APPENDIX F

Artificial General Intelligence   2025.3.20

Kilnam Chon

1. Introduction

Herbert Simon Received the Nobel Prize in Economics which was related to AI in 1978 [NobelPrize 1978]. In 2024, four received the Nobel Prizes; Demis Hassabis and John Jumper along with David Baker received the Nobel Prizes in Chemistry for protein structure prediction based on the AI model [NobelPrize 2024]. Jeffrey Hinton was awarded the 2024 Nobel Prize on Physics with John Hopfield on artificial neural networks. His comments include "Industrial Revolution exceeding in physical ability, and AI (Revolution) possibly exceeding in intellectual ability. We don't have any experience, and we have to worry about it" [NovelPrizeinPhysics 2024]. Demis Hassabis described AGI as "AGI – the ultimate general-purpose tool to help us understand the universe" in his recent talk, "Accelerating science discovery" [Hassabis 2024b]. He talked "Technology as transformative as AGI requires explicit care and foresight," during his Nobel Prize talk. Max Tegmark warned on "Tool AI vs Uncontrollable AGI" in the recent newsletter of Future of Life Institute [Tegmark 2024]. He also gave a talk, "Why we should build Tool AI, not AGI" at Web Summit recently [Tegmark 2024b].

An interesting YouTube video from Digital Engine in 2024 [DigitalEngine 2024]. This video shows many major players, and many major organizations, as well as many projects on Artificial General Intelligence (AGI) today.

The following AI experts and podcasters are covered in this video.

Sam Altman
Ilya Sutskever
Geoffrey Hinton
Dario Amodei
Demis Hassabis
Eliezer Yudkowsky
Yuval Noah Harari
Yoshua Bengio
Yann LeCun

Dwarfish Patel, Podcaster
Lex Fridman, Podcaster
Craig Smith, Podcaster

Artificial General Intelligence and Artificial Super Intelligence - Definition

"Artificial general intelligence (AGI) is a type of artificial intelligence that matches or

surpasses human cognitive capability across a wide range of cognitive tasks. Artificial superintelligence (ASI), on the other hand, refers to AGI that greatly exceeds human cognitive capabilities" [Wikipedia 2024].

2. History

Turing Test

"The Turing test, originally called the imitation game, was proposed by Alan Turin in 1950 to test a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human," [Turin 2014]. The recent YouTube shows several cases where the latest AI systems such as GPT-4 passed the Turing Test [YouTube 2024].

The 1956 Dartmouth Workshop

"The Dartmouth Summer Research Project on Artificial Intelligence was a 1956 summer workshop widely considered to be the founding event of artificial intelligence as a field" [Dartmouth 1956]. The project proposal covers computers, natural language processing, neural networks, theory of computation, abstraction and creativity.

Strong AI (AGI) vs Narrow AI (Weak AI or AI)

Artificial intelligence was classified to Strong AI, and Narrow AI (or Weak AI) initially. Later the Strong AI was also called Artificial General Intelligence (AGI) which implies human-level or higher intelligence on a wide range of cognitive tasks. Narrow AI is a term used to describe artificial intelligence systems to handle a specific task. In the 21st century, we generally use the terms AGI and AI. The latter is a generic term. We don't use terms such as the Strong AI, the Narrow AI or the weak AI anymore.

In the 20th century, most AI developments focus on Narrow AI such as natural language processing and image recognition. In the 21st century, we started having companies focusing on artificial general intelligence such as DeepMind, Open AI and Anthropic in addition to many companies focusing on Narrow AI, in particular on its applications [AGI 2024; OpenAI 2024; Deep Mind 2024].

Auto driving may be a special case; super intelligent beyond the narrow AI, but not the artificial general intelligence. Research and development on the auto driving system started in the 20th century [DARPA 2004; SelfDriving 2024]. Many kinds of the auto driving systems are installed in passenger cars now. These automatic driving systems may be classified as the narrow AI. But it is focusing on the single task, automatic driving, and may not be appropriate to classify as the artificial general intelligence. But the driving systems may be superintelligent since many of the latest driving systems are better than human drivers with much less accidents.

