TECHNICAL COMMUNICATION

ARTIFICIAL INTELLIGENCE



* DIVESH.K CB.EN.U4CSE19422
* SHANTHAN.S CB.EN.U4CSE19459
* ABHINAV.R CB.EN.U4CSE19453
* KOUSHIK.P CB.EN.U4CSE19449
* KARTHIK.N CB.EN.U4CSE19444

ARTIFICIAL INTELLIGENCE

1. INTRODUCTION

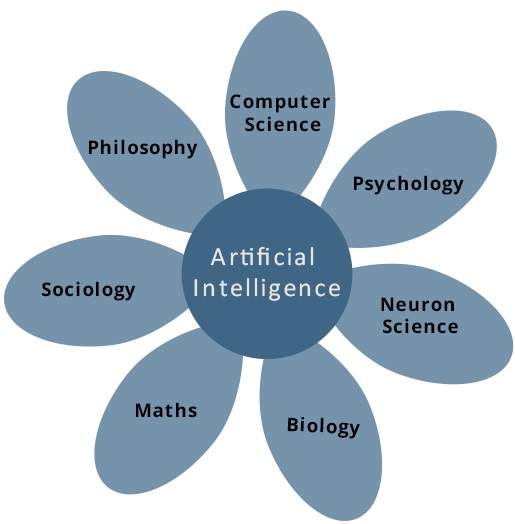
Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction. Particular applications of AI include [expert systems](https://searchenterpriseai.techtarget.com/definition/expert-system), [speech recognition](https://searchcrm.techtarget.com/definition/voice-recognition) and [machine vision](https://searchenterpriseai.techtarget.com/definition/machine-vision-computer-vision).

AI can be categorized as either [weak](https://searchenterpriseai.techtarget.com/definition/narrow-AI-weak-AI) or [strong](https://searchenterpriseai.techtarget.com/definition/artificial-general-intelligence-AGI). Weak AI, also known as narrow AI, is an AI system that is designed and trained for a particular task. Virtual personal assistants, such as Apple's Siri, are a form of weak AI. Strong AI, also known as artificial general intelligence, is an AI system with generalized human cognitive abilities. When presented with an unfamiliar task, a strong AI system is able to find a solution without human intervention.

Because hardware, software and staffing costs for AI can be expensive, many vendors are including AI components in their standard offerings, as well as access to Artificial Intelligence as a Service ([AIaaS](https://searchenterpriseai.techtarget.com/definition/Artificial-Intelligence-as-a-Service-AIaaS)) platforms. AI as a Service allows individuals and companies to experiment with AI for various business purposes and sample multiple platforms before making a commitment. Popular AI cloud offerings include [Amazon AI](https://searchaws.techtarget.com/definition/Amazon-AI)services, [IBM Watson Assistant](https://whatis.techtarget.com/definition/IBM-Watson-Assistant), [Microsoft Cognitive Services](https://whatis.techtarget.com/definition/Microsoft-Cognitive-Services) and [Google AI](https://whatis.techtarget.com/definition/Google-AI) services.

While AI tools present a range of new functionality for businesses, the use of artificial intelligence raises ethical questions. This is because deep learning algorithms, which underpin many of the most advanced AI tools, are only as smart as the data they are given in training. Because a human selects what data should be used for training an AI program, the potential for human bias is inherent and must be monitored closely.

Some industry experts believe that the term artificial intelligence is too closely linked to popular culture, causing the general public to have unrealistic fears about artificial intelligence and improbable expectations about how it will change the workplace and life in general. Researchers and marketers hope the label [augmented intelligence](https://whatis.techtarget.com/definition/augmented-intelligence), which has a more neutral connotation, will help people understand that AI will simply improve products and services, not replace the humans that use them.



* 1. HISTORY

The idea of inanimate objects coming to life as intelligent beings has been around for a long time. The ancient Greeks had myths about robots, and Chinese and Egyptian engineers built automatons.

