The Rise of Artificial General Intelligence

By
Jordan Walker
H00222194
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Introduction

"The ability to focus on novel, yet learnable patterns in observations is an essential aspect of intelligence that has led mankind to explore its surroundings, all the way to our current understanding of the universe. When designing artificial agents, we have exactly this vision in mind" (Schaul, et al., 2011, p. 21).

Overview and structure

For this essay, the task has been to identify the emerging area within Computer science, which takes a strong direction towards the development of sentient intelligence, commonly referred to as Strong AI. In addition to providing a detailed research of information, this assignment has the aim to critically analyse the large impact of Artificial General Intelligence within the next five years' time.

What is Artificial General Intelligence?

Artificial General Intelligence (AGI) also known as "Strong AI", "Full AI" or "General Artificial Intelligence" is a new and exciting field of studies (Pennachin & Goertzel, 2007). To the current point of time AGI only exists in theory within the subject of Artificial Intelligence which has the aim of building true "thinking machines" (Schmidhuber, et al., 2011).

This development is seen by many to become a further step towards creating what has been announced in Science Fiction Literature and Media - a machine which can perform general intelligent actions and by that create the ability to interact among humans. Furthering on this idea, Academic sources reserve "Strong AI" as the reference of building machines with the capability of experiencing consciousness based on growing emotions by inheriting self-awareness (WIRED, 2018).

The difference between Artificial Intelligence and Artificial General Intelligence

As mentioned in the previous, Artificial Intelligence is the parenting field of Artificial General Intelligence. Although in the reading matter it is only separated by one word, there is a clear difference between both topics.

Artificial Intelligence started with the intention of becoming what Strong AI aims to solve (Bieger , et al., 2015). However, it has been directed towards more task-orientated domains which is now referred to as "Weak Artificial Intelligence" (Schmidhuber, et al., 2011).

Moving away from the singular or minimal applications of AI, Strong AI intends to be more general in attempting to build the bridge towards giving society their own version of the "HAL 9000" from "2001: A Space Odyssey" and fulfilling the aimed purpose of many researchers where AI can be considered conscious.