3. Current Status and Definition

Future of Life Institute

"AI systems will only get more capable. Corporations are actively pursuing 'artificial

general intelligence' (AGI), which can perform as well as or better than humans at a wide range of tasks. These companies promise this will bring unprecedented benefits, from curing cancer to ending global poverty. On the flip side, more than half of AI experts believe there is a one in ten chance this technology will cause our extinction."

Wikipedia

"Artificial general intelligence (AGI) *is a type of [artificial intelligence](#) (AI) that can perform as well or better than humans on a wide range of cognitive tasks,[1] as opposed to [narrow AI](#), which is designed for specific tasks.[2] It is one of various definitions of [strong AI](#).*

Creating AGI is a primary goal of AI research and of companies such as [OpenAI](#),[3] [DeepMind](#), and [Anthropic](#). A 2020 survey identified 72 active AGI [R&D](#) projects spread across 37 countries.[4]

The timeline for AGI development remains a subject of ongoing debate among researchers and experts. As of 2023, some argue that it may be possible in years or decades; others maintain it might take a century or longer; and a minority believe it may never be achieved.[5] There is debate on the exact definition of AGI, and regarding whether modern [large language models](#) (LLMs) such as [GPT-4](#) are early, incomplete forms of AGI.[6] AGI is a common topic in [science fiction](#) and [futures studies](#).

Contention exists over the potential for AGI to pose a threat to humanity;[7] for example, OpenAI claims to treat it as [an existential risk](#), while others find the development of AGI to be too remote to present a risk.[8][5][9]"

Levels of AGI were recently defined by Open AI as follows [AIrevolution 2024; OpenAI 2024c];

        Level 1 Chatbots; AI with Conversational Language
        Level 2 Reasoners; Human level problem solving

        Level 3 Agents; Systems that can take actions

        Level 4 Innovators, AI that can aid in invention
        Level 5 Organizations, AI that can do the work of an organization

Deep Mind also defined AGI in five levels [AGI 2024];

        Emerging
        Competent
        Expert
        Virtuous (Circle)
        Superhuman

4. Issues

Common sense

"In artificial intelligence, common sense reasoning is a human-like ability to make presumptions about the type and essence of ordinary situations humans encounter every day"

[CommonSense 2024]. *Ernest Davis characterizes common sense knowledge as "what a typical seven year old knows about the world", including physical objects, substances, plants, animals, and human society.*

Consciousness

Lex Feldman interviewed many AI specialists on consciousness including artificial consciousness recently. They include Joshua Back [Fridman #392], Sam Harris [Fridman #365], Christopher Koch [Fridman #2], Philip Goff [Fridman #261], and David Chalmers [Fridman #69].

There are several YouTube videos on consciousness;
  "This AI system is conscious and experts are starting to agree," Digital Engine [DigitalEngine 2023].
  "How AI attains consciousness?,"DW, 2023 [DW 2023].
  "Did Google AI just become sentient?" Cold Fusion, 2023 [ColdFusion 2023].
 "Is consciousness an illusion?" [BigThink 2024].

Wikipedia has the articles on consciousness as well as artificial consciousness [Consciousness 2024; ArtificialConsciousness 2024].

First "creativity" symptom

AlphaGo had the unusual move, "Move 37" during its second match against Lee Sedol in 2016 which was unthinkable by Go experts [Hassabis 2023; Hassabis 2024]. This move may be considered one of the first creative moves by the AI systems. Bubeck noted an initial AGI during his experience on ChatGPT in 2023 as described in his article and video [Bubeck 2023b].

Artificial Super Intelligence

Artificial Super Intelligence (ASI) is the major topic along Artificial General Intelligence (AGI) in AI lately. There are many articles and talks on these topics lately. Ray Kurzweil published the book, "The Age of Spiritual Machine" in 1999 where he discussed on artificial superintelligence. Nick Bostrom also wrote the book on the same topic, "Superintelligence: Paths, Dangers, Strategies in 2014. He also wrote the book, Deep Utopia in 2024.

We may consider two cases of Artificial Super Intelligence (ASI);

Artificial General Super Intelligence (AGSI), and
Artificial Narrow Super Intelligence (ANSI)

Many argue that we may reach ASI fairly quickly once we reach AGI. On the other hand, we may also consider ANSI like Artificial Narrow Intelligence. We are having several cases of ANSI lately. One of them is the Level 4 autonomous driving which reduce traffic accidents including fatality substantially described in the next paragraph.