The beginnings of modern AI can be traced to classical philosophers' attempts to describe human thinking as a symbolic system. But the field of AI wasn't formally founded until 1956, at a conference at Dartmouth College, in Hanover, New Hampshire, where the term "[artificial intelligence](https://www.livescience.com/3407-robot-madness-creating-true-artificial-intelligence.html)" was coined.

MIT cognitive scientist Marvin Minsky and others who attended the conference were extremely optimistic about AI's future. "Within a generation [...] the problem of creating 'artificial intelligence' will substantially be solved," Minsky is quoted as saying in the book "AI: The Tumultuous Search for Artificial Intelligence" (Basic Books, 1994). [[Super-Intelligent Machines: 7 Robotic Futures]](https://www.livescience.com/29376-rise-of-super-intelligent-robots.html). But achieving an artificially intelligent being wasn't so simple.

After several reports criticizing progress in AI, government funding and interest in the field dropped off – a period from 1974–80 that became known as the "AI winter." The field later revived in the 1980s when the British government started funding it again in part to compete with efforts by the Japanese.

The field experienced another major winter from 1987 to 1993, coinciding with the collapse of the market for some of the early general-purpose computers, and reduced government funding. But research began to pick up again after that, and in 1997, IBM's Deep Blue became the first computer to beat a chess champion when it defeated Russian grandmaster Garry Kasparov. And in 2011, the computer giant's question-answering system [Watson won the quiz show "Jeopardy!"](https://www.livescience.com/47591-ibm-watson-science-discoveries.html) by beating reigning champions Brad Rutter and Ken Jennings.

This year, the talking computer "chatbot" Eugene Goostman captured headlines for tricking judges into thinking he was real skin-and-blood human during a Turing test, a competition developed by British mathematician and computer scientist Alan Turing in 1950 as a way to assess whether a machine is intelligent. But the accomplishment has been controversial, with artificial intelligence experts saying that only a third of the judges were fooled, and pointing out that the bot was able to dodge some questions by claiming it was an adolescent who spoke English as a second language.

Many experts now believe the Turing test isn't a good measure of artificial intelligence. "The vast majority of people in AI who've thought about the matter, for the most part, think it’s a very poor test, because it only looks at external behavior," Perlis told Live Science. In fact, some scientists now plan to develop an [updated version of the test](https://www.livescience.com/47296-turing-test-needs-an-update.html). But the field of AI has become much broader than just the pursuit of true, humanlike intelligence.

1. DISCUSSION
   1. REACTIVE MACHINES

The most basic types of AI systems are purely reactive, and have the ability neither to form memories nor to use past experiences to inform current decisions. [Deep Blue, IBM’s chess-playing supercomputer](http://www.techrepublic.com/article/ibm-watson-the-inside-story-of-how-the-jeopardy-winning-supercomputer-was-born-and-what-it-wants-to-do-next/), which beat international grandmaster Garry Kasparov in the late 1990s, is the perfect example of this type of machine.

Deep Blue can identify the pieces on a chess board and know how each move. It can make predictions about what moves might be next for it and its opponent. And it can choose the most optimal moves from among the possibilities.

But it doesn’t have any concept of the past, nor any memory of what has happened before. Apart from a rarely used chess-specific rule against repeating the same move three times, Deep Blue ignores everything before the present moment. All it does is look at the pieces on the chess board as it stands right now, and choose from possible next moves.

This type of intelligence involves the computer [perceiving the world directly](https://www.youtube.com/watch?v=t3kXWSctj2Q) and acting on what it sees. It doesn’t rely on an internal concept of the world. In a seminal paper, AI researcher Rodney Brooks argued that [we should only build machines](http://dx.doi.org/10.1016/0004-3702(91)90053-M) like this. His main reason was that people are not very good at programming accurate simulated worlds for computers to use, what is called in AI scholarship a “representation” of the world.

