

Artificial Intelligence (AI)

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	low	medium	high
Impact			
Complexity			

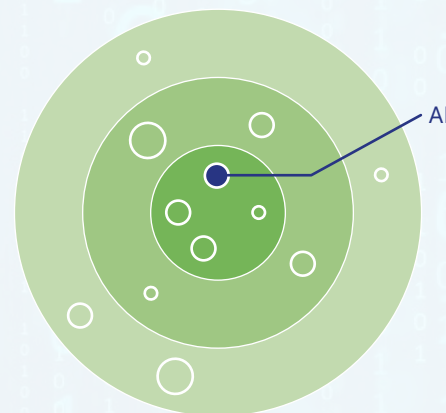
1 INTRODUCTION

Purpose

Artificial Intelligence (AI) is the interdisciplinary field focused on developing systems that can perform tasks traditionally requiring human intelligence, such as decision making, problem solving, learning and natural language processing (NLP). Machine Learning (ML) is based on rules and mathematical optimisations, while Deep Learning (DL) is a self-optimising, complex system that uses multiple layers.

Key benefits

AI offers significant advantages such as automating complex processes, enhancing decision-making accuracy, improving customer experiences and enabling predictive analytics, which lead to increased efficiency, cost savings and innovation across industries.



2 KEY CONCEPTS

Fundamental principles

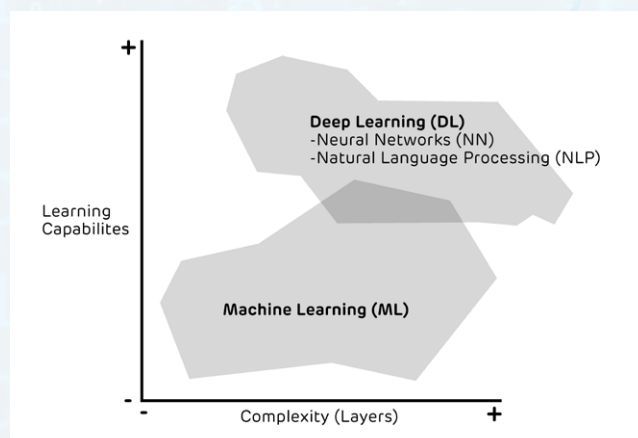
The fundamental principles of AI include machine learning (ML) for learning from data, deep learning (DL) for handling large datasets with complex structures, neural networks (NN) that simulate human brain functions, and natural language processing (NLP) for understanding and generating human language.

Terminology

In AI terminology, **supervised learning** involves training models on labelled data, **unsupervised learning** finds patterns in unlabelled data, reinforcement learning enables models to learn by interacting with environments, and **computer vision** focuses on interpreting visual data. **Artificial General Intelligence (AGI)** refers to AI with the ability to perform any intellectual task that a human can do, while **Artificial Narrow Intelligence (ANI)** is specialised in specific tasks.

The Three Pillars of AI

- Learning:** the ability of AI systems to learn from data and experiences.
- Reasoning:** the capability of AI to make decisions based on learned information.
- Adaptation:** the capacity of AI systems to improve over time and adapt to new data.



3 POPULAR TOOLS AND FRAMEWORKS

Primary tools

- TensorFlow:** an open-source platform for machine learning and deep learning.
- PyTorch:** a flexible deep learning framework often used in research.
- Keras:** an easy-to-use neural network API, running on top of TensorFlow.

Comparison

- TensorFlow vs PyTorch:** TensorFlow is widely used in production settings, while PyTorch is preferred in research due to its ease of use and flexibility.
- Keras (ease of use) vs Scikit-learn (classical ML):** Keras simplifies deep learning model building, whereas Scikit-learn is ideal for traditional machine learning techniques.

4 APPLICATIONS

Industry use cases

- Healthcare:** AI-powered diagnostics, personalised treatment plans.
> **Best Practice:** [IBM Watson Health](#).
- Finance:** AI for fraud detection, risk management and algorithmic trading.
> **Best Practice:** [ZestFinance](#).
- Retail:** AI in personalised recommendations, inventory management and customer service automation.
> **Best Practice:** [Amazon's AI-driven recommendations](#).

