Seminar on Artificial Intelligence

Introduction

Artificial intelligence (AI) is the capability of computational systems to perform tasks typically associated with human intelligence, such as learning, reasoning, problem-solving, perception, and decision-making. It is a field of research in computer science that develops and studies methods and software that enable machines to perceive their environment and use learning and intelligence to take actions that maximize their chances of achieving defined goals.

High-profile applications of AI include advanced web search engines (e.g., Google Search); recommendation systems (used by YouTube, Amazon, and Netflix); virtual assistants (e.g., Google Assistant, Siri, and Alexa); autonomous vehicles (e.g., Waymo); generative and creative tools (e.g., language models and AI art); and superhuman play and analysis in strategy games (e.g., chess and Go). However, many AI applications are not perceived as AI: "A lot of cutting edge AI has filtered into general applications, often without being called AI because once something becomes useful enough and common enough it's not labeled AI anymore."

Various subfields of AI research are centered around particular goals and the use of particular tools. The traditional goals of AI research include learning, reasoning, knowledge representation, planning, natural language processing, perception, and support for robotics. To reach these goals, AI researchers have adapted and integrated a wide range of techniques, including search and mathematical optimization, formal logic, artificial neural networks, and methods based on statistics, operations research, and economics. AI also draws upon psychology, linguistics, philosophy, neuroscience, and other fields. Some companies, such as OpenAI, Google DeepMind and Meta, aim to create artificial general intelligence (AGI)?AI that can complete virtually any cognitive task at least as well as a human.

Artificial intelligence was founded as an academic discipline in 1956, and the field went through multiple cycles of optimism throughout its history, followed by periods of disappointment and loss of funding, known as AI winters. Funding and interest vastly increased after 2012 when graphics processing units started being used to accelerate neural networks and deep learning outperformed previous AI techniques. This growth accelerated further after 2017 with the transformer architecture. In the 2020s, an ongoing period of rapid progress in advanced generative AI became known as the AI boom. Generative AI's ability to create and modify content has led to several unintended consequences and harms, while raising ethical concerns about AI's long-term effects and potential existential risks, prompting discussions about regulatory policies to ensure the safety and benefits of the technology.

Goals:

The general problem of simulating (or creating) intelligence has been broken into subproblems. These consist of particular traits or capabilities that researchers expect an intelligent system to display. The traits described below have received the most attention and cover the scope of AI research.

Techniques:

AI research uses a wide variety of techniques to accomplish the goals above.

Applications:

AI and machine learning technology is used in most of the essential applications of the 2020s, including: search engines (such as Google Search), targeting online advertisements, recommendation systems (offered by Netflix, YouTube or Amazon), driving internet traffic, targeted advertising (AdSense, Facebook), virtual assistants (such as Siri or Alexa), autonomous vehicles (including drones, ADAS and self-driving cars), automatic language translation (Microsoft Translator, Google Translate), facial recognition (Apple's FaceID or Microsoft's DeepFace and Google's FaceNet) and image labeling (used by Facebook, Apple's Photos and TikTok). The deployment of AI may be overseen by a chief automation officer (CAO).

Ethics:

AI has potential benefits and potential risks. AI may be able to advance science and find solutions for serious problems: Demis Hassabis of DeepMind hopes to "solve intelligence, and then use that to solve everything else". However, as the use of AI has become widespread, several unintended consequences and risks have been identified. In-production systems can sometimes not factor ethics and bias into their AI training processes, especially when the AI algorithms are inherently unexplainable in deep learning.

History:

