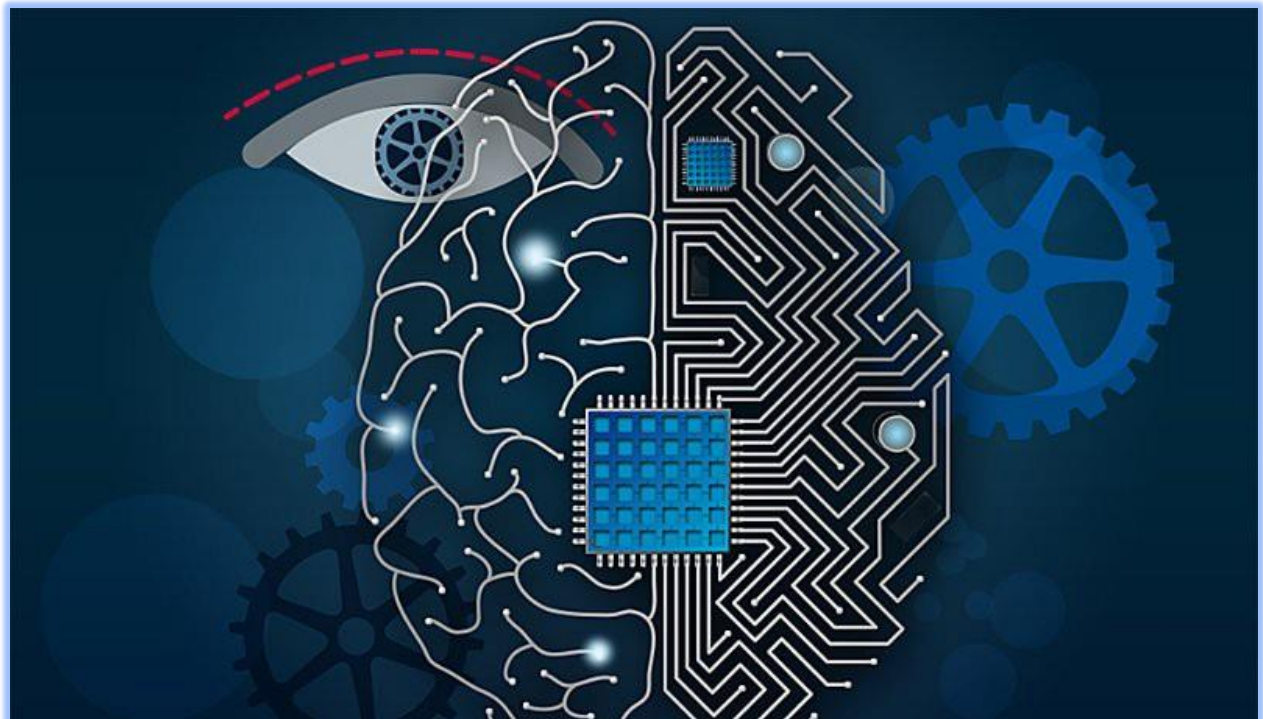


# ARTIFICIAL INTELLIGENCE

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*"It's going to be interesting to see how society deals with artificial intelligence, but it will definitely be cool." --Colin Angle*

# Abstract

*Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. AI is an interdisciplinary science with multiple approaches, but advancements in machine learning and deep learning are creating a paradigm shift in virtually every sector of the tech industry.*

# Introduction

Artificial intelligence (AI) is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals, which involves consciousness and emotionality. The distinction between the former and the latter categories is often revealed by the acronym chosen. 'Strong' AI is usually labeled as artificial general intelligence (AGI) while attempts to emulate 'natural' intelligence have been called artificial biological intelligence (ABI). Leading AI textbooks define the field as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term "artificial intelligence" is often used to describe machines that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem-solving".

# Methods

- History

Thought-capable artificial beings appeared as storytelling devices in antiquity, and have been common in fiction, as in Mary Shelley's *Frankenstein* or Karel Čapek's *R.U.R.* These characters and their fates raised many of the same issues now discussed in the ethics of artificial intelligence.

The study of mechanical or "formal" reasoning began with philosophers and mathematicians in antiquity. The study of mathematical 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 act of mathematical deduction. This insight, that

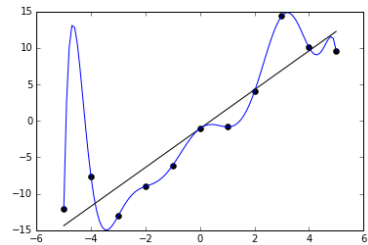


*Silver didrachma from Crete depicting Talos, an ancient mythical automaton with artificial intelligence*

digital computers can simulate any process of formal reasoning, is known as the Church–Turing thesis. Along with concurrent discoveries in neurobiology, information theory, and cybernetics, this led researchers to consider the possibility of building an electronic brain. Turing proposed changing the question from whether a machine was intelligent, to "whether or not it is possible for machinery to show intelligent behavior". The first work that is now generally recognized as AI was McCulloch and Pitts' 1943 formal design for Turing-complete "artificial neurons".

