

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.

ANNs and Graph Structures

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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.

Reinforcement Learning

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

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In simple terms, it works by calculating the error (difference between predicted and actual output) and rewinding it through the network to update the weights of the connections.

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

Backpropagation steps

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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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Summary 1

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Summary 2

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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.

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

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

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