The Future of Robotics, Labor, and Society

Alex Tacescu

HUA 4900 Robotics, AI, and Ethics

Worcester Polytechnic Institute

The Future of Robotics, Labor, and Society

Introduction

Throughout history, humanity has focused to become more and more productive. From the moment we as cave-men built our first fires and developed our first tools, we have strived to create bigger and better things. In just roughly 12,000 years (Stringer, 2016), we have walked the moon, built structures like the pyramids and the Burj Khalifa, developed computers that can think for themselves and drive cars, and visited other planets! None of this, however, was possible without the constant persitence to improve and move humanity forward. This focus has also introduced automation several times throughout history. Therefore, we should look at this past history as well as current trends to explore 3 stages of automation in our near future and the many ways society and humanity can deal with the dramatic change in labor and economy. Initially, humanity will find jobs for those who are displaced via retraining. As time goes on, jobs will continue to be removed and a universal basic income will be placed to allow for all to survive. The last jobs will be focused in creativity and personability while working alongside AI and robotics to push humanity to new heights. Let's take a trip down a potential future.

Learning from History

It is generally accepted that there have been 3 major industrial revolutions throughout history, although humans have been attempting to mechanate things since the time of Greek empire (Pouspourika, 2019). The first indusrial revolution started in 1765, and included the mechanization of agricultural tools, like the horse-drawn cradle. A century later, humanity industrialized once again, this time grasping control over energy in the form of electricity, oil, and gas. This lit up cities, enabled the development of cars and planes, and most importantly created new machines to increase produced goods. The age of the production line was now here. Fast forward another 100 years, and the age of computers had arrived. With this came basic robotics, PLCs (programable logic compuers),

and of course the internet. However, while we enjoy the fruits of our past revolutions, the next (and potentially final) one is looming around the corner: the Robotics and Artificial Intelligence Industrial (AI) Revolution. And it is coming much faster than one may think.

Why is this important?

To prepare for the societal changes this revolution will bring, we can take a look at our history to premptively plan for our future. While we have been able to live "in the moment" without any plan in the past, advanced robotics and artificial intelligence allows for a sort of 'end game,' where we have the capability to no longer force people to do work (See Long-Term Section)!

While our potential in the future may seem exciting, it is important to look at the alternative as well. While some may say that it has just worked out in the past, we can't rely on such a mentality this time around. Without planning, we risk an extreme wealth and power gap, never before seen in history. The few owners, developers, and maintainers of the advanced and artificially intelligent robots will profit at an unprecedented rate if no regulation, taxation, or other plan is created. In the past, we've been able to use government regulation to control the outliers in capitalism, like John D. Rockefeller (oil), John Jacob Astor (real estate), JP Morgan (banking) and Andrew Carnegie (steel) (Llewellyn and Thompson, 2018). However, the potential billionares and trillionares in the future can have so much power in society that we may have no choice but to bend to their demands. A quick look at history depicts a warning; JP Morgan, Rockefeller, and Andrew Carnegie infamously had strong control in late 19th century and early 20th century American politics, until **PRESIDENT** famously introduced many governmental reforms to attempt to prevent such an issue.

While government regulation may be a suitable solution, I truly beleve societal change is the correct answer to this threat. By implementing a fundemental change in the way we develop, share, and profit from software (and maybe even hardware), we can

democratize innovation, and prevent the possibility of capitalistic control as seen in the past. The open-source movement is a great current-day example (**INSERT IN-TEXT CITATION**) - a movement I am particularly very passionate and involved in. As we move forward in the future, we will see the

Robotics and AI is coming, and it's coming fast!

There is no squestion that robotics is a booming industry. The growth of robotics has been compared to the Cambrian Explosion, where life on Earth experienced a very short but rapid growth and diversification (Pratt, 2015). Similarly, the field of robotics - and by extension Artificial Intelligence (AI) - has benefited to the growing complexity of complicated algorithms as hardware (like microelectronics and single-board computers) becomes cheaper, more accessible, and more powerful.

