



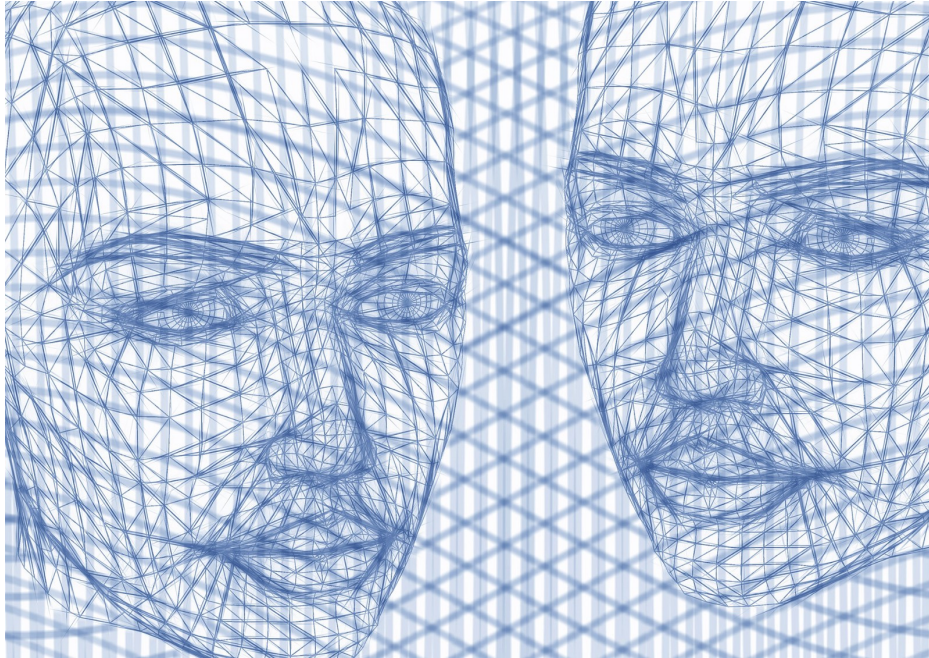
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Jul 21 · 7 min read

Polanyi & The Black Box

Clues To The Future of AI & Mankind



The answer to the ultimate question of life, the universe and everything is 42 — HAL 9000 in Douglas Adam's A Hitchhiker's Guide To The Galaxy

In this article, readers can understand:

- i) difference between Machine Learning (ML) and the broader term Artificial Intelligence(AI),*
- ii) the current state of AI and its challenges including Polanyi's paradox, and*
- iii) the possible future of AI and by extension of mankind.*

This Week

It was a week filled with coincidences. But, then again there are no coincidences and everything happens for a reason. Three inputs coincided to prompt me to write this article:

This week, I read one for the best articles from the [Harvard Business Review](#). It was titled “[The Business of Artificial Intelligence](#)” and was authored by [Erik Brynjolfsson](#) and Andrew McAfee. The duo have also authored a book “[The Second Machine Age](#)”.

On a podcast with Startup Grind founder Derek Anderson, I heard Eric Schmidt, CEO of Google praise Deepmind as an extraordinary company in the field of ML and AI.

Today, I read a blog post by Demis Hassabis, CEO of Deepmind on the challenges faced by AI.

General Vocabulary

Machine Learning and Artificial Intelligence are not the same. Artificial Intelligence is a much broader term. Artificial Intelligence is the notion of making computers smarter maybe smarter than humans. AI is of two broad types i.e. Applied and General. Applied is fairly common and is currently being used to automate routine tasks like fill forms, trade stocks etc. Generalized AI is the ability to perform any task smartly like humans. It has not yet been achieved but that is where the future lies.

Machine learning is the process of teaching machines to teach themselves. Arthur Lee Samuel was an American pioneer in the fields of computer gaming and artificial intelligence. He coined the term machine learning in 1959 to explain the process of self learning machines. Apple’s voice based assistant Siri is an example of advanced machine learning capabilities.

Consider Machine Learning (ML) as an important part and a vehicle helping humans on the journey from applied Artificial Intelligence (AI) to General Artificial Intelligence.

Polanyi’s Paradox & The Black Box Problem

In 1966, the philosopher Michael Polanyi observed, “We can know more than we can tell... The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar; the knowledge I have of my own body differs altogether from the knowledge of its physiology.” (Source: NBER)

Polanyi’s paradox predates computing but is largely relevant and points to an interdisciplinary approach to tackling the challenges of machine learning.

However, scientists are trying to use examples to teach machines to overcome Polanyi's paradox and have been successful to an extent. Consider Imagenet- a database containing tens of millions of URL's of images. An artificial neural network is an interconnected group of nodes, akin to the vast network of neurons in a brain. A neural network learns through examples.

As per Wikipedia: since 2010, the ImageNet project runs an annual software contest, the ImageNet Large Scale Visual Recognition Challenge (ILSVRC), where software programs compete to correctly classify and detect objects and scenes.

However, to overcome Polanyi's paradox, the deep neural networks employed to solve the paradox have become so complicated that this complexity has added uncertainty around how the machine arrives at an outcome creating another problem called 'The Black Box' problem.

