The economic impact of AI: will humans ever become redundant?

Abstract

Especially the latest achievements of AI like self-driving cars and Google's AlphaGo have increased the interest in economic and social ramifications. In this paper we take a look at the positive and negative predictions made by authors in the past and primarily focus on the impact a potential mass unemployment would have. Following that we present our own prediction. We will argue that with the right political measures, such as improvements to the education system and changes to society's expectation that everyone should spend the majority of their time working, the broad adaption of AI can indeed lead to an overall increase in life quality.

1 Introduction

Throughout history humanity has invented tools to reduce the effort needed in repeating tasks, facilitate technological progress and make life in general more pleasant. This process has started to accelerate with the invention of steam machines resulting in the Industrial Revolution reducing the amount of labour occupied by direct food production and allowing people to specialise. The development of computers in the last century has allowed an even higher pace of technological driven changes. With their help, more and more jobs can be automated and allowing companies to replace human workers with smarter becoming machines. Considering the by Moores Law implicated steady increase of computation power and the latest advances in the field of Artificial Intelligence, we should start to think about the future of our economy and society enabled by this development. Assuming that in the future machines and robots will be able to decide autonomously and conduct actions without human supervision that development raises deep questions about the fate of humanity.

To investigate a potential future, we will give an overview of different opinions brought forward during the last 30 years, first considering positive aspects in Section 2 as well as the potential downsides in Section 3. We shall focus on the impact Artificial Intelligence might have on society in general and the employment situation in particular. Based on this, we will conclude our own point of view in Section 4 and highlight potential pitfalls in the future development.

2 Positive aspects

Since a large part of the discussion surrounding the economic and social impacts seems to be dominated by negative news coverage and warnings against mass unemployment and its implications for society, the following section will largely focus to refute them and then later seeks to explore the benefits the arrival of true AI might bring. One obvious force that drives the development of AI is its potential economic benefit to current employers - once a software for a certain task is developed, the costs of running it are a fraction of what wages for human work would cost. While these gains may in parts lead to bigger profits for established players, they may also result in more affordable and abundant goods and services for consumers. Not only can AI make the provision of goods and services known today cheaper, it will most likely also facilitate inventions inconceivable today.

The most prominent argument brought forward by critics of AI therefore its implications for the job market and its potential to make a large number of jobs superfluous. Initially, we shall counter the grim prediction of mass unemployment caused by AI. Since predicting future economic developments is highly speculative it might be a good idea to look at previous transitions in history, where technological development made large numbers of jobs redundant. The obvious parallel is the industrialization with its replacement of manual labour by mechanized production. As pointed out by Nilsson in (Nilsson, 1984, page 6), automation has eventually led to a net increase in employment opportunities, and correlation between a high degree of automation and low unemployment quotas can still be found today when comparing different economies throughout the world. The notion that the major technological transitions

of the past have - after a transitional period of economic turmoil - had a positive effect on the job market is supported by various economic and AI researchers, as indicated in the survey (Anderson and Smith, 2014). One can assume that at the time, the invention of the steam engine and the mechanical loom was perceived as just as threatening as one might perceive the arrival of AI now, but as society adapted to the major shift back then, it is reasonable to assume that it will now as well.

For instance making many positions occupied by white-collar workers superfluous might release the creative and inherently human potential of these workers. Instead producing goods that can be made using various means of automation, the economic sector surrounding artisanal and handcrafted products might see significant growth. This argument has been brought forward by Tony Siesfeld in (Anderson and Smith, 2014), among others.

A necessary major policy challenge is to avoid the monopolization of the knowledge about AI, as well as the profits made using it. Since the replacement of human workers by machines results in an increased profitability of capital, there is the risk of amplification of existing disparities in wealth. A situation in which only a tiny fraction of the population controls access to AI technologies would be undemocratic and inevitably lead to economic disparities large enough to disintegrate society as a whole. However, it is equally possible for policymakers to seize the opportunity that the economic transition offers to create a more equal society. Both the technical knowledge and the profits surrounding AI need to be distributed through some mechanism. As James Albus has suggested in (Nilsson, 1984), shares in AI companies funded by the Federal Reserve System could be issued to the general public so "[e]veryone would be a capitalist, not just the wealthy".

