

Machine Learning



Introduction

Machine Learning (ML)

- Short intro to ML: https://youtu.be/Ob_UjoIZNTQ
(3 min)

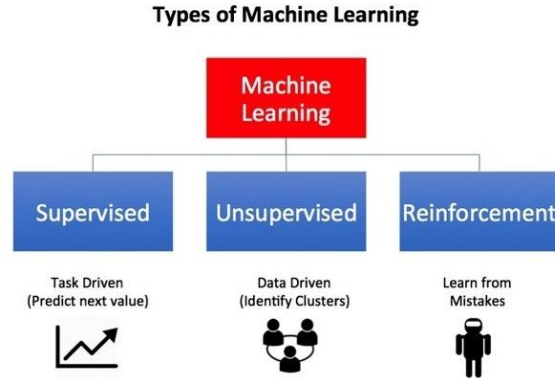
General Machine Learning Steps

1. Collect data
2. Prepare data
3. Choose a model type
4. Build the model (“train it”)
5. Evaluate the model
6. Make predictions (“deploy it”)

- Machine learning involves adaptive mechanisms that enable computers to:
 - learn from experience
 - learn by example
 - learn by analogy (i.e. similarity)

Main Learning Mechanisms

- Learning mechanisms (styles/types) are:



Reinforcement learning A brief intro:

<https://youtu.be/gIJl3N3FBuY?si=NK9Y3G0AkyZLm7Wh> (2min)

- Popular approaches are:
 - Artificial Neural Networks (ANN)
 - Deep (Learning) Neural Networks DNN are a subset of ANN, with multiple hidden layers between the input and output layers.
 - Evolutionary Computing using Genetic Algorithms (GA)
 - Probabilistic Machine Learning

