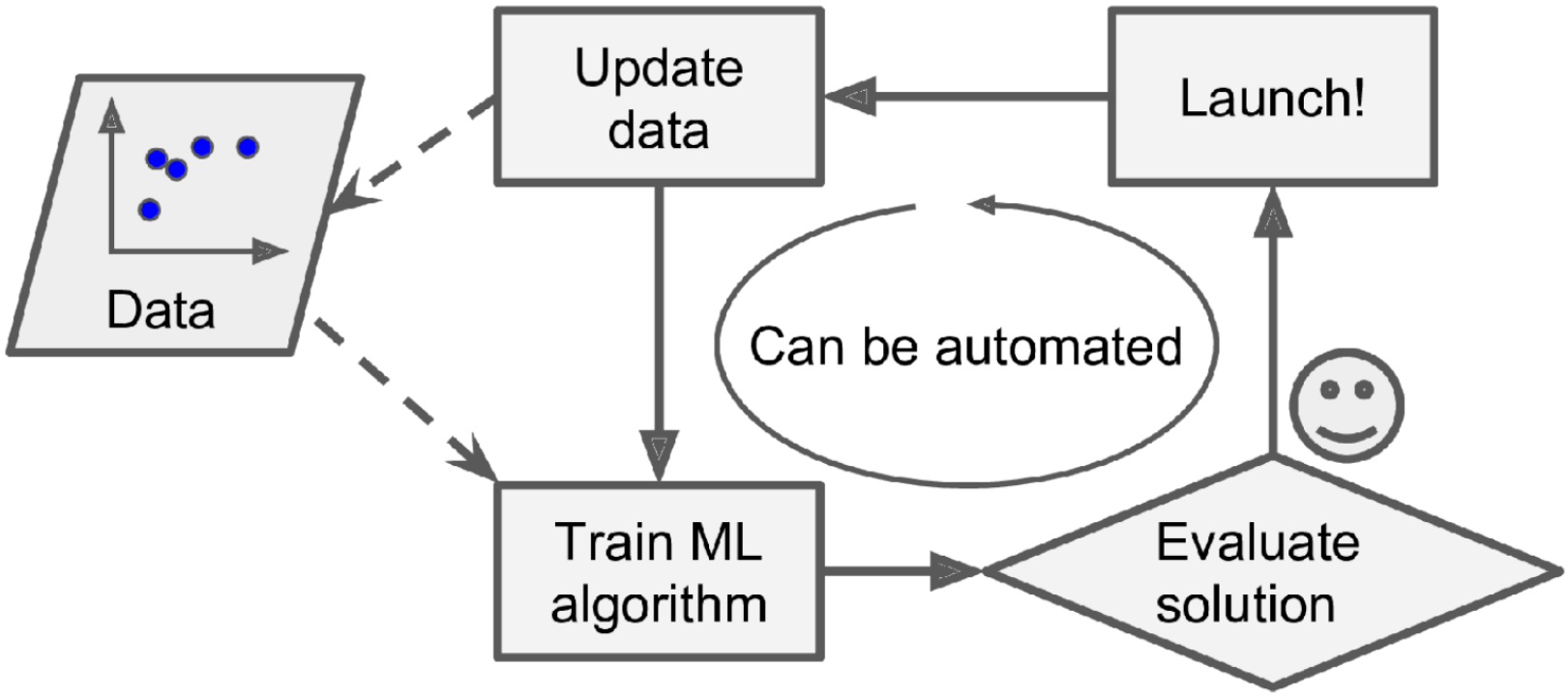
Traditional Solution



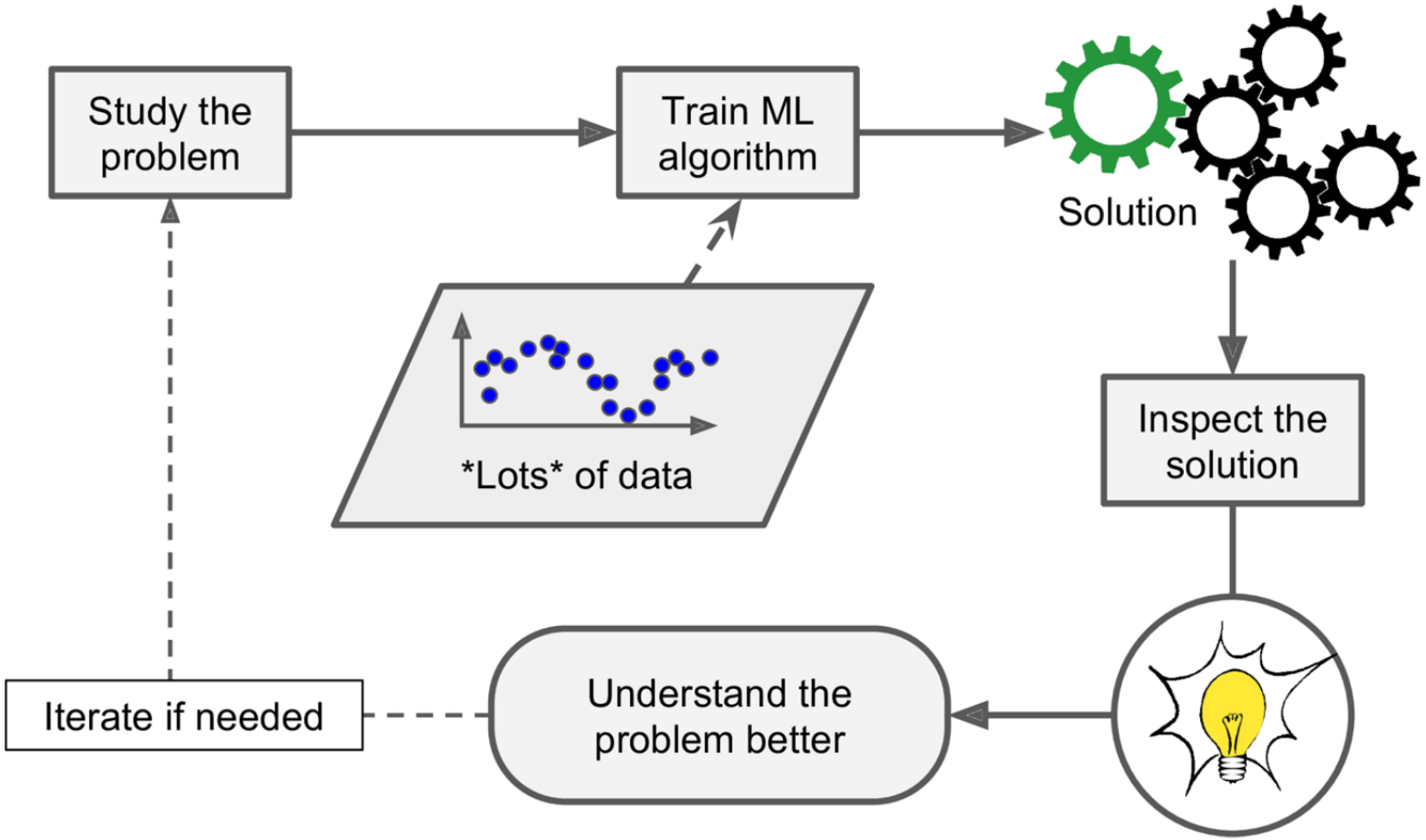
Machine Learning Approach



Machine Learning for Adaptation



Learn with Machine Learning



Machine Learning Tasks

- Classification
- Regression
- Clustering
- Anomaly Detection
- Generation
- Modelling