Finally, contrary to the widely held belief that the time humans spend working has steadily decreased since prehistoric times, there is strong evidence that the high individual workload around the industrialization - and to a lesser extent ever since - might be a historic anomaly. As Juliet Schor notes in (Schor, 1992), the average number of working hours peaked around the 1850s, but was lower in the 13th century than it is today. It has been estimated in (Sackett, 1996) that in pre-agricultural societies, the daily workload was as low as 6.5 hours per day. Therefore one should not consider an overall reduction in workload for humanity an economic failure, but rather a return to a normal state, in which every individual works fewer hours per day. That puts fears of mass unemployment with the arrival of AI into perspective, as they are based on the assumption that the workload of the individual will stay constant.

If the reduction of overall workload is met with appropriate policies, its effects on society can be expected to be largely positive - Nilsson predicts in (Nilsson, 1984) a liberating effect by eliminating the need for dull work to be done by humans and quotes Margaret Boden who sees a "rehumanizing" power in not having to work for the larger part of the day and argues that for instance in traditional Polynesian society, the abundance of natural food sources led to little need to work fields for long hours, but society still functioned without the expectation of everyone working. As Francois-Dominique Armingaud phrases it in (Anderson and Smith, 2014), "[t]he main purpose of progress now is to allow people to spend more life with their loved ones instead of spoiling it with overtime while others are struggling in order to access work". We should therefore welcome the prospect of having less work to do rather than fear it.

3 Negative aspects

Even though humanity might eventually profit from the breakthroughs in the field of AI, it must also face significant challenges. While automation and development of new tools and technologies has transformed human work throughout history, some researchers argue that AI is fundamentally different from other forms of automation and that therefore, lessons learned from previous technological shifts do not apply.

Mark Nall, a program manager for NASA, is not the only one to note that, "Unlike previous disruptions such as when farming machinery displaced farm workers but created factory jobs making the machines, robotics and AI are different. Due to their versatility and growing capabilities, not just a few economic sectors will be affected, but whole swaths will be. This is already being seen now in areas from robocalls to lights-out manufacturing." (Anderson and Smith, 2014) In contrast to the technological progress in

the last century that mainly replaced human muscle, today's information technologies will eventually bring a sophisticated artificial machine that could replace our brain. In fact, Carl Benedikt Frey and Michael A. Osborne predict that 47% of people in the U.S are employed in occupations that could be automated (Frey and Osborne, 2013, page 38). Already today's computer programs are handling some of the cognitive tasks. Stock trading, fraud detection, pre-trial research are just few examples where software has substituted human labor (Frey and Osborne, 2013, page 17). According to the article "AI, Robotics, and the Future of Jobs", in the next wave of automation machines will have great impact on range of industries: transportation, logistics, healthcare, customer service and home maintenance. (Anderson and Smith, 2014).

Even the breakthrough in computerization in the last decades have transformed labor market in US and other developed countries into a polarization of low-skills and high-skills jobs and lead to marginalisation of middle-skill jobs (Frey and Osborne, 2013, page 12). Marginalisation of middle-skill jobs will be even more tangible as AI starts to significantly displace human workers. As the result this could increase income inequality and creating permanent unemployable lower classes (Anderson and Smith, 2014).

In the essay "Artificial Intelligence Employment and Income", Nils J. Nilsson presents three ways to overcome these unemployment issues. The first one is to adopt the Luddite approach, which consists in refuting technology in favor of human labor. The second is to create economically unnecessary jobs in order to give work to all of us. The third one is to redefine employment, forget the idea of the "good old days" in which "everyone did an honest day's work for an honest day's pay" (Nilsson, 1984). The Luddite approach will only slow down the process of progress, but will never stop the technological breakthrough. The second approach will force humans to work for an uncertain purpose. Therefore, the only hope is to rely on a new idea of employment. Although Nils J. Nilsson explores some of these possibilities from different economists such as Kelso and Adler, establishing those systems will require tremendous incentives and regulations from a world organization. Some might argue this is very unlikely to happen since dangerous technological developments in the past like nuclear weapons also were not prevented this way, as pointed out by Bill Joy (Joy, 2000).

Moreover, the education will also have to cope with drastic changes as well, because "[...] only the best-educated humans will compete with machines. And education systems in the U.S. and much of the rest of the world are still sitting students in rows and columns, teaching them to keep quiet and memorize what is told to them" (Anderson and Smith, 2014, Howard Rheingold in). Not only is the education system unadapted to provide high skill workers to compete with machines, but also unable to keep the pace of change. Even today, this lack of flexibility manifests itself in a shortage of IT personnel. As Tae Yoo a Senior Vice President in Corporate Affairs at Cisco explains, "A ManpowerGroup study shows that in the Americas, 39 percent of employers report hiring challenges caused by IT talent shortages. Acute shortages were reported by employers in Brazil, India, Turkey, Hong Kong and Japan, where that number skyrockets to 85 percent. And across the globe, engineers, technicians and IT staff are among the top seven hard-to-fill jobs." (Yoo, 2014) This shortage reveals the sorry state of our educational system and this inability to face technological progress. In addition, the education will have more and more trouble to deals with such changes, because the pace of technological breakthrough is due to increase exponentially with the growing help of artificial intelligence.

