Future of Artificial Intelligence

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May 25, 2022

1 Introduction

There's no denying we live in an era where Artificial Intelligence (AI) is becoming predominant. The recent advancements in computer hardware and manufacturing processes have made it possible for technology to permeate our lives in every aspect. It is now an essential aspect of our professional endeavors, our leisure and entertainment, and even our social interaction as humans.

Moreover, it seems like the line between what is authentic human behavior and technologically influenced behavior is bound to get blurrier. With the introduction of AI to the public, we could see how the future could feature plenty of dystopian concepts. For example, instances where people are interacting "humanly" with intelligent systems [1], ignorant of the other party's lack of humanity. We should observe a plethora of jobs being wiped out because someone developed an AI that controls a system or robot to perform a specific task, an AI that's extremely more skilled and capable than any human could possibly be. All this is sure to shake up how society works, and will that be a positive change for the future of mankind?

2 What is AI History?

Intelligent systems have originated and have been discussed for most of the twentieth century, but the exact date where they have begun to be discussed is unknown. One reason for this may very well be that, the definition of AI is not precise. Is a machine learning algorithm intelligent? A system computing the solution to a search problem doesn't seem very intelligent. On the contrary, it's only, and strictly, the following of rules laid out by someone who wrote its software.

2.1 Early Days

A lot of the early work on AI was inspired from the premise that an artificial brain could be constructed. It was just discovered that the neurons found in our brain responded to electrical stimuli [2], therefore, the idea that we could somehow simulate this network didn't seem too far-fetched.

Furthermore, Alan Turing proposed that machine thinking could be feasible [3], since the only way to test its intelligence would be through conversation. This prompted prominent researchers at the time to analyze this topic in more detail: led by Dr. John McCarthy, several experts met in what is known as the Dartmouth Summer Research Project on Artificial Intelligence [4]. In 1956, they discussed how to transfer human reasoning to a machine, effectively founding the AI research field, where they would go on to become leading researchers for decades to come.

What followed was extreme excitement over the potential of artificial intelligence, which became further incentivized by the appearance of innovative systems such as ELIZA [5] or the Perceptron [6], or even the multitude of optimism coming from lead researchers [7].

Government institutions were racing to invest and capitalize in these technologies, but couldn't help but feel disappointed when, in the 1970s, they failed to produce meaningful results. Moreover, Minsky and Papert publishing a book [8] affirming the Perceptron's limitations and James Lighthill releasing the famous "Lighthill report" [9] put the final nail in the coffin. In the eyes of these institutions, public money was now misplaced and research funding to AI was to be cut, leading to the remarkable first AI winter.

In fact, this wave of optimism and letdowns happened once more: expert systems dealing with a subset of knowledge appeared [10][11] in the 1980s. They were much more practically inclined and their applications in real life were plausible, which excited investors and the general public. However, they still had to deal with the lack of proper computing power and ended up suffering from much of the same fate as their predecessors.

Only in the 90s and early 2000s was AI to pick up steam again, accompanying the rise of the personal computer and overall computing abilities. Deep Blue remarkably beat Garry Kasparov in the game of chess [12], signaling to all the people watching on television and the overall world, that AI was here to stay.

2.2 Modern systems

Reflecting upon history, we can't deny the current AI summer we live in: the technological limitations of the past are generally suppressed, Moore's Law [13] has continued to hold until very much recently; investment is continuing to grow at an astonishing rate [14]; research output is sky-high due to the democratization of Deep Learning tools (Pytorch, Tensorflow, among others), the topic being in the limelight of public attention and an abundance of private research investment [15].

Our intelligent systems have now reached unprecedented scale, consider PaLM [16] with it's measly 540 billion parameters for instance. Along with their size, their inherent capabilities have also reached superhuman level in specific domains, take AlphaGo [17] who beat the reigning Go champion, a game notoriously difficult to "solve" with classical search problems. Furthermore, this particular model's successors are landmark achievements by themselves, MuZero [18] can also play Go with superhuman ability, except that it can also play Chess, Shogi and Atari, and no one even coded these game's rules into it, it just learned them.