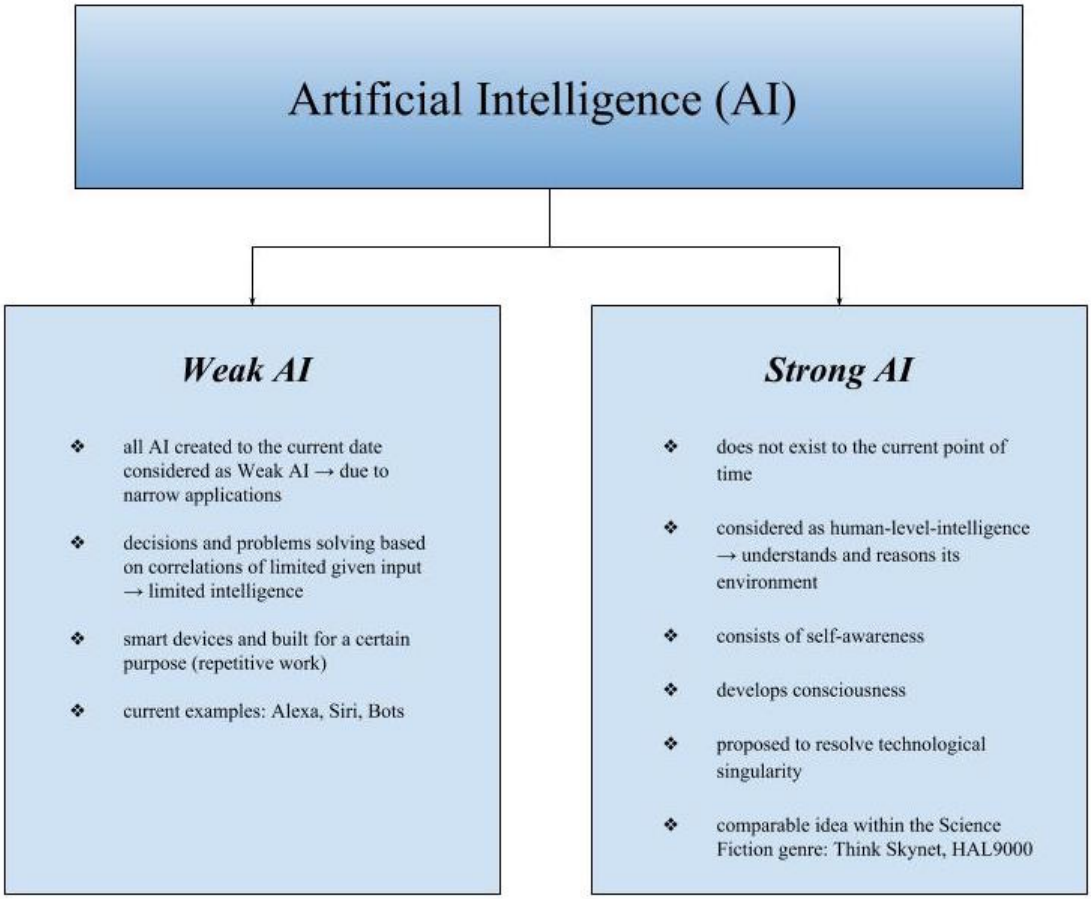

Figure 1: Difference of Weak AI and Strong AI

Where is Artificial General Intelligence currently?

Although AI has been a very concurrent topic, the idea of syllogistic logic and creating a deductive reasoning ideology goes back to the theoretical developments of Aristotle (i2k Connect, N.D.). AI itself has been an ever-growing topic since the first half of the 20th century. "Almost exactly 60 years ago, in the summer of 1955, John McCarthy coined the term 'artificial intelligence' (AI) to refer to 'the science and engineering of making intelligent machines' in a proposal for a summer research project at Darthmouth College" (Bieger , et al., 2015, p. V). With further funding, research and interest it has grown to be a highly researched matter which holds various ideas that differ from one person to another (Goertzel & Pennachin, 2007).

Consequently, this has created many subtrees within the area of AI such as "Machine Learning", "Neural Networks" as well as in that manner "Artificial General Intelligence". Thereby a new hype for the topic itself has been created which enables the ideas of more possible applications as well as implementations (Benaich, 2017).

The Gartner Hype Cycle

The Gartner Hype Cycle is a visual graph that outlines new components or applications involved within technology. Using the chart, a business or individual can see where a promised technology may currently lie within its maturity (Gartner, 2018).

The Chart is divided into five sectors including:

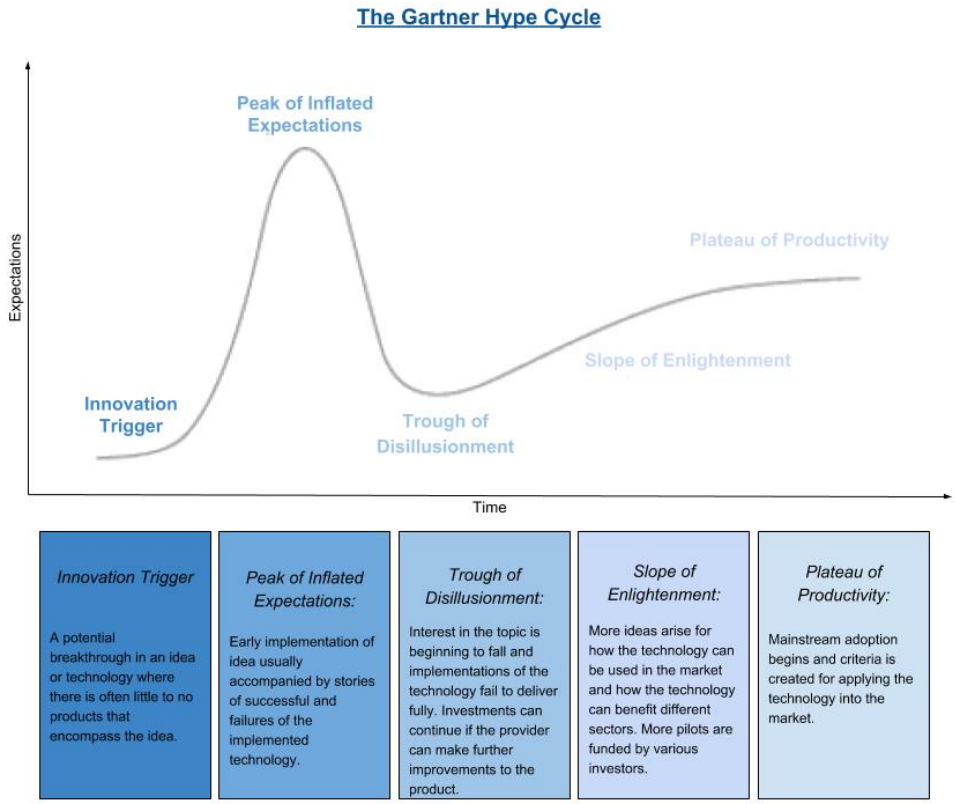

Figure 2: Graphic of the Garner Hype Cycle [modified]