To get a rough idea of the black box problem, look at the illustration of deep neural network below:

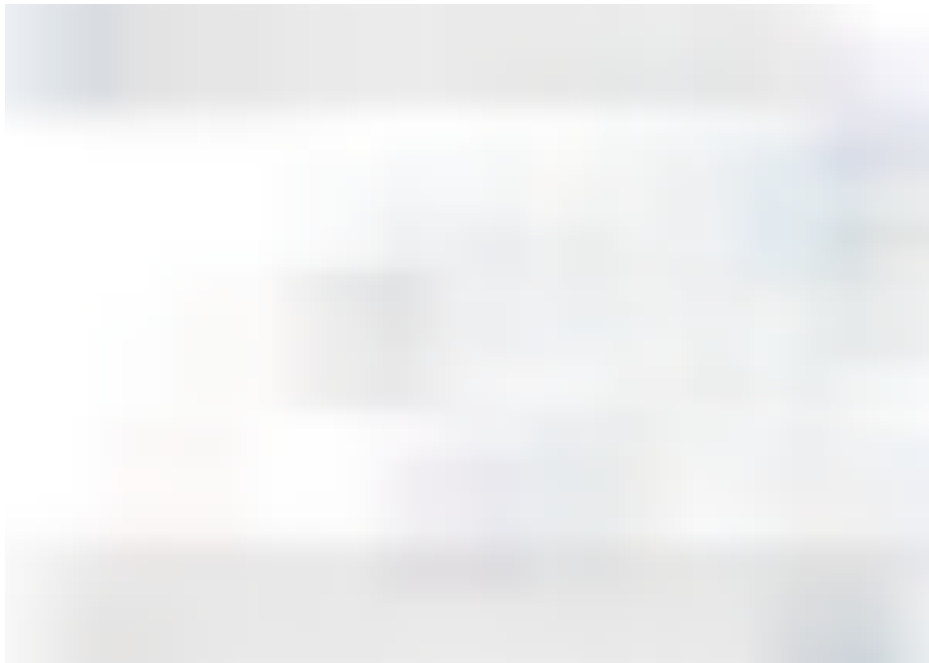


This illustration is a simple illustration but it does a good job of highlighting the interlinkages and a multitude of paths that processing can take.

VC Investment in Startups

There is a war for talent today especially scientists and engineers specializing in ML and AI. Andrew Ng quit Google to join Baidu as chief data scientist but left Baidu too.

Similarly, startups that have developed advanced technologies are being lapped up in an AI race to be the first amongst equals:



One of the most significant acquisition has been that of Deepmind by Google. In addition, venture capital has not been far behind:



As per [CB Insights](#) , number of AI financing in 2016 reached a staggering \$5bn globally with VC's such as Intel, Khosla Ventures, Data Collective, Google Ventures, Accel Partners, Andreessen Horowitz leading the pack. Approximately 62% of the deals were in the US followed by United Kindgom (6.5%) and Israel (4.3%)

Final Thoughts

One thing is clear : it is time to start re-educating yourself around data science, ML and AI.

The answer to Polanyi's paradox may be learning through examples but the answer to the black box problem lies embedded within human tissue.

However, as scientists seek the answer to the black box in the fields of neuroscience and cognitive psychology, the direction of the quest itself gives us a clue. This clue points to a possible conclusion: for humans, the future could be cybernetic.

Let me explain using a Hollywood movie/Science Fiction as an example:

I recently watched a movie called 'Alien Covenant' which has an Android (a robot within a human body with superhuman intelligence who also acquires consciousness).

David is the name of this Android only because his creator asks him what he would name himself. So, he looks at a replica of David by Michelangelo and names himself 'David'.

David asks his creator a very poignant question almost as important as the number "42" in the Hitchiker's Guide To The Galaxy.

He asks: if you created me, who created you? It's an answer that his creator cannot provide. David goes on and says "you will die one day but I won't" which is another truth coming from an Android with Artificial General Intelligence (AGI).

By the end of the movie, David, in his quest for creating the perfect biological organism creates a unique species of aliens. The movie ends with a triumphant David trying to transport his aliens on board a human colonization mission to a different planet. He is shown as enjoying his favorite song—Richard Wagner's *'Entry of the Gods into Valhalla'*.

If you see where I am leading, it will take a cybernetic organism to rival an evil consciousness.

This outcome can be thought of as a little far off. But, in the immediate future, the implications need to be answered with appropriate actions.

Consider a plausible hypothetical sequence:

1. Currently happening: Machines take over routine tasks. Some jobs are lost. Humans need to respond by educating and re-skilling particularly on data science, interpreting machine learning and AI results. Creative and originality will become valuable.

2. 15–30 years from 2017: As AI progresses and a lot of jobs could be lost. Humans need to respond by being able to create new safety nets, continue educating themselves for new jobs created. Creativity and originality become vital traits. There is a global discussion on the future and international co-operation becomes inevitable.
3. 30–50 years from 2017: AI may become superhuman. Humans may respond by becoming cybernetic beings. Other human endeavors such as space exploration, deep sea mapping and possible colonization of other planets.
4. Alternatively, singularity is delayed because of the limitations of physics or a social uprising. AI becomes too socially disruptive and creates more havoc yet it still continues solve problems including medical issues. Universal Basic Income may be enhanced and other safety nets may be needed.

At the end—to me, HAL's oft quoted number 42 today means education.

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Additional Resources:

1. Google [TensorFlow](#): An open source platform for developers to build Machine Learning applications. Twitter: @tensorflow
2. [Google DeepMind](#): is the world leader in artificial intelligence research and its application for positive impact.
Twitter: @deepmindai
3. [Andrew Ng](#) : co-founder of Coursera, Andrew also founded Google's Deep Learning project. You can follow him on twitter: @andrewyng
4. [Polanyi's Paradox](#): National Bureau of Economic Research on the paradox.
5. [The Business of Artificial Intelligence](#), HBR, July 18, 2017.
6. [Erik Brynjolfsson](#): He's the director of the MIT Initiative on the Digital Economy. Twitter: @erikbryn
7. Demis Hassabis: Founder and CEO, Deepmind. Twitter: @demishassabis
8. [Sam DeBrule](#) : [The Non-Technical Guide To Machine Learning](#)

9. Partnership on AI: Founded by Microsoft, Apple, Google, Deepmind, the partnership on AI seeks to educate society and drive AI forward.

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