

Theme A4.1 Machine Learning Fundamentals

Research Report Handout

[Machine Learning](#) is a hot topic right now.

There are a variety of terms that invade our daily routines:

- Deep Learning
- Supervised Learning
- Unsupervised Learning
- Transfer Learning
- Reinforcement Learning

and more...

You will research the fundamentals of **machine learning (ML)** and produce a short report based on the results of your research.

From this report you will develop a presentation and present some of your findings to your peers.

Use reliable, free online resources (you should not have to pay when subscribing to resources).

Include references to the websites or videos you used. Aim for about **2–3 pages** in total.

Deliverables

A 2–3 page research report (typed) answering all questions above. Include references at the end.

A 5-10 minute presentation (see appendix) on the results of your research

1. Introduction

Let's start at the beginning.

a) What **is** [machine learning](#)?

b) How is it **different** from traditional programming?

2. Core Concepts

a) Describe/define the main types of Machine Learning

- Deep Learning
- Supervised Learning
- Unsupervised Learning
- Transfer Learning
- Reinforcement Learning

b) Market Basket Analysis (**MBA**) uses Machine Learning. Do some research on MBA. What are the goals of MBA and how does Machine Learning contribute to this endeavour?

c) What is **feature selection** in machine learning and what are the benefits of employing it?

d) Another application of Machine Learning is Natural Language Processing (**NLP**). What are the goals of NLP and how does Machine Learning contribute to this endeavour?

e) What is the difference between the terms **features** and **labels** used in ML?

f) Watch the [video](#) and summarise how Large Language Models work.

3. Dimension Reduction

Machine Learning suffers from a “***curse of dimensionality***”.

- a) What is the curse of dimensionality?
- b) Define overfitting and underfitting in ML.
- c) How can developers reduce these problems?
- d) Find an online article or video about [bias](#) in ML. Summarize the key points.
- e) Data cleaning is an essential part of Machine Learning. What is data cleaning and why is it so essential?

4. Applications of Machine Learning

- a) In section 2 we looked at MBA and NLP. Identify **two** other fields where ML is applied (e.g., healthcare, finance, entertainment, self-driving cars).
- b) Explain how ML is used in these two fields.
- c) What are the benefits and challenges of using ML in these contexts?

5. Ethical and Social Implications

Ethical and social issues relating to ML and AI use may include:

- Accountability
- Bias
- Consent
- Environmental impact
- Privacy
- Security
- Transparency

a) Choose 3 of the above, and make notes on the ethical and/or social impact of each one.

b) How can ML systems be unfair or biased?

c) What are some risks of relying on ML for decision-making?

d) How can developers and society reduce these risks?

Practical Online Resources

Here are some starter resources.

- [Scratch](#)
- [ML5.JS](#)
- [Google Teachable Machine](#)
- [Machine Learning for Kids](#) →
- Khan Academy – [Video Series](#)
- [Google AI Blog](#)

My ML Journal

Date:	
Something I learned	Something I'm curious about