Another interesting case is Alphafold by DeepMind. Demi Hasserbis and his colleague received the Nobel Prize in 2024 on discovering numerous protein structures with Alphfafold. Each protein structure may take years to be discovered. Alphafold discovered numerous protein structures in a very short time. Hasserbis predicts Alphfafold could be applied to many other science fields in his Nobel Prize speech [Hasserbis 2024]. This may be

half-way between ANSI and AGSI by covering many areas of natural science.

We may expect many more cases of ANSI in the coming years before we realize the ultimate goal of AGSI, similarly to Artificial Narrow Intelligence and Artificial General (Strong) Intelligence.

Future of Life Institute organized the contest on "SuperIntelligence Imagined" in 2024 with more than 100 submissions with five winners [FLI 2024c]. Hendrycks, Schimidt and Wang wrote the article, Superintelligence Strategy with the following coverage recently with the following coverage; Deterrence, Nonproliferation, and Competitiveness [Hendrycks 2025]. They also authored "Super Intelligent Expert Version" recently.
There are many articles warning the superintelligence including the following in addition to the above article;

Keepthefuturehuman.ai by A. Aquire
Experts show why WW3 over AI is inevitable, Digital Engine, 2025.

AI Uncovered posted "The 10 levels of AI" in the YouTube recently [YouTube 2025] with the following 10 levels;

1. Rule-Based
2. Context-Based
3. Narrow AI
4. Reasoning AI
5. AGI
6. Super Intelligent AI
7. Self-Aware AI
8. Transcend AI
9. Cosmic AI
10. God-like AI

Autonomous Driving

DARPAN sponsored autonomous driving technology demonstrations in the 2000s [DARPA 2024] such as autonomous driving from Las Vegas to Los Angeles. Then, many automobile companies including Tesla as well as universities put much efforts on autonomous driving. We classify autonomous driving from Level 1 to 4 now [SelfDriving 2024]. Many automobile companies are reaching Level 4 now. Waymo in the USA is offering the commercial taxi services in San Francisco and Phoenix now [Waymo 2024]. China is also developing autonomous driving. WeRide is offering commercial autonomous driving service in China. Other companies including Baidu are also offering the commercial service now. Collectively, the eleven cities offer commercial autonomous driving in China now. Additionally, there are many "Little Yellow EV" for delivery of goods. All commercial autonomous driving cars in China are equipped with Lidar unlike Tesla.

The autonomous driving at Level 4 may be considered one of the first artificial super intelligence as the Level 4 reduces the fatality due to automobile accidents substantially compared with human driving.

Robots

Robots have been under development for many decades starting from the robot arms for manufacturing. The robots are some of the intensive developments including humanoid development along other AI technology development latterly.

Jensen Huang, the NVIDEO founder gave a talk at 2025 CES [CES 2025], and classified intelligence to

- Cognitive Intelligence including perception AI, generative AI, and agentic AI
- Physical Intelligence

He further classified the physical intelligence to Robot, Automobile, and Drone.

Raibert, the founder of Boston Dynamics described his effort at Boston Dynamics which is one of the leaders on the robot engineering. In his talk with Lex Fridman #412, He described the development at Boston Dynamics. He also commented on AGI [Fridman 2024]. Humanoid robots are being demonstrated in Race for AI Robot, Cold Fusion, 2024 [ColdFusion 2024]. Figure AI have been working with Open AI, Tesla/Optimus, NVIDIA and among others to develop these robots. China is also working on "AGI robots" [AGIrobot 2024].

AI Data Center, AI Supercomputer, and AI Personal Computer

Data centers for AI are very important, but could be very expensive and consume much electricity [situational-awareness.ai 2025]. Only the very large companies could afford the large-scale AI data centers. Processors for the AI data centers are very expensive, costing tens of thousand dollars or more, and we need up to a million processors. NVIDIA dominates the Graphic Processor Unit (GPU) market [NVIDIA 2024]. The GPU is used for the AI data center. Additionally, the GPU processor consumes a substantial amount of electricity. [Science 2023] AI data centers globally consume 2% of the electricity generated in the world in this decade. Additionally, AI data centers require appropriate backup electric power which could be problematic.