With all this progress in mind, what sets this era of AI apart from the past is the sheer amount of private investment: most of the research developments are happening in institutions with ties to global enterprises, or directly under their tutelage (DeepMind and Google AI, OpenAI, Meta AI and many others). Since it's extremely profitable [19], almost every technological giant has an AI division.

In stark contrast with the winters of the past, computation is accessible through our phones, meaning that AI models have a much larger reach than the lab environment where they were built. When users easily interact with large language models, be it for translation or a personal assistant, and effectively improve their every day lives, they illustrate that AI models now have practical use cases.

3 Future

Regarding the future of AI, with computing power continuously increasing, we should observe a rather accelerated rate of technological advancements, spurring new and exciting use cases for AI. Therefore, before making predictions on what the future may hold, we should consider some aspects: the continued permeation of technology into our every day lives, the development of groundbreaking systems and, the regulations that will need to accompany these innovations.

3.1 Immersion

Firstly, there are some avenues for technology to become even more prominent in our direct lives: our smartphones could morph into something even more intrusive than what they currently are, making us even more susceptible to the technological zombies phenomena [20]; we could live imaginary lives in an imaginary world [21]; we could interact with technology directly through our brains [22], producing sensory data and being fed constant feedback on the world around us and, most importantly, profoundly altering our brain's structural framework.

The immersion of human beings in technology provides many opportunities for AI to be useful. From originating an absurd amount of data to creating more occasions for human-AI interaction, we will have to just wait and see what future technology looks like.

3.2 Artificial General Intelligence

As for AI innovations, we should obviously mention Artificial General Intelligence (AGI). AI researchers all over the world are working towards this end goal, this system that mimics the intelligence of a human being. How truly marvelous would this be? The possible societal impact this system would have would be extraordinary, but scientific admiration aside we should still be a couple of decades away [23].

Today, we have systems that are excellent at a multitude of tasks [24], but are still domain constrained. Meaning they can't learn new situations by themselves, they just reference a "database" for a particular signal similar to the one it's presented with. However, scientists at DeepMind

argue that through Reinforcement Learning, the technique used to construct these systems, we could induce the model into figuring out it's environment and actually learning [25].

Similar to what we've seen in the past, as long as these systems continue to deliver on their promises, funding is very unlikely to falter and summer should be indefinite. But the future is also uncertain and technological barriers might be hit, halting research progress and compromising the future of AI.

3.3 Regulations

Lastly, with great innovation comes great responsibility: proportional to the widespread adoption of these technologies are the dangers they might pose. Consider a possibly biased system making a life altering decision, we might have a faulty AI deciding whether someone gets a loan or not, deciding whether they deserve parole, amongst many others.

It's up to the governments to regulate these systems and find ways to protect their citizens from these models' shortcomings. Of course, researchers need to be wary of these problems when developing their models and balance the innovation versus risk scale. In fact, there has been a substantial amount of research in this direction, especially in the interpretability of models [26], in the robustness of models [27] and privacy respecting models [28]. However, this is a relatively young research topic and a lot of work is still to be complete.

Moreover, when we consider the European Commission's statement on AI [29], they absolutely recognize the potential these technologies have for the EU and hope to bolster investment in the member states, all while remaining cautious for problems that this might introduce and prioritizing the well-being of European citizens.

4 Conclusion

The future of AI lies somewhere in a harmonic compromise between innovation and regulation. As long as intelligent systems continue to improve and reach their proposed goals, we'll be living in a never ending AI summer.

However, we shouldn't fail to consider the risks it might bring and how they might pose a challenge to humanity. How many jobs will be replaced with intelligent systems? How will these workers be paid? Are we going to observe an exodus into AI and programming jobs? But not all the population is suited for these areas. Governments and prominent thinkers throughout the world need to seriously consider these problems, and they shouldn't take too long, or AI might just surprise them.

Additionally, on a personal note, I am very much excited to watch this all unveil. All in all, If successful, AI is bound to become an extraordinary revolution to the structure of our society, as its impacts will be sure to be unprecedented.

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