Types of Machine Learning

1. Classification

- Predicting an object's category/class

2. Regression

- Predicting continuous values

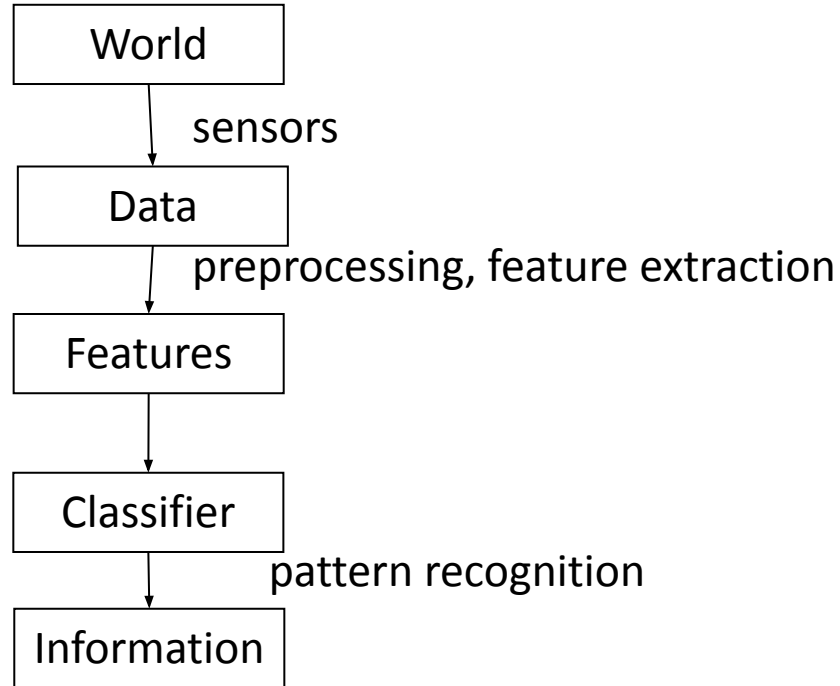
Supervised learning algorithms

3. Clustering

- Grouping similar items into clusters

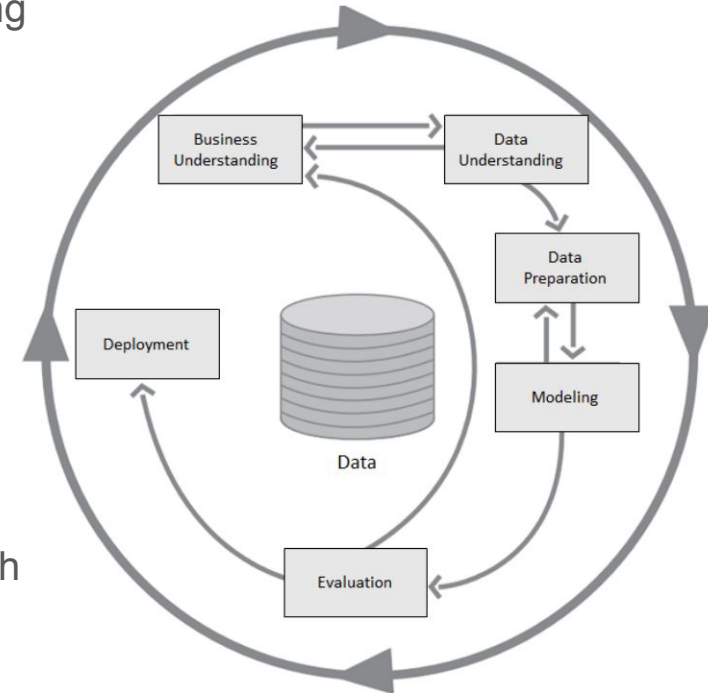
Unsupervised learning algorithms

From the world to information



CRISP-DM [Cross-Industry Standard Process for Data Mining]

- Is a **Process Model** originally developed for Data Mining
- CRISP-DM is a structured, flexible framework for data mining projects, consisting of six phases: 1. Business Understanding, 2. Data Understanding, 3. Data Preparation, 4. Modeling, 5. Evaluation, and 6. Deployment.
- It guides systematic data analysis to extract useful insights.
- Significance of CRISP-DM in AI and Data Science
 - CRISP-DM provides a proven, organized approach that helps data scientists and AI projects stay focused, efficient, and aligned with goals.
 - It ensures repeatability and better project outcomes by following clear, structured steps.