Microsoft with Open AI proposed the AI data center, especially for AGI at $100 billion to be ready by 2028 [Reuter 2024]. This would be a part of Stargate Project now. xAI developed the AI data center with 100,000 GPUs in 2024 doubling GPUs in 2025. Meta, Amazon, Open AI and Google are also developing the AI data centers [TopFives 2025]. Google uses its own processor, TPU. Europe also joined the large-scale AI data center as Macron announced at AI (Safety) Action Summit in Paris.

Microsoft with Intel announced AI personal computer in 2024, and NVIDEA also announced Digits, "Personal AI supercomputer" at 2025 CES [Wired 2025].

AI Safety

AI safety has been one of the important issues. Future of Life Institute raised this issue in the last decade and carried out AI safety projects [FLI 2024; AIsafety 2024]. Recently, The UK government with the US government organized an AI Safety Summit [UK 2023]. The next summits will be held in Seoul and the USA in 2024 followed by France in 2025. There were International dialogues on AI safety (IDAIS) focusing on AGI in London (2023) and Beijing (2024). Many national AI safety institutes have been founded recently including the UK, USA, France, South Korea and Canada [Chon 2024]. There are several AI safety institutes in China which are collaborating in China and internationally [Zeng 2024; IAPS 2024]. China AI Safety and Development Association (CNAISDA) was founded to represent all AI safety institutes in China recently [CNAISDA 2025; Stanford 2025].

AI safety and AI development have possible conflicts. This is particularly true among the leading AI development companies such as OpenAI. The recent YouTube video describes the Open AI case [AIsearch 2024]. Meantime, Ilya Suskever quit Open AI, and founded Safe Superintelligence (SSI) in 2024 [Suskever 2024]. Jan Leike also quit OpenAI and joined Anthropic. Hassabis also commented on safe and responsible AGI development [Hassabis 2024]. Stewart Russel also gave talks on AI safety including "Make safe AI, not make AI safe" [Russell 2024b]

Military Artificial Intelligence Applications

Military AI applications need to be paid particular attention. Many countries are putting much effort into military AI [Autonomous 2024; Economist 2024; FLI 2024]. Weapons with AGI could be devastating. There is much effort on coordinating military AI applications globally.

AI Agents

ChatGPT is a typical passive AI as it reacts to the input by its users. On the other hand, AI agents actively process with/without human inputs [IntelligentAgent 2024].
The intelligent agents were commented on by Yann LeCun and Andrew Ng among others [LeCun 2022; Ng 2024; Sutskever 2024; Oriol Vinyals 2024]. June Park and his colleagues are working on generative AI Agent as recorded in YouTube lately [June Park 2024]. Google recently announced its AI agent software, Gemini [Gemini 2024]. D. Hadi and Liam Othley commented on AI agents in their recent YouTube talks [Hadi 2024; Othley 2025]. Hadi stated that generative AI is just beginning. AI agents are what comes next. He stated that "*AI agents plan tasks to execute, reflect on outcome and use tools to accomplish goals*". Jason Huang also talked on the agent as the last step of the cognitive AI as follows [CES 2025];

Perception AI
Generative AI
Agentic AI

Amazon is considering to offer agentic AI for shopping at Amazon [Wired 2025b].

We are facing the end of pre-training due to lack of more data in the world as pointed out by Ilya Sutskver of Safe Superintelligence [Sutskever 2024]. One of the natural choices is the

agentic approach followed by reasoning and understanding.

The panel discussion at Davos addressed on the AI agents with respect to AI safety and AGI [Davos 2025]. Please refer the Remark for further comment on this panel discussion.

Deep Seek

Deep Seek, the Chinese venture developed AI software including Deep Seek-R agent and announced as an open-source software in February 2025 [Berman 2025; CNBC 2005; Mint 2025; Wired 2025b]. The performance of Deep Seek-R exceeds all major AI companies in USA including OpenAI, Google and Meta. Please refer Figure AGI-1 for detail. This shocked all over the world including and stock prices dove down, NASDAQ with 3% and NVIDIA with 17% over the weekend of January 25-26. Deep Seek is not using the expensive GPUs to accomplish these performances.