This will result in more automation, reducing costs of goods and allowing for humanity to focus on what they do best: creativity. However, this also will remove many of the jobs people currently hold. Communities will therefore seek to adapt to the inevitable automation (Green, 2019), as people are forced to adjust to the new reality.

<center>**Short-Term (< 20 years)**</center>

With the current growth of technology, it will not be surprising if most jobs are affected by automation in some way in the next 20 years (Rutkin, 2020). At the heart of every one of these jobs is a person who relies on the paycheck they receive to stay healthy and happy. While the idea of optimizing our society with automation to make high quality things more affordable and available, it is extremely important to remember those who will suffer from the change. According to a statistical report written by Oxform in 2013, nearly half of jobs may be replaced by some form of automation (Frey and Osborne, 2017). This includes computer programs that automate tasks, physical robots interacting with the physical world, and artificially intelligent systems that decide the best path to take. So what exactly will the world look like by 2040?

Outlook on Robotics and Jobs by 2040

While most of us agree that robots will take over jobs in the future, it is hard to predict exactly what will change in 20 years. The first jobs to be automated are those that either pose a health risk (ex. repetitive injuries, heavy lifting risks, etc.) or are very mundane that doesn't require extreme amounts of dexterity. Most factory and warehouse jobs will fall underneath this category, including material handlers and some general assembly associates. Other minimum wage jobs may also suffer in the next 20 years. David Autor sees most of these jobs reduced and replaced with robotics (Autor, 2015). The reduction of minimum wage jobs will also hit young people the hardest, since most of these jobs are held by those who are trying to get through college or are just out of high school, as they act as stepping stones to more permanent professions.

On a more positive note, many jobs will thrive and grow! Software development and eningeering positions will obviously benefit in this moderately robotic future. However, several professions may actually indirectly boom with the addition of automation. According to a recent report by the U.S. Bureau of Labor Statistics, healthcare jobs will thrive in the next decade. While initially this may seem unintuitive, artificial intelligence and robotics will work alongside doctors and nurses to better detect and treat diseases and illnesses ("U.S. Bureau of Labor Statistics Outlook", 2020). For example, a mixture of artificial intelligence algorithms in communication with a physician and an MRI (Magnetic Resonance Imaging) compatible robot can take significantly more accurate biopsies of cranial (brain) cancer patients (Fischer et al., 2008). The current method has a surgeon look at MRI images and blindly guess a location and depth for needle incertion. Technologies like this won't replace jobs, but rather improve accuracy and quality of care. It shows that automation can work alongside people to make a better place and world.

Potential Solutions for Job Loss

While the outlook on minimum wage labor looks bleak, the U.S Bureau of Labor Statistics actually predicts that the number of jobs will increase by roughly 6 million ("U.S. Bureau of Labor Statistics Outlook", 2020), even though the market will look very different from what it is now. Since people will be displaced from their regular jobs, society should put in place some plans to avoid social and economic backlash from the change of labor.

Retraining Programs.   One of the most proposed solutions to the issue of labor displacement caused by automation has to be retraining programs. This highly debated topic argues that either goverment and/or companies who implement job-removing automation should create retraining programs for displaced workers. This seems like a win-win for all involved, and encourages a more educated and specialized society. However, many issues remained unanswered with current implementations. The first is the argument of desire. Some people argue that those who's jobs are displaced don't want to be retrained in another field, but rather want to stick to their original job (Miller, 2017). However, most jobs removed during this time period would be minimum wage or close to minimum wage positions usually done by those who have minimal education and few choices to switch to a more desireable carreer path. Essentially, those who work these types of jobs don't work because they want to but rather because they have to. Introducing them to a more technical field - like low-level sotware development and mechanical drafting - is a great way to give people who may be struggling a chance at a higher paying carrier. One great example of this is a non-profit organization working to retrain coal miners to website development. Although it is too early to tell, inital indications show that the people who have gone through the program have ended up living a healthier, wealthier, and happier life (Pham et al., 2018).