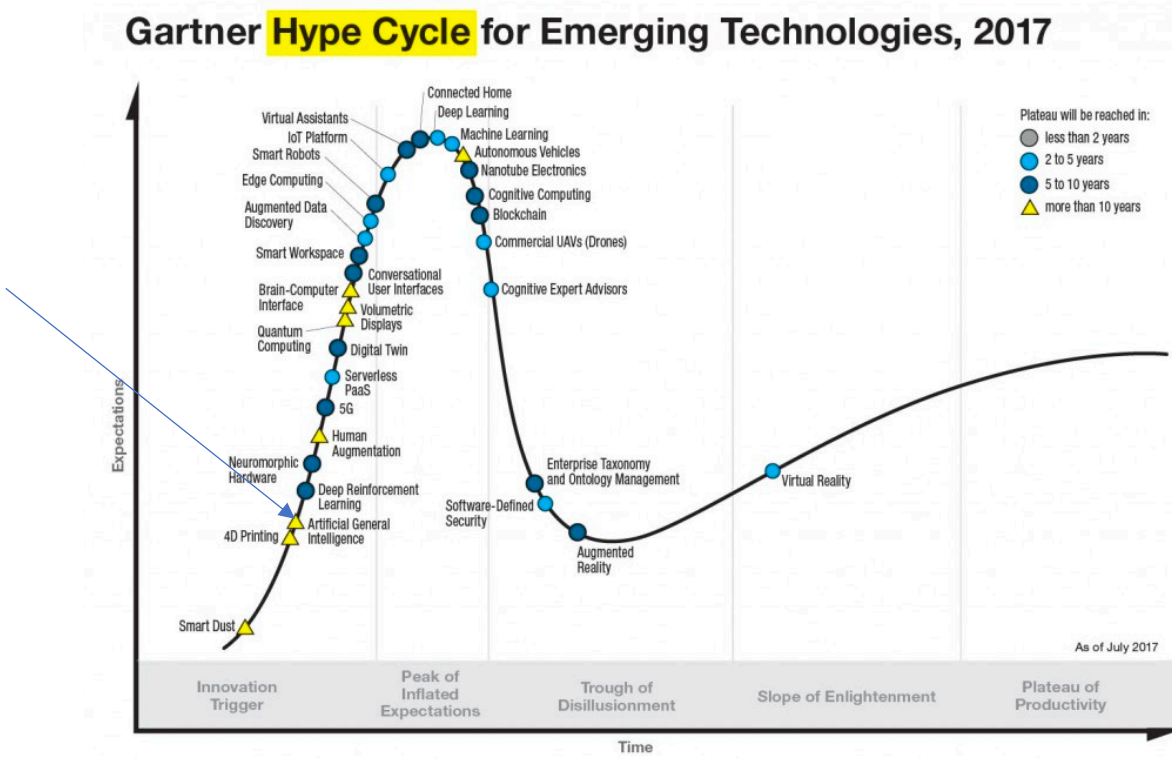

Figure 3: Gartner Hype Cycle for Emerging Technologies (2017)

According to the Gartner Hype Cycle for Emerging Technologies (2017), AGI currently stands in the first period of maturing development - the "Innovation Trigger" stage. As stated previously in this paper, the idea of Strong AI has been around for many years and becomes realistically possible through the current research which has been invested into AI, such as Google's "DeepMind", as well as the sophistication with refinement of creating AI using methods, suchlike "Machine Learning" and "Neural Networks (Gartner, 2017).

As one can see, the Hype Cycle predicts that the plateau of Artificial General Intelligence will not be reached for over the next 10 years. However, this is only an estimation which goes into one of the most debatable deliverable within the AI community. This is due to many reasons, which to explain would exceed the extent of this assignment. Nonetheless, whereas the Gartner Cycle states at what point of maturity the technology currently stands, it seems to be evident that Artificial General Intelligence cannot just being seen as a technology. It is rather the idea of the ability to create an intelligence that could potentially outperform humans at nearly every cognitive task and contain a breakthrough for every future development itself.

A scientific estimation of Strong AI

As stated in the previous section, the deliverable of a Strong AI is a heavily debatable and critiqued subject. During an Interview between MIRI researcher Elizer Yudkowsky and MIT Computer Scientist Scott Aaronson, it was debated by Yudkowsky that "[…] in one to ten decades we are going to build an AI smart enough to improve itself" (Muehlhauser, 2013). Aaronson replied hereon that it would be "[…] a few thousand years […]" (Intelligence, 2013).

