

History of Artificial Intelligence

Luís Macedo

University of Coimbra

September 23, 2024

Introduction

- Artificial Intelligence (AI) has evolved significantly since its inception, with periods of rapid development, setbacks, and breakthroughs.
- This presentation provides an overview of the major milestones in the history of AI, from early theoretical foundations to modern advances.

Early Foundations of AI (Pre-1950s)

- **Ancient Philosophical Roots**: Ideas about intelligent machines date back to **ancient Greece** and **mythology** (e.g., Talos, the mechanical man).
- **Mathematical Logic**: In the 1800s, **George Boole** developed Boolean algebra, laying the foundation for binary logic.
- **Alan Turing (1936)**: Introduced the concept of the **Turing Machine**, a theoretical model that could simulate any algorithm, forming the basis for modern computers.

Birth of AI (1950s)

- ****Turing Test (1950)****: Alan Turing proposed a test to determine if a machine could exhibit intelligent behavior indistinguishable from a human.
- ****Dartmouth Conference (1956)****: Official birth of AI as a field of study. Coined the term "Artificial Intelligence."
- ****Early Pioneers****: John McCarthy, Marvin Minsky, Herbert Simon, and Allen Newell were key figures in the early days of AI research.

Early AI Programs (1950s-1960s)

- ****Logic Theorist (1956)****: Developed by Simon and Newell, it was the first AI program capable of proving mathematical theorems.
- ****General Problem Solver (1957)****: Another program by Simon and Newell aimed at solving problems using a symbolic logic approach.
- ****ELIZA (1966)****: An early natural language processing program created by Joseph Weizenbaum, simulating conversation with a human.

AI Winter (1970s-1980s)

- ****Disillusionment****: Progress slowed due to unmet expectations, lack of computational power, and funding cuts.
- ****Symbolic AI Limitations****: Early AI was based on symbolic logic and rule-based systems, which struggled with real-world complexities.
- ****Funding Declines****: Major AI research centers lost funding, leading to reduced research output during this period.

The Rise of Expert Systems (1980s)

- **Expert Systems**: AI systems that mimic the decision-making abilities of a human expert.
- **Notable Systems**:
 - **DENDRAL**: Used to analyze chemical compounds.
 - **MYCIN**: Medical diagnostic system for identifying bacterial infections.
- **Industry Adoption**: Expert systems found commercial success in industries like healthcare and finance.

Machine Learning and Neural Networks (1980s-1990s)

- ****Neural Networks Resurgence****: ****Backpropagation**** algorithm popularized in the 1980s, enabling the training of multi-layer neural networks.
- ****Machine Learning Emerges****: Shift from symbolic AI to data-driven approaches where machines could learn from experience.
- ****Notable Contributions****: Geoffrey Hinton, Yann LeCun, and others contributed to the development of neural networks and deep learning.

Modern AI Breakthroughs (2000s-2010s)

- ****Big Data GPUs****: Increased data availability and advancements in GPU technology fueled rapid AI growth.
- ****Deep Learning (2012)****: Deep neural networks, popularized by researchers like Hinton and LeCun, revolutionized fields like image recognition and natural language processing.
- ****AlphaGo (2016)****: Developed by Google DeepMind, AlphaGo defeated a world champion in Go, marking a major milestone in AI development.

Recent Developments (2020s)

- **GPT-3 (2020)**: Developed by OpenAI, GPT-3 is one of the largest language models, capable of generating human-like text.
- **AI in Healthcare**: AI is being increasingly used in drug discovery, diagnostics, and personalized medicine.
- **Ethical AI**: Growing emphasis on ensuring that AI development is ethical, fair, and transparent, with discussions around bias, privacy, and regulation.

The Future of AI

- ****General AI****: Continued efforts toward creating AI systems with general intelligence that can perform any intellectual task that a human can do.
- ****Ethics and Governance****: The future will likely involve stricter regulations and ethical frameworks to ensure AI is safe, fair, and aligned with human values.
- ****AI for Social Good****: AI's potential to address global challenges like climate change, education, and poverty alleviation.

Conclusion

- AI has evolved through multiple stages, from early theoretical work to modern deep learning breakthroughs.
- The field has experienced both rapid progress and setbacks, with increasing attention to ethical concerns and societal impact.
- The future of AI holds great promise, but also challenges that will require careful management and interdisciplinary collaboration.