Practical examples

- GPT-4:** Advanced AI model (Generative AI) used in NLP, content creation and customer support.
- AlphaGo:** deep reinforcement learning to master the game of Go, surpassing human experts.
- Tesla Autopilot:** autonomous driving, utilising real-time data processing and decision making.

5 IMPLEMENTATION INSIGHTS

Best practices and tips

- **Data Quality:** ensuring high-quality, diverse datasets for training AI models to avoid biases and inaccuracies.
- **Model Testing:** conducting extensive testing of AI models in various scenarios to ensure robustness and reliability.
- **Ethical AI Development:** creating transparent practices to prevent biases and ensure fair decision making.

Common challenges

- **Bias in AI:** addressing and mitigating bias in training datasets to ensure fair outcomes.
- **Scalability:** scaling efficiently as the volume of data and the complexity of tasks increase.
- **Privacy:** handling sensitive data and ensuring privacy, especially with personal information

6 KEY TRENDS AND PREDICTIONS

Top milestones in AI

- **1956:** the [Dartmouth Conference](#) marks the birth of AI as a field of study.
- **1997:** [IBM's Deep Blue defeats world chess champion Garry Kasparov](#), demonstrating complex decision making.
- **2016:** [AlphaGo by DeepMind defeats the world champion in Go](#) by advancements in deep reinforcement learning.

Current trends

- **Explainable AI (XAI):** making AI decisions more transparent and understandable to humans.
- **AI Ethics and Laws:** growing focus on the ethical implications of AI, including bias, privacy and the impact on jobs ([e.g., the new EU AI Act](#)).
- **AI and Automation:** expansion of AI in automating routine tasks across various industries, improving efficiency and productivity.

Future predictions

- **AI in Autonomous Systems:** expansion of AI into autonomous vehicles, drones and robotics for a wide range of applications.
- **AI and Quantum Computing:** leveraging quantum computing to solve complex AI problems faster and more efficiently.
- **Advancements in Natural Language Processing:** more sophisticated language understanding, enabling more seamless human-computer interactions and better contextual understanding.

Authors



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Torsten established Digital Innovations at Luft-hansa, founded the FlyingLab, and was responsible for the digital strategies of Austrian, Lufthansa and Swiss airlines. Today, as the "Inno Doc", he is digital advisor, coach and catalyst, interim manager and fire fighter for many organisations in their pursuit for digital innovations.

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7 KEY RESOURCES AND MOST HELPFUL LINKS

Websites and blogs

- [AI Index Report](#): a comprehensive, annual report from Stanford University.
- [Towards Data Science Blog](#): comprehensive articles and tutorials on AI and machine learning.
- [TechCrunch AI](#): provides the latest developments in AI, especially covering start-ups and trends.
- [Theresanaiforthat](#): Link collection and categorisation of AI applications.

Online courses

- [AI for Business Leaders by Udeemy](#): tailored for executives and entrepreneurs, discusses practical AI applications and strategies to integrate AI into business processes.
- [Elements of AI \(University of Helsinki\)](#): a free course aimed at professionals across industries to learn the fundamentals of AI and how it can be applied in various fields.

Communities and forums

- [Kaggle](#): a community for data scientists and AI practitioners to compete, collaborate and share datasets.
- [AI Alignment Forum](#): a platform for discussions on AI safety, ethics and long-term impacts.
- [Cross Validated \(StackExchange\)](#): a community focused on AI, statistics and data science where you can ask questions or explore in-depth discussions.

8 GLOSSARY

Common terms and definitions

- **Machine Learning (ML):** a subset of AI focused on building mathematical (algorithm-based) systems that learn from data.
- **Algorithm:** a set of instructions followed by a computer to perform tasks or solve problems.
- **Deep Learning (DL):** a type of AI/ML based on NL in which multiple layers of processing are used to extract progressively higher level features from data.
- **Neural Networks (NN):** models inspired by the human brain, used to recognise patterns and make predictions.
- **Natural Language Processing (NLP):** techniques used to understand, interpret and generate human language.
- **Reinforcement Learning (RL):** a type of ML where AI learns by interacting with an environment and maximising rewards.
- **Agentic AI:** is a type of AI that can act autonomously and make decisions to achieve goals.

→ See our separate fact sheet on **Generative AI**.



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