

Lecture 3 - AI, ML, and DL

Computer Science is a multifaceted discipline, encompassing various specialized fields including, but not limited to, operating systems, databases, computer networks, information security, software engineering, and **artificial intelligence** (AI). Notably, AI is a subset of computer science, and it is a subject matter of significant interest in this context.

AI is a concept that has been interpreted by many, but perhaps the most precise definition would be: **it is software designed to emulate human thinking or actions**. But AI is not monolithic; it too consists of several sub-branches, including computer vision, natural language processing, robotics, and machine learning. Our focus will be on the latter.

Let's then ask ourselves, what is Machine Learning (ML)? But before that, let's understand the essence of learning itself. How would you encapsulate the notion of learning? While diverse definitions exist, a fitting one might be: **it is the process of utilizing past experiences to enhance future performance**.

In the realm of machine learning, these 'experiences' come in the form of data, and the 'performance goal' is determined by an objective function. The system then engages in an optimization process using the available data to improve its performance.

So, why should we lean towards machine learning? The answer lies in its potential to allow computers to make data-driven decisions on previously unseen data. It often proves impractical, if not impossible, to manually craft an exhaustive set of rules. **Machine learning offers an automated way to distill pertinent information from data and use it for the analysis of new data.**

Now, let's turn our attention to **deep learning**. It's a subfield of machine learning that employs specific algorithms known as neural networks. Even though neural networks have long been a part of machine learning, the domain of deep learning has flourished over the last 15 years due to theoretical advancements and hardware improvements. This progression has allowed deep learning to address problems that were once considered too complex for 'massive' neural networks to handle.