The current intelligent machines we marvel at either have no such concept of the world, or have a very limited and specialized one for its particular duties. The [innovation in Deep Blue’s design](https://www.scientificamerican.com/article/how-the-computer-beat-the-go-master/) was not to broaden the range of possible movies the computer considered. Rather, the developers found a way to narrow its view, to [stop pursuing some potential future moves](https://www.cnet.com/news/did-a-bug-in-deep-blue-lead-to-kasparovs-defeat/), based on how it rated their outcome. Without this ability, Deep Blue would have needed to be an even more powerful computer to actually beat Kasparov.

Similarly, Google’s AlphaGo, which has beaten top human Go experts, can’t evaluate all potential future moves either. Its analysis method is more sophisticated than Deep Blue’s, using a [neural network](http://pages.cs.wisc.edu/~bolo/shipyard/neural/local.html) to evaluate game developments.

* 1. LIMITED MEMORY

This Type II class contains machines can look into the past. Self-driving cars do some of this already. For example, they observe other cars’ speed and direction. That can’t be done in a just one moment, but rather requires identifying specific objects and monitoring them over time.

These observations are added to the self-driving cars’ preprogrammed representations of the world, which also include lane markings, traffic lights and other important elements, like curves in the road. They’re included when the car decides when to change lanes, to avoid cutting off another driver or being hit by a nearby car.

But these simple pieces of information about the past are only transient. They aren’t saved as part of the car’s library of experience it can learn from, the way human drivers compile experience over years behind the wheel.

So how can we build AI systems that build full representations, remember their experiences and learn how to handle new situations? Brooks was right in that it is very difficult to do this. My own research into methods inspired by Darwinian evolution can start to [make up for human shortcomings](http://dx.doi.org/10.1162/NECO_a_00475) by letting the machines build their own representations.

* 1. THEORY OF MIND

We might stop here, and call this point the important divide between the machines we have and the machines we will build in the future. However, it is better to be more specific to discuss the types of representations machines need to form, and what they need to be about.

Machines in the next, more advanced, class not only form representations about the world, but also about other agents or entities in the world. In psychology, this is called “[theory of mind](http://dx.doi.org/10.1017/S0140525X00076512)” – the understanding that people, creatures and objects in the world can have thoughts and emotions that affect their own behaviour.

This is crucial to [how we humans formed societies](https://theconversation.com/can-great-apes-read-your-mind-66224), because they allowed us to have social interactions. Without understanding each other’s motives and intentions, and without taking into account what somebody else knows either about me or the environment, working together is at best difficult, at worst impossible.

If AI systems are indeed ever to walk among us, they’ll have to be able to understand that each of us has thoughts and feelings and expectations for how we’ll be treated. And they’ll have to adjust their behavior accordingly.

* 1. SELF-AWARENESS

The final step of AI development is to build systems that can form representations about themselves. Ultimately, we AI researchers will have to not only understand consciousness, but build machines that have it.

This is, in a sense, an extension of the “theory of mind” possessed by Type III artificial intelligences. Consciousness is also called “self-awareness” for a reason. (“I want that item” is a very different statement from “I know I want that item.”) Conscious beings are aware of themselves, know about their internal states, and are able to predict feelings of others. We assume someone honking behind us in traffic is angry or impatient, because that’s how we feel when we honk at others. Without a theory of mind, we could not make those sorts of inferences.

While we are probably far from creating machines that are self-aware, we should focus our efforts toward understanding memory, learning and the ability to base decisions on past experiences. This is an important step to understand human intelligence on its own. And it is crucial if we want to design or evolve machines that are more than exceptional at classifying what they see in front of them.

### ARTIFICIAL NARROW INTELLIGENCE (ANI)

### This type of artificial intelligence represents all the existing AI, including even the most complicated and capable AI that has ever been created to date. Artificial narrow intelligence refers to AI systems that can only perform a specific task autonomously using human-like capabilities. These machines can do nothing more than what they are programmed to do, and thus have a very limited or narrow range of competencies. According to the aforementioned system of classification, these systems correspond to all the reactive and limited memory AI. Even the most complex AI that uses machine learning and deep learning to teach itself falls under ANI.

