Bocconi

Hosted by POKI Open Knowledge MI

Artificial Intelligence fundamentals: a managerial perspective

Week 1 - Artificial Intelligence Fundamentals for Business

Finanziato dall'Unione europea NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

edunce DIGITAL EDUCATION HUB HIGHER EDUCATION

Bocconi

Week 1 – Artificial Intelligence Fundamentals for Business

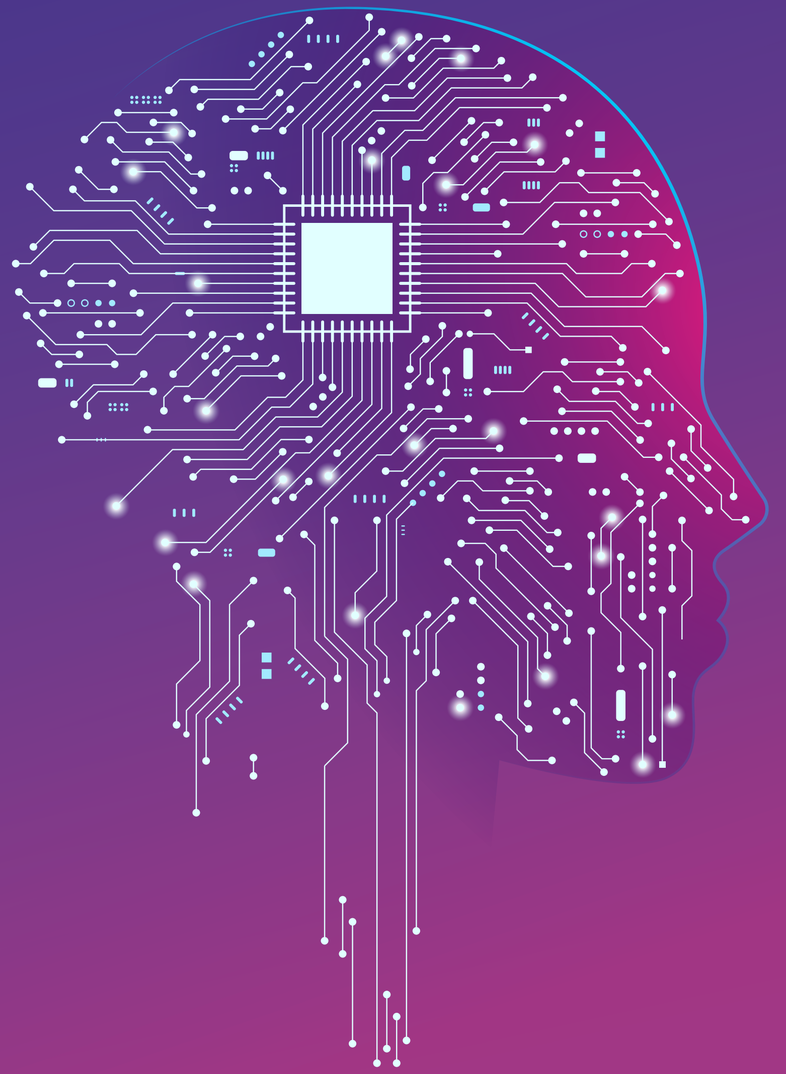
In this first week of the course, we introduced the concept of Artificial Intelligence (AI) as a rapidly evolving field that aims to build intelligent systems capable of performing tasks traditionally associated with human cognition. This definition of AI has changed over time as technological advancements have shifted our perception of what constitutes an "intelligent" behavior for a machine. Due to this, AI has been often called a "moving target", as it constitutes an ever-increasing aspiration for machines to achieve. Today, AI is broadly understood as the development of computational models that can learn from data and support decision making or automate complex processes.

AI has gone through several phases of development, from early rule-based systems based on a rigid top-down logic, to modern machine learning (ML) and deep learning (DL) approaches. The transition from deterministic, rule-driven methods to data-driven, probabilistic models has enabled AI to handle more complex, unstructured data and improve performance in various domains.