Supervised Learning

- kNN
- Decision Tree & Random Forest
- Support Vector Machine

Labelling Information

Labelling Information is available though the training process

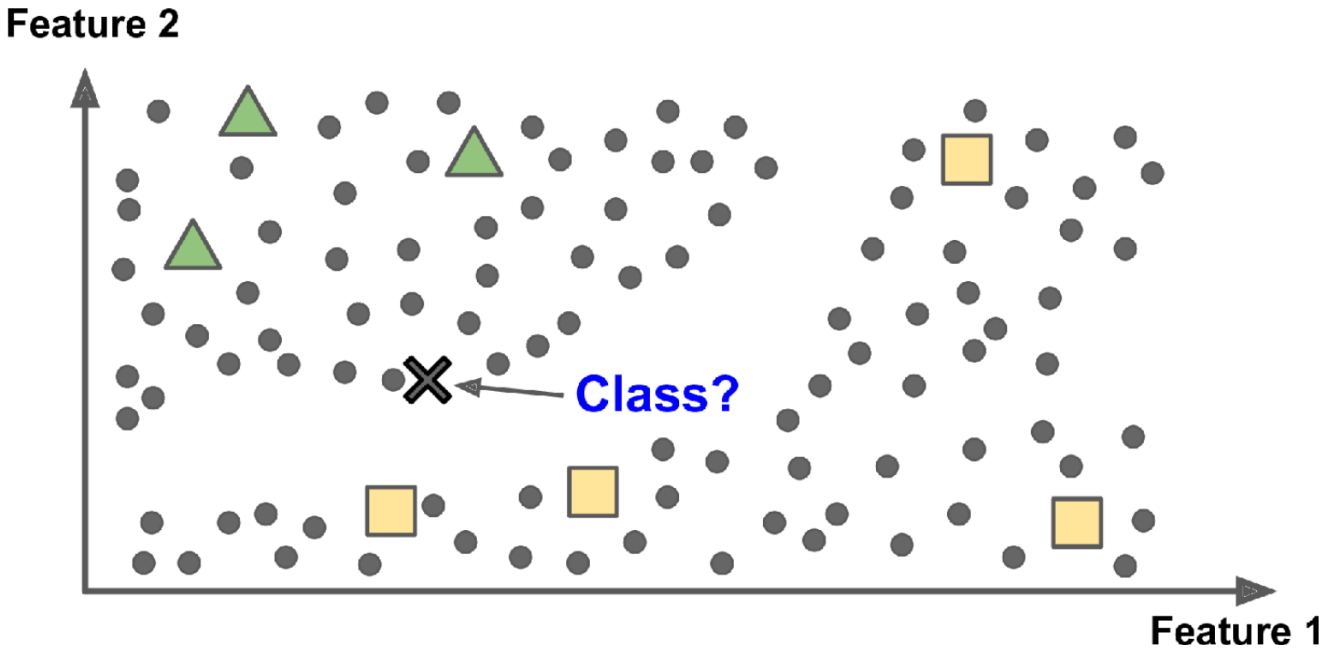
Unsupervised Learning

- k-means
- DBSCAN
- Hierarchical Cluster Analysis (HCA)