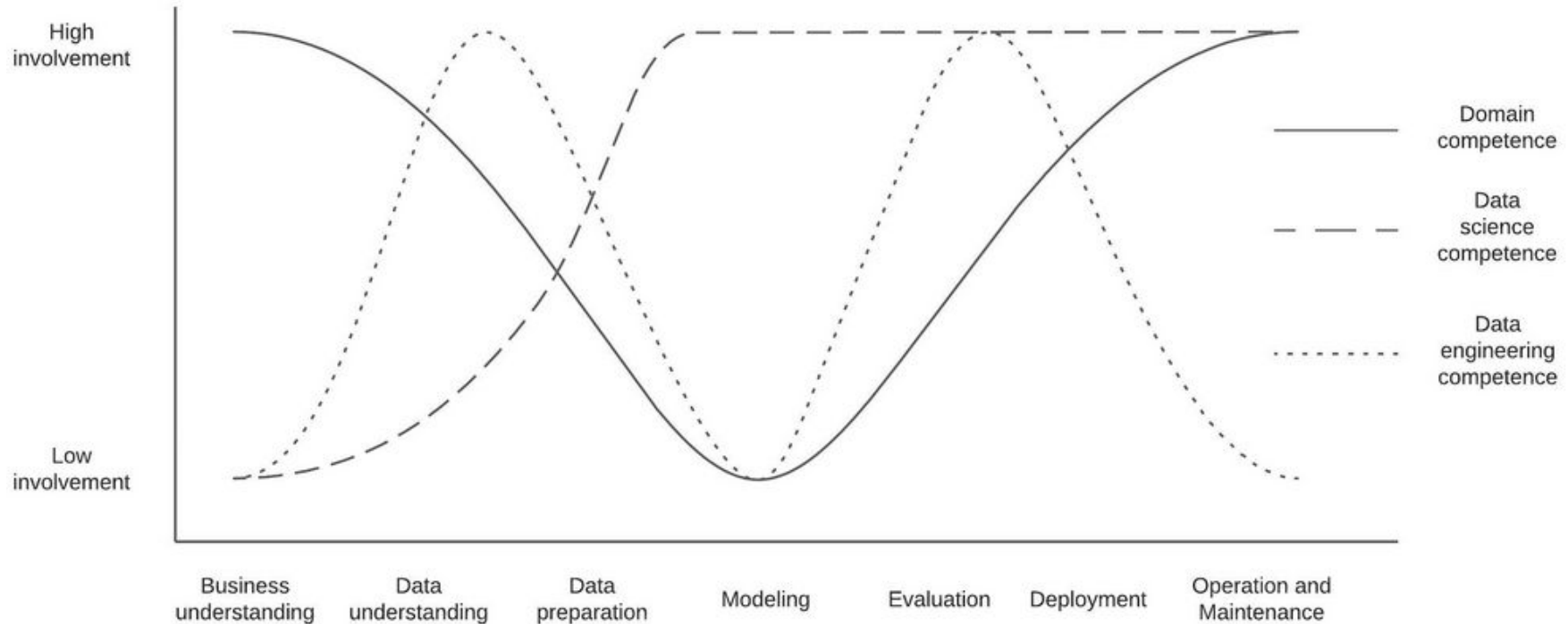
The CRISP-DM life-cycle

the CRISP-DM process phases

CRISP-DM is composed of the following six phases, which are typically described in this order, though the process is iterative and phases may be revisited as the project progresses:

1. **Business Understanding:** Identify the project's objectives and requirements from a business perspective to understand what is to be accomplished.
2. **Data Understanding:** Collect, describe, and explore the data in order to gain an overview and identify potential issues.
3. **Data Preparation:** Process, clean, and prepare the data for analysis and modeling.
4. **Modeling:** Select and apply suitable analytical methods or algorithms to build models based on the prepared data.
5. **Evaluation:** Assess the models against the project's objectives to ensure relevance and quality
6. **Deployment:** Implement the model and plan for its ongoing use and maintenance within the business context.

Trajectories of involvement from competencies throughout the CRISP-DM phases



From: Bokrantz et. al. (2023)

Classification, Class Label, Classifier and Model

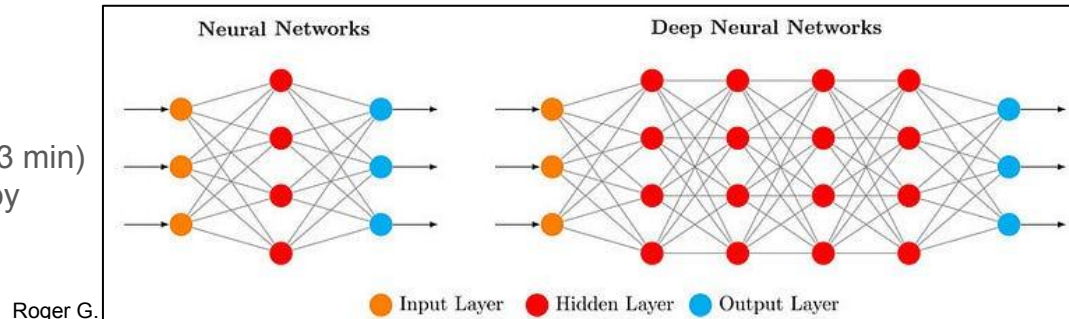
- **Classification** is the task of assigning a class label to an input pattern
 - The **class label** indicates one of a given set of classes
 - A class label could be “car”, “aeroplane”, “dog”
 - The classification is carried out with the help of a classification **model** obtained using a learning procedure.
- A **classifier** is the ML algorithm itself – the rules used to classify data. It tries to classify your input data into the given output class labels
- A (**classification**) **model** is *the end result* of your ML classifier
- So, the **model** is trained *using the classifier*, so that the model, ultimately, classifies your data

Artificial and Deep Learning Nets - The Connection

- ANN (Artificial Neural Networks)
 - Networks that adapt weights and connections based on data
- Adaptivity
 - the ability to adjust parameters during training is fundamental for learning
- Deep
 - Learning – uses adaptive ANNs with many layers to interpret complex patterns
- Deep
 - Layers – learn abstractions from simple to advanced data representations

Neural Networks Demystified [Part 1:
Data and Architecture]

<https://www.youtube.com/watch?v=bxe2T-V8XR8> (3 min)
Includes a simple example of supervised learning by
regression



References

Bokrantz, J., Subramaniyan, M., & Skoogh, A. (2023). Realising the promises of artificial intelligence in manufacturing by enhancing CRISP-DM. *Production Planning & Control*, 35(16), 2234–2254. <https://doi.org/10.1080/09537287.2023.2234882>

THANK YOU! :)