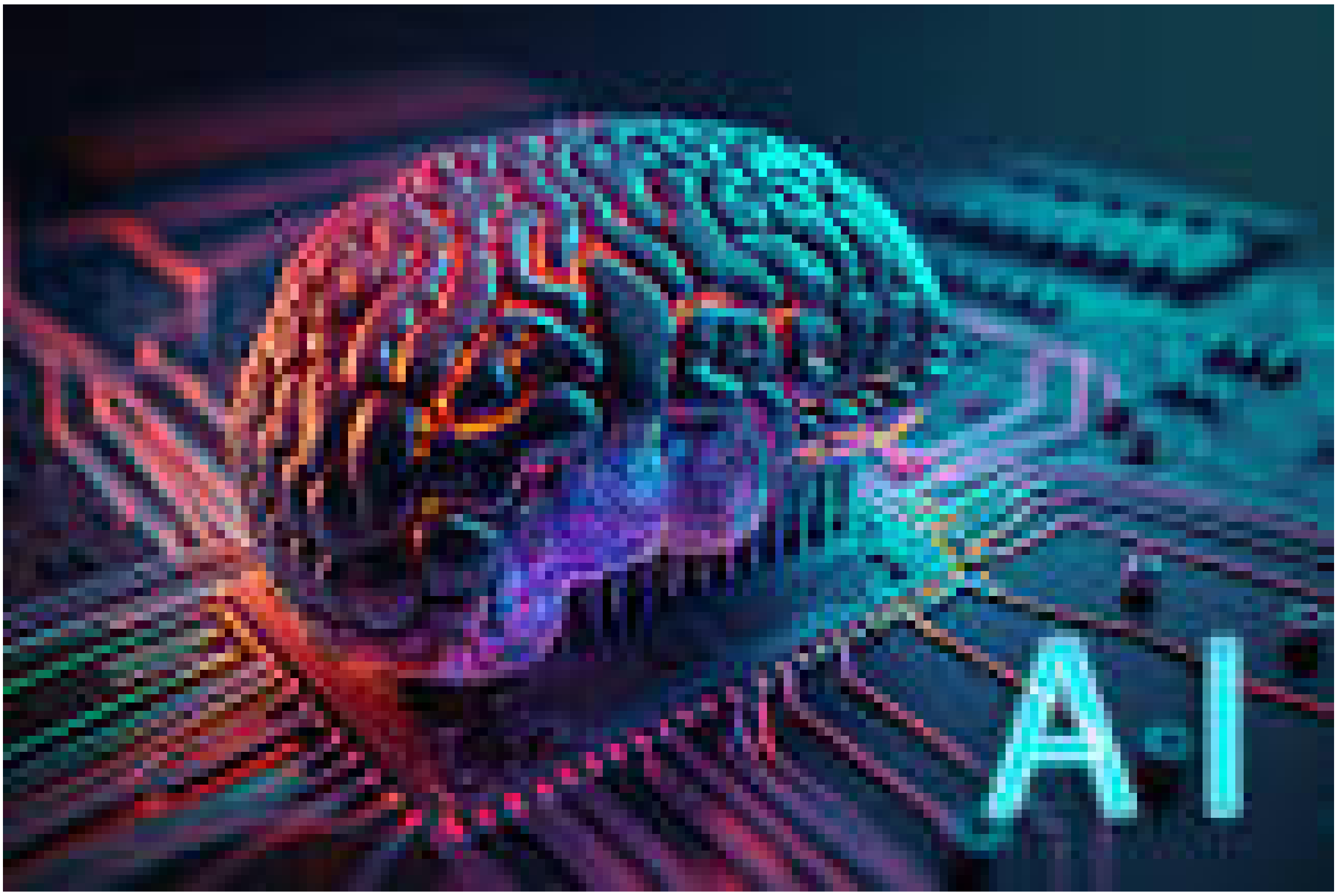
The study of mechanical or "formal" reasoning began with philosophers and mathematicians in antiquity. The study of logic led directly to Alan Turing's theory of computation, which suggested that a machine, by shuffling symbols as simple as "0" and "1", could simulate any conceivable form of mathematical reasoning. This, along with concurrent discoveries in cybernetics, information theory and neurobiology, led researchers to consider the possibility of building an "electronic brain". They developed several areas of research that would become part of AI, such as McCulloch and Pitts design for "artificial neurons" in 1943, and Turing's influential 1950 paper 'Computing Machinery and Intelligence', which introduced the Turing test and showed that "machine intelligence" was plausible.

The field of AI research was founded at a workshop at Dartmouth College in 1956. The attendees became the leaders of AI research in the 1960s. They and their students produced programs that the press described as "astonishing": computers were learning checkers strategies, solving word problems in algebra, proving logical theorems and speaking English. Artificial intelligence laboratories were set up at a number of British and U.S. universities in the latter 1950s and early 1960s.

Researchers in the 1960s and the 1970s were convinced that their methods would eventually succeed in creating a machine with general intelligence and considered this the goal of their field. In 1965 Herbert Simon predicted, "machines will be capable, within twenty years, of doing any work a man can do". In 1967 Marvin Minsky agreed, writing that "within a generation ... the problem of creating 'artificial intelligence' will substantially be solved". They had, however, underestimated the difficulty of the problem. In 1974, both the U.S. and British governments cut off exploratory research in response to the criticism of Sir James Lighthill and ongoing pressure from the U.S. Congress to fund more productive projects. Minsky and Papert's book Perceptrons was understood as proving that artificial neural networks would never be useful for solving real-world tasks, thus discrediting the approach altogether. The "AI winter", a period when obtaining funding for AI projects was difficult, followed.

In the early 1980s, AI research was revived by the commercial success of expert systems, a form of AI program that simulated the knowledge and analytical skills of human experts. By 1985, the market for AI had reached over a billion dollars. At the same time, Japan's fifth generation computer project inspired the U.S. and British governments to restore funding for academic research. However, beginning with the collapse of the Lisp Machine market in 1987, AI once again fell into disrepute, and a second, longer-lasting winter began.

Up to this point, most of AI's funding had gone to projects that used high-level symbols to represent mental objects like plans, goals, beliefs, and known facts. In the 1980s, some researchers began to doubt that this approach would be able to imitate all the processes of human cognition, especially perception, robotics, learning and pattern recognition, and began to look into "sub-symbolic" approaches. Rodney Brooks rejected "representation" in general and focussed directly on engineering machines that move and survive. Judea Pearl, Lotfi Zadeh, and others developed methods that handled incomplete and uncertain information by making reasonable guesses rather than precise logic. But the most important developme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