The AI data center of Deep Seek consists of 10,000 A100 GPUs including approximately 1,250 GPU compute nodes, nearly 200 storage servers, 122 200G Infiniband switches and optical interconnect products [Kim 2025]. Some of Deep Seek's model uses distillation.

Ben Norton gave an interesting review various articles related to Deep Seek and the related issues in his recent You Tube, "Tech CEOs admit they want AI monopoly: US plans to block China, Geopolitical Economy Report" [Norton 2025]. France 24 also posted the YouTube, "The debate panic in silicon valley; China's Deep Seek challenges US supremacy", 2025.1.27 [France24 2025].

5. Remarks

1. Alan Turing stated that *"It seems probable that once the machine thinking method had started, it would not take long to outstrip our feeble power. At some stage therefore we should have to expect the machines to take control"* [Turing 1951].

2. Ilya Sutskver elaborated on AGI on various occasions [Sutskever 2021; Sutskever 2023; Sutskever 2024b]. Stuart Russell elaborated on AGI in his talk in 2024 [Russell 2024b]. Sam Altman also elaborated on AGI during his recent talk with Lex Fridman [Altman 2024].

3. Yoshua Bengio also elaborated on AGI including safe AGI in his talk during AI Safety (Seoul) Summit in May 2025 [Bengio 2024b]. His explanation on "Uncertain timeline of AI Capabilities," during his talk is interesting with AI capabilities with respect to the time in 2000s; Agentic AI, Generative AI, Narrow AI/ML, and Early Systems. The report, International Scientific Report on Safety of Advanced AI [Bengio 2024].

4. Eric Schmidt elaborated on AGI at the 2024 Future Investment Initiative Conference [Schmidt 2024b]. He stated AGI based on 90% performance by AI in various science disciplines; physics, chemistry and biology among others. The overall intelligence on the natural science of AI exceeds human beings [IIF 2024]. The recent YouTube. "What happens when AI knows too much?" [Beeyond 2024]. This may also be considered at AGI.

5. Ben Goertzel of Singularity Net stated that artificial superintelligence (ASI) could be accomplished fairly quickly once artificial general intelligence (AGI) could be developed. AGI could iterate itself many times to move up to ASI [Goertze 2024].

6. Future of Life Institute organized many talks to warn on AGI recently [Tegmark 2024]. Max Tegmark tries to focus on Tool AI, not AGI. Similarly, Connor Leahy published a book, Compendiums recently as well as gave a talk, "Why humanity risks extinction?" at FLI recently [Leahy 2024].

(Figure AGI-1)

7. The panel discussion, "Do we need international collaboration for safe AGI?, The panelists include Max Tegmark (chair), Yoshua Bengio, Demis Hassabit, Yan-Qin Zhang of Tsinghua University, and a professor at UC Berkeley. Demis defined on AI, AGI, and Super AGI. Bengio, the chief editor of the AI Safety Summit reports in 2023, 2024 and 2025, explained on the importance of AI safety on AGI agent. He Zhang explained the international collaboration among governments, among business, and among academic with examples [Davos 2025].

8. Lex Fridman also posted the extensive podcast with over 5-hour video to YouTube recently [Fridman 2025].

9. Another interesting YouTube is "Ethical Hacker: This is how deep seeker will destroy the entire AI industry as Ryan Montgomery forecasted [TopMaster 2025].

10. AI Safety Newsletter #47 Reasoning Models has an interesting analysis on computing resources. V3 to R1 in the case of Deep Seeks or o1 to the later model in the case of Open AI do not require much computing resource since the reasoning in V3 and o1 consumed much computing resources already [AIsafety 2025].

11. There is a very interesting and informative interview of the Deep Seek founder, Liang, WenFeng by Awakening Richard [Liang 2025].

12. There is an interesting video, New AI, Open Thinker, just beat Deep Seek by Open Thoughts, AI Revolution, 2025.2 [OpenThinker 2025].

13. There is Mistral AI in France which offers generative AI like Open AI and others in USA and Deep Seek in China [Mistral 2025].

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