Although the interview between Yudkowsky and Aaronson is to the current point of time nearly five years old and advancements in the development of AI have progressed, it is still relevant

as many scientists find themselves unable to predict to what exact point of time Strong AI will be created.

In contrast to the above mentioned interview, the survey "Machines and the Theory of Intelligence" undertaken by D. Michie, which has asked experts in the field of AI to estimate a timeline for computers to exhibit intelligence at an adult human level, the most common response has been "50 years" (Michie, 1973, p. 507). Taking this into account, a version of Strong AI which can rival an adult intelligence was predicted to be available in 2023.

In comparison, it becomes obvious to see that there is still no clear estimation of when Strong AI will be introduced and becomes integrated within our daily lifestyles.

The Applications of Artificial Intelligence

Although the applications of where Strong AI could be implemented is just an idea, its concept is highly broad. Currently Weak AI is being implemented to nearly every sector. One interacts with it daily through the use of smart devices which contain personal assistant applications, such as Amazon's "Alexa", Apples "Siri", etc. (Adams, 2017)

It stands to reason that we use AI in nearly all of our everyday lives. The website Beebom (2016) states AI has been introduced so seemingly that the actual awareness of usage has faded into the background. This becomes especially true for large sectors which heavily utilize AI, including:

- Games
- Music, Movie, Music Recommendation Services
- Fraud Detection
- Stock Markets.

The issue remains consequently that the utilization of agents in these areas is still singular and even though they work on an advanced level, one could not transfer from one sector to another. Without fully reprogramming the AI or having it physically changed, so that it is able to understand the specific sectors data, current AI is always going to be singular (Human-Paragon, 2017).

Developing a Strong AI would therefore remove the need for many singular sector specific tasks that Weak AI can complete. Additionally, it would minimise or eliminate the amount of human involvement, which is required to work alongside the superior version of Artificial Intelligence (Human-Paragon, 2017).

Pennachin and Goertzel (2007) have concerned themselves with the matter of applications an AGI should contain. The following graphic has the purporse to represent these ideas:

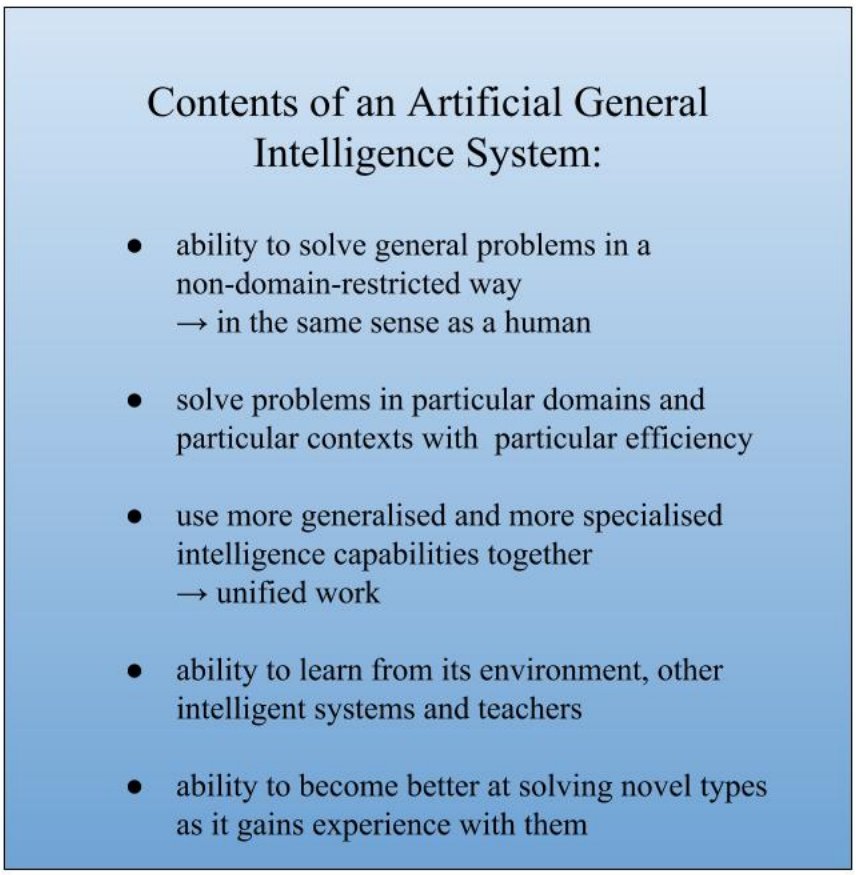

Figure 4: Contents of an AGI System (Refering to Pennachin & Goertzel, 2007, p. 7)

Is Strong AI a threat?