The impact of automation on the labor market raises another important question regarding who will control such a power. In the article "Why the future doesn't need us", Bill Joy claims that either the machines will make their own decisions without human oversight or control of machines will be in hands of a tiny human elite. He argues that the consequences of the first are hard to predict, and therefore focusing on the latter is more reasonable. In this case, gathering this self-improving technology in a few hands will give the elite more control over the rest of the population than they have today. As Joy explains, if the elite is ruthless they could exterminate the mass of humanity should they be a burden for their existence. But he points out that the elite could also play the role of good shepherds and ensure that everyones physical needs are satisfied if they give up on their freedom. Both possibilities are, taking the current western value system as reference, undesirable (Joy, 2000).

4 Prediction

As advocates of both sides agree, the greatest challenge in the future will be to avert permanent unemployment of a large number of people that cannot contribute to the economy since there are machines that can do their jobs for a fraction of the cost and with superior results. We do believe that as a society, we have agency in determining the outcome of this development and strongly oppose technodeterminism, a term proposed by Seth Finkelstein in (Anderson and Smith, 2014) to describe the notion that technological development itself induces the outcome for society. In our opinion, the development of AI offers a unique opportunity to humanity of raising the life quality of everybody and especially the living standards of the developing countries if we elaborate measures to counter possible pitfalls. These measures must include both fundamental improvements to the education systems to prepare students for a work-life on and with AI in the 21st century as well as a shift in attitude towards work in general - it might be neither possible nor necessary, that everyone spends the largest share of their life working. Instead we should nurture the development of alternative forms of occupation. Emphasizing the uniquely human social and creative abilities of humans will be key to the latter.

Sticking to our current economic approach people working less there will lead to a lower demand for products and services because of a reduced income. This would consequently lead to an economic collapse which in turn would lead to reduced employment. The future employment situation therefore mainly depends on what form of income distribution will be applied. Since it is desirable to avoid a further amplification of social and economical disparity, this is a rather pressing issue. The changes during the industrialization took place over longer period of time which meant that humans had better possibilities adapting to their new life The accelerated pace of development demands that social reform efforts begin as soon as possible. With these restructuring efforts it is equally important to prevent the concentration of the power of AI in the hands of few individuals. Either private companies or a socialist state through large government funded projects could ensure a transparent and open development leading to a distribution of the benefits of AI.

In a long-term, nothing is set yet, and it is hard to predict what is going to happen. Many factors have to be considered, from social and political factor to technological limitations. Our societies have faced these challenges before - during the industrialization for instance. The outlook the was equally grim, but they have coped by adopting new educational policies. There was however a painful transition period. One may expect the arrival of meaningful AI to trigger a similar period, but in the end, society will find a way.

5 Conclusion

Independent of the actual technological development it is for safe to say that AI is going to have a dramatic impact on world's economy. Depending on how humans will address the risk of mass unemployment we might end up either having a utopian future where everybody will have a reasonable standard of living or more dystopian one. We argue that a positive outcome is realistically achievable, if meaningful changes to the education system and the individual working time are made.

References

Janna Anderson and Aaron Smith. 2014. AI, Robotics, and the Future of Jobs.

Carl Benedikt Frey and Michael A Osborne. 2013. The future of employment: how susceptible are jobs to computerisation. *Retrieved September*, 7:2013.

Bill Joy. 2000. Why the Future Doesn't Need Us. *Wired Magazine*, 8.04.

Nils J. Nilsson. 1984. Artificial intelligence, employment, and income. *AI Magazine*, 5(2):5–14.

Ross De Forest Sackett. 1996. *Time, energy, and the indolent savage : a quantitative cross-cultural test of the primitive affluence hypothesis*. Ph.D. thesis, Ph. D. University of California, Los Angeles.

Juliet B. Schor. 1992. Pre-industrial workers had a shorter workweek than today's.

Tae Yoo. 2014. 5 ways we can prepare the next generation of workers for tomorrows technology.