Labelling Information

Labelling Information is available though the training process

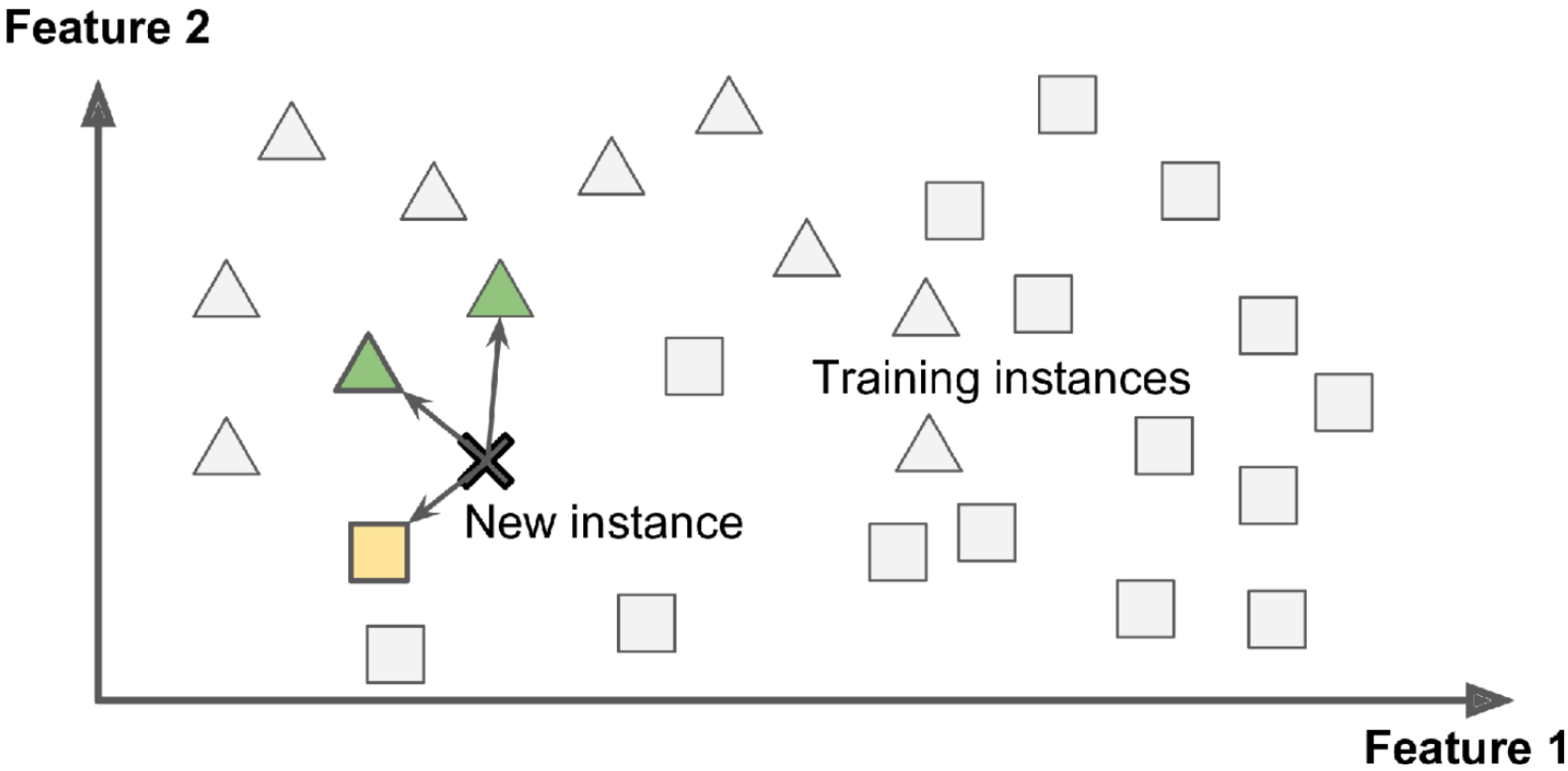
Semi-supervised Learning



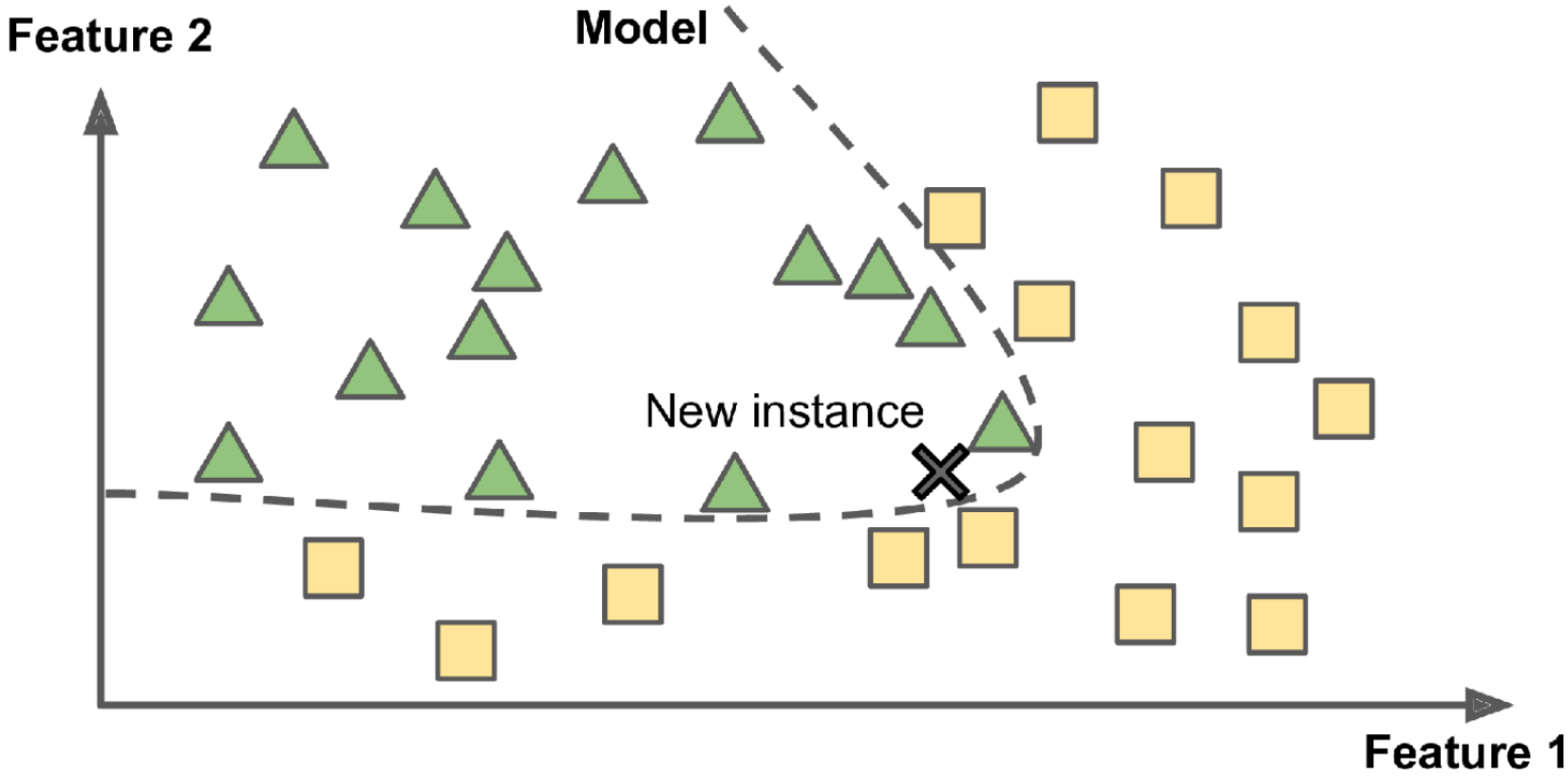
Labelling Information

Labelling Information is partially available

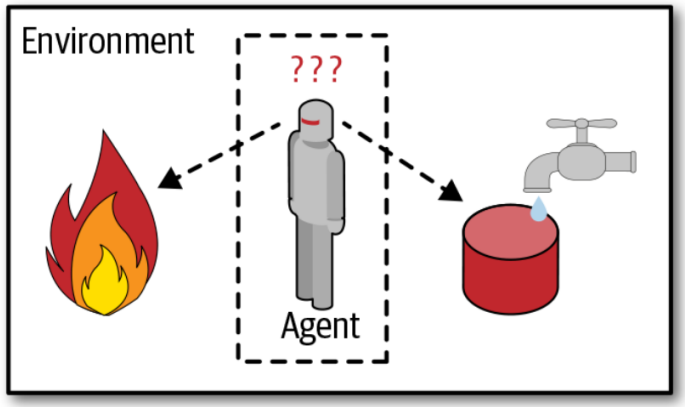
Instance Learning



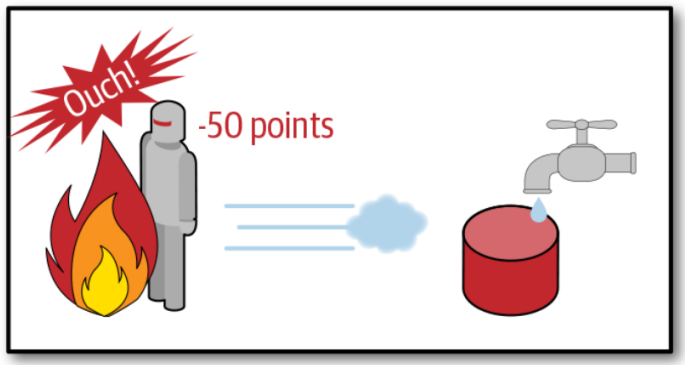
Instance Learning



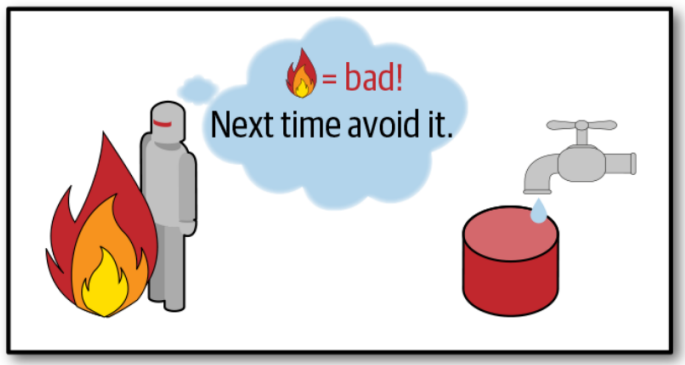
Reinforcement Learning



1. Observe
2. Select action using policy



3. Action!
4. Get reward or penalty



5. Update policy (learning step)
6. Iterate until an optimal policy is found

Model Selection

- Training Dataset
- Testing Dataset
- Validation Dataset

Model Validation

Training dataset should not overlap with validation dataset

Challenges for Machine Learning

- Insufficient Data
- Nonrepresentative Training Data
- Poor-Quality Data
- Irrelevant Features
- Overfitting the Training Data
- Underfitting
- Data Mismatch (Data Domain)