

# AI, Machine Learning and Deep Learning

Made for A2 at Musashi International School Tokyo

# Outline

- 1 Refresher on AI
- 2 Machine Learning
- 3 Types of training
- 4 Regression and Backpropagation
- 5 Summary
- 6 Extra vocabulary
- 7 Practice Questions

# What is AI?

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AI can be categorized into two main types: Narrow AI, which is designed for specific tasks, and General AI, which aims to perform any intellectual task that a human can do.

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They are simply ways to classify the capabilities of AI systems.

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# What is Machine Learning?

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Machine learning is one, and arguably the best to date, way to answer the question "**how?**".

Next are types of machine learning.

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This **graph structure** with nodes (neurons) and edges (connections) has proven to be very effective for various machine learning tasks.

It is excellent at handling messy, high-dimensional data.

# Deep Learning

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Deep learning has been particularly successful in tasks such as image and speech recognition, natural language processing, and game playing.

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Without this interaction, there is no point in talking about reinforcement learning.

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# Types of training - What do we want it to do?

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- We want to classify emails as spam or not spam, or sticks shapes as bows or lances.
- We want to quickly sort similar lab experiments to find patterns, without knowing what these patterns might look like.
- We want to predict likeliness of rain tomorrow based on current weather data.

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Common algorithms include decision trees, support vector machines, and neural networks.

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Common algorithms include clustering methods and dimensionality reduction techniques (like PCA).

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# Regression Methods

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Regression is **mostly** used in supervised learning contexts, but can be adapted for unsupervised learning as well.

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This process is repeated iteratively, allowing the network to learn from its mistakes and improve its performance over time.

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**Weight update:** The weights are updated using an optimization algorithm (e.g., gradient descent) to minimize the loss.

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- Reinforcement learning is a type of machine learning where an agent learns to make decisions by interacting with an environment to maximize cumulative reward.
- Supervised learning uses labeled data, while unsupervised learning finds patterns in unlabeled data. Regression methods predict continuous outcomes, and backpropagation is a key algorithm for training neural networks.

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These are not directly part of the curriculum, but having an idea of what they mean will prevent you from writing nonsense when discussing AI topics.

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## Practice Questions

Explain what is meant by **Reinforcement Learning** in relation to Artificial Intelligence.

[3]

[3]

Artificial neural networks have played a significant role in the development of machine learning.

Explain what is meant by the term **artificial neural network**.

[4]

[4]