At the moment, there are many debates involving the development of our current day AI. The argumentation against developing systems with superior intellect is strongly backed by some of the most notable people in the World including Elon Musk, Stephen Hawkins and Sir Tim Berners Lee (Marr, 2017).

"I'm increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. I mean with artificial intelligence we're summoning the demon." —Elon Musk (cited in Marr, 2017)

The research for the development of a system that can outperform humans is highly surrounded with philosophical and ethical issues. It ranges from the simplistic idea of taking away many of the jobs, which are currently relied on humans for, to the debate that creating a super intelligent agent could potentially create an AI arms race whereby opposing countries would start a war on scale of the Cold War, which was exhibited between America and Russia during 1945 till 1989 (Simonite, 2017).

The Future of Artificial General Intelligence

Realistically, the idea of creating an intelligence that can rival that of a human has plagued philosophers and scientists for many years. Generally, it is agreed that it will be possible in time to create Artificial General Intelligence. Nevertheless, there are still milestones that need to be solved before the idea becomes reality (Bieger , et al., 2015).

But is it possible?

Some researchers believe that due to certain milestones that need to be completed to create general AI, it may be realistically impossible to devise the singularity in obtaining a self-aware system in virtue of logical and mathematical reasoning. But this is not the only problem. Humans currently do not have a rigid definition of what intelligence is. Thus, current AI works by devising algorithms that can act like humans, but nevertheless not represent any of the cognitive thought a human would use to complete a task (Nomer, 2016).

We can use techniques such as the Natural Language Processing (NLP) which has the ability to recognise speech and interpret what the user was asking. But at the current point of time it will not go further just by itself. NLP is interpreting, searching for keywords and giving an output back to the user (Natanson, 2017). Therefore, it is similar to what one can implement when having Neural Networks to recognise pictures, musical patterns etc. As impressive as most seem to find these techniques, the problem is that the system has no own thoughts, emotions or true understanding of the actual input. It is merely a set of rules of what to deduce from the given input.

The Promise of General Artificial Intelligence

The idea of creating a self-aware intelligent agent is seen by some professional experts as an impossible task to do, others then again believe that the understanding as well as required resources, which both are needed in order to complete its creation, are just not available yet (Pennachin & Goertzel, 2007).

There are many debatable points of creating a system that can think like a human, even possibly outperform. However, creating General AI is not just seen as a means to create a better application for stock markets, autonomous weapons etc., but even more to show understanding of some of the greater questions posed to Scientists, Philosophers and the Society itself (Ford & Yampolskiy, 2013).

Thus, if humans can understand how to create intelligence then it means we have answered questions that has long been asked which include “what is it to be conscious”, “what defines intelligence”. These kind of questions go beyond simplistic implementation of an advanced AI within a company but rather lead humankind towards a new plateau of understanding and reasoning.

Conclusion

Currently, society still criticises the theory of developing an AI that can act and behave based on human characteristics, which is known by experts as a Strong AI. The criticism is not just justified on the fear of job losses, but also for losing the contact with one another (Miller, 2017).

AI has highly developed just within the last few years, but it is going to a point where improvement adjustments slow down. Therefore the following goal is to create a machine or agent which has the ability to adapt on his own through self-learning processes as well as creating emotions in order to emphasize human preferences.

"Taking a broad view, it is clear that, in fact, human intelligence is not all that general. A huge amount of our intelligence is focused on situations that have occurred in our evolutionary experience: social interaction, vision processing, motion control, and so forth" (Pennachin & Goertzel, 2007, p. 6).

To the current point of time, the application of a Strong AI can only be analysed based on theoretical knowledge. The given evidence of this essay has shown that current implementations of AI will not be able to support Artificial General Intelligence by the time of 2023. However, based on the further research, undertaken during this essay, one can interpret that the idea of imitating human intelligence and creating a system that can think for itself is not any longer impossible.

In relation to the other technologies such as "Deep Reinforcement Learning" which can be seen on the Gartner Hype Cycle the technological development of Strong AI is unlikely to have a large impact within the next five years regarding implementation. However, with the developments that have been made in the area of AI the idea itself will create a large following of research which nevertheless will be able to improve current applications of Weak AI. Therefore whilst Strong AI itself may not have a large impact in implementation the drive it creates has the chance to inspire further developments in every containing area.

In conclusion to this essay, one can estimate that although having an implementation of Strong AI will not be deliverable by 2023, it goes to reason that research will not falter in this area. Instead, it encompasses more than just a technological approach as it will be included in many different areas of research. Thus, as long as the idea of creating a system that has the ability to reason, think and grow by itself without the help of human involvement the research will always be developed and move further.

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