### ARTIFICIAL SUPER INTELLIGENCE (ASI)

### The development of Artificial Superintelligence will probably mark the pinnacle of AI research, as AGI will become by far the most capable forms of intelligence on earth. ASI, in addition to replicating the multi-faceted intelligence of human beings, will be exceedingly better at everything they do because of overwhelmingly greater memory, faster data processing and analysis, and decision-making capabilities. The development of AGI and ASI will lead to a scenario most popularly referred to as the singularity. And while the potential of having such powerful machines at our disposal seems appealing, these machines may also threaten our existence or at the very least, our way of life.

At this point, it is hard to picture the state of our world when more advanced types of AI come into being. However, it is clear that there is a long way to get there as the current state of AI development compared to where it is projected to go is still in its rudimentary stage. For those holding a negative outlook for the future of AI, this means that now is a little too soon to be worrying about the singularity, and there's still time to ensure AI safety. And for those who are optimistic about the future of AI, the fact that we've merely scratched the surface of AI development makes the future even more exciting.

* 1. ARTIFICIAL GENERAL INTELLIGENCE (AGI)

### Artificial General Intelligence is the ability of an AI agent to learn, perceive, understand, and function completely like a human being. These systems will be able to independently build multiple competencies and form connections and generalizations across domains, massively cutting down on time needed for training. This will make AI systems just as capable as humans by replicating our multi-functional capabilities.

2.5.1 HOW DOES IT WORK?

Less than a decade after breaking the Nazi encryption machine Enigma and helping the Allied Forces win World War II, mathematician Alan Turing changed history a second time with a simple question: "Can machines think?"  Turing's paper "[Computing Machinery and Intelligence](https://www.csee.umbc.edu/courses/471/papers/turing.pdf)" (1950), and it's subsequent Turing Test, established the fundamental goal and vision of artificial intelligence.  At it's core, AI is the branch of computer science that aims to answer Turing's question in the affirmative. It is the endeavor to replicate or simulate human intelligence in machines. The expansive goal of artificial intelligence has given rise to many questions and debates. So much so, that no singular definition of the field is universally accepted.  The major limitation in defining AI as simply "building machines that are intelligent" is that it doesn't actually explain what artificial intelligence is? What makes a machine intelligent?

In their groundbreaking textbook Artificial Intelligence: A Modern Approach, authors Stuart Russell and Peter Norvig approach the question by unifying their work around the theme of intelligent agents in machines. With this in mind, AI is "the study of agents that receive percepts from the environment and perform actions."

Norvig and Russell go on to explore four different approaches that have historically defined the field of AI:

1. **Thinking humanly**
2. **Thinking rationally**
3. **Acting humanly**
4. **Acting rationally**

The first two ideas concern thought processes and reasoning, while the others deal with behavior. Norvig and Russell focus particularly on rational agents that act to achieve the best outcome, noting "all the skills needed for the Turing Test also allow an agent to act rationally." (Russel and Norvig 4). Patrick Winston, the Ford professor of artificial intelligence and computer science at MIT, [defines AI](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/lecture-videos/lecture-1-introduction-and-scope/) as  "algorithms enabled by constraints, exposed by representations that support models targeted at loops that tie thinking, perception and action together."

While these definitions may seem abstract to the average person, they help focus the field as an area of computer science and provide a blueprint for infusing machines and programs with machine learning and other subsets of artificial intelligence. While addressing a crowd at the [Japan AI Experience in 2017](https://www.youtube.com/watch?v=ZChA63CpX5o),  DataRobot CEO Jeremy Achin began his speech by offering the following definition of how AI is used today:

"AI is a computer system able to perform tasks that ordinarily require human intelligence... Many of these artificial intelligence systems are powered by machine learning, some of them are powered by deep learning and some of them are powered by very boring things like rules."