In the following paragraphs we provide a summary of the main foundational AI concepts introduced during this week.

Data as the Fuel of Modern AI

Due to its functioning, modern AI models rely on training data as the foundation of their working mechanisms. The quality, quantity, and variety of data can significantly impact an AI model's performance. Just as an engine requires high-quality fuel to function optimally, AI models need clean, diverse, and representative data to make accurate predictions and generate insights. AI data can be categorized as structured (numerical, tabular data) and unstructured (text, images, audio, video). Despite these difference, businesses must focus on data collection, cleaning, and preprocessing to ensure that AI models learn useful patterns instead of noise.



The Machine Learning Approach

Despite some similarities, traditional statistical modeling and machine learning differ in their approach to data analysis:

Statistical Modeling is hypothesis-driven, used to infer relationships between variables and test predefined assumptions. It is typically employed when interpretability and causal inference are essential.

Machine Learning is data-driven, uses algorithms to identify patterns and optimize predictions without strict predefined assumptions. Machine learning is more suitable for handling complex, high-dimensional datasets where traditional statistical models may struggle.

The choice between these approaches depends on the business problem, the need for explainability, and the complexity of the data.

Supervised vs. Unsupervised Learning

Machine learning can be broadly categorized into:

Supervised Learning:
the model is trained on labeled data, learning to map input variables to known output labels. Common applications include fraud detection, customer churn prediction, and sales forecasting.

Unsupervised Learning:
the model identifies patterns in unlabeled data, clustering similar observations or reducing dimensionality for better data representation. Applications include customer segmentation and anomaly detection.

Reinforcement Learning (RL):
though less common in traditional business settings, RL optimizes sequential decision-making through trial and error, often used in dynamic pricing and robotics.

Bocconi

Deep Learning and Neural Networks

Deep Learning (DL) is a subset of machine learning that employs Artificial Neural Networks (ANNs) to model complex data patterns.
Neural networks are structured in layers:

- **Input Layer:** receives raw data.
- **Hidden Layers:** perform computations to identify relationships and features.
- **Output Layers:** Produce the final prediction or classification.

Deep learning excels in processing unstructured data, such as images and text, enabling advancements in fields like Natural Language Processing (NLP), Computer Vision (CV), and Audio Processing.

Deep Learning and Neural Networks

Some examples of deep learning models include:

Convolutional Neural Networks (CNNs) specialize in analyzing image data, detecting edges, textures, and object shapes.

Recurrent Neural Networks (RNNs) and Long Short-Term Memory Networks (LSTMs) process sequential data, such as speech recognition and time-series forecasting.

Transformer-based models (e.g., GPT and BERT) are the most recent advancement in the NLP domain and are enabling language comprehension and generation at unprecedented levels.

Predictive AI vs. Generative AI

Predictive AI analyzes historical data to forecast outcomes, classify data, and optimize business processes. Examples include demand forecasting, fraud detection, and predictive maintenance.

Generative AI focuses on creating new content (e.g., text, images, code) based on learned patterns. Applications range from marketing content generation to AI-assisted product design and creative media production.

AI in Business: Applications and Integration

Companies can leverage AI and integrate it into their businesses in various ways.
There are at least three distinct logics that companies can exploit depending on the business problem they aim to solve:

One-shot AI-based analysis:
using AI for standalone one-shot tasks, such as customer segmentation or sentiment analysis.

Process integration:
embedding AI into internal or customer-facing processes to improve efficiency and effectiveness (e.g., AI-driven chatbots, automated quality control in manufacturing).

AI in products and services:
enhancing existing products with AI (e.g., predictive maintenance integrated as a new module for clients in industrial equipment) or developing entirely new AI-driven products (e.g., businesses based on virtual assistants or AI-powered design tools).