## • Basics

A typical AI analyzes its environment and takes actions that maximize its chance of success. An AI's intended utility function (or goal) can be simple ("1 if the AI wins a game of Go, 0 otherwise") or complex ("Perform actions mathematically similar to ones that succeeded in the past"). Goals can be explicitly defined or induced. If the AI is programmed for "reinforcement learning", goals can be implicitly induced by rewarding some types of behavior or punishing others. Alternatively, an evolutionary system can induce goals by using a "fitness function" to mutate and preferentially replicate high-scoring AI systems, similar to how animals evolved to innately desire certain goals such as finding food. Some AI systems, such as nearest-neighbor, instead of reason by analogy, these systems are not generally given goals, except to the degree that goals are implicit in their training data. Such systems can still be benchmarked if the non-goal system is framed as a system whose "goal" is to successfully accomplish its narrow classification task.

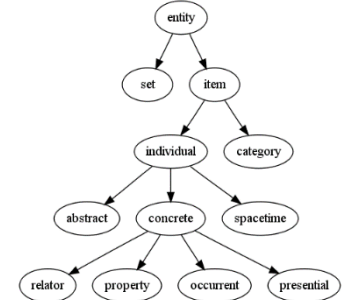


*The blue line could be an example of overfitting a linear function due to random noise.*

## • Challenges

Knowledge representation and knowledge engineering are central to classical AI research. Some "expert systems" attempt to gather explicit knowledge possessed by experts in some narrow domain. Also, some projects attempt to gather the "commonsense knowledge" known to the average person into a database containing extensive knowledge about the world. Among the things a comprehensive commonsense knowledge base would contain are objects, properties, categories, and relations between objects; situations, events, states, and time;[104] causes and effects; knowledge about knowledge (what we know about what other people know);[106] and many other, less well-researched

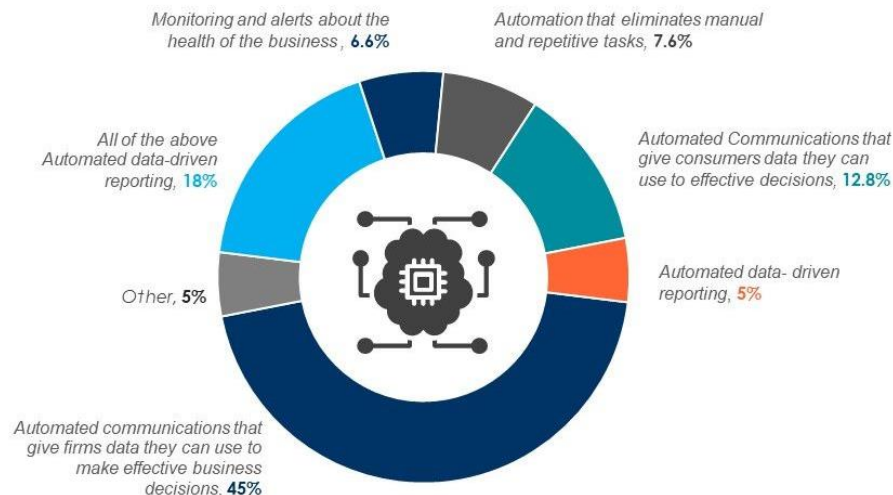
domains. A representation of "what exists" is an ontology: the set of objects, relations, concepts, and properties formally described so that software agents can interpret them. The semantics of these are captured as description logic concepts, roles, and individuals, and typically implemented as classes, properties, and individuals in the Web Ontology Language. The most general ontologies are called upper ontologies, which attempt to provide a foundation for all other knowledge by acting as mediators between domain ontologies that cover specific knowledge about a particular knowledge domain (field of interest or area of concern). Such formal knowledge representations can be used in content-based indexing and retrieval, scene interpretation, clinical decision support, knowledge discovery (mining "interesting" and actionable inferences from large databases), and other areas.



*An ontology represents knowledge as a set of concepts within a domain and the relationships between those concepts.*

## Results

### Reasons for using Artificial Intelligence



## Conclusion

*The creation of a machine with human-level intelligence that can be applied to any task is the Holy Grail for many AI researchers, but the quest for*

*AGI has been fraught with difficulty. The search for a "universal algorithm for learning and acting in any environment," (Russel and Norvig 27) isn't new, but time hasn't eased the difficulty of essentially creating a machine with a full set of cognitive abilities. AGI has long been the muse of dystopian science fiction, in which super-intelligent robots overrun humanity, but experts agree it's not something we need to worry about anytime soon.*

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