The question of who would pay for these retraining programs is another topic of contention. Some argue that it is up to companies to retrain those who are laid off. A government mandate could force retraining through non-profit organizations that could

ensure the quality of classes. However, comapnies are likely to spend minimal effort and money to properly give their previous employees the training needed in a field that interests each individual. Rather, the government should be respobsilble to manage unemployment and work to encourage those who are recently displaced. The question of how governments should pay for these efforts lay in the idea of robot taxation.

Robot Taxation.   This innovative idea places additional costs on companies who choose to replace human jobs with automated ones by taxing each robot or system of automation per hour of work. This deincentivizes automation that replaces human jobs while paying for programs that do the work itself (Abbott and Bogenschneider, 2018). Goverments can then decide how to best distribute funds to help society with the increase in automation. Proponents also argue that it will better distribute wealth from the richest companies to the lower class in a society. However, the plan has several fundemental flaws. Such a tax encourages companies to avoid automation unless absolutely necessary, which would stiffle innovation and potentially leave a country behind technologically. It also poses a difficult question of which robot should be taxed and which should not be taxed, especially when the definition of a ŕobotór an artificially intelligent system is very loose. Finally, taxing robots and other forms of automation could bring voting into question. The argument that robots should be represented in government since they are taxed could be brought up, with similar claims as what the American settlers brought up to their English king back in the late 18th century. Ultimately, the question of robot taxation is a discussion our society will need to have. I believe each country will implement their own version of this law. However, those with the smallest tax (or no tax at all) will ultimately lead the technological development race.

Mid-Term

Outlook on Robotics and Jobs

Wealth distribution Solutions

Universal Basic Income.

Open-Source Movement.

Long-Term

Conclusion

References

Abbott, R., & Bogenschneider, B. (2018). Should robots pay taxes: Tax policy in the age of

    automation. *Harv. L. & Pol'y Rev.*, *12*, 145.

Autor, D. H. (2015). Why are there still so many jobs? the history and future of workplace

    automation. *Journal of Economic Perspectives*, *29*(3), 3–30.

    https://doi.org/10.1257/jep.29.3.3

Fischer, G. S., Iordachita, I., Csoma, C., Tokuda, J., DiMaio, S. P., Tempany, C. M.,

    Hata, N., & Fichtinger, G. (2008). Mri-compatible pneumatic robot for

    transperineal prostate needle placement. *IEEE/ASME Transactions on

    Mechatronics*, *13*(3), 295–305. https://doi.org/10.1109/TMECH.2008.924044

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs

    to computerisation? *Technological Forecasting and Social Change*, *114*(100),

    254–280. https://EconPapers.repec.org/RePEc:eee:tefoso:v:114:y:2017:i:c:p:254-280

Green, K. (2019). How unions can protect the workers vulnerable to automation.

    https://www.uniontrack.com/blog/unions-and-automation

Llewellyn, J., & Thompson, S. (2018). Capitalist america. Alpha History.

    https://alphahistory.com/coldwar/capitalist-america/

Miller, C. C. (2017). How to beat the robots. *The New York Times*, *7*.

Pham, Q., Madhavan, R., Righetti, L., Smart, W., & Chatila, R. (2018). The impact of

    robotics and automation on working conditions and employment. *IEEE Robotics &

    Automation Magazine*, *25*(2), 126–128.

Pouspourika, K. (2019). The 4 industrial revolutions.

    https://ied.eu/project-updates/the-4-industrial-revolutions/

Pratt, G. (2015). Is a cambrian explosion coming for robotics? *Journal of Economic

    Perspectives*, *29*, 51–60. https://doi.org/10.1257/jep.29.3.51

Rutkin, A. H. (2020). Report suggests nearly half of u.s. jobs are vulnerable to

    computerization. MIT Technology Review.

https://www.technologyreview.com/2013/09/12/176475/report-suggests-nearly-

half-of-us-jobs-are-vulnerable-to-computerization/

Stringer, C. (2016). The origin and evolution of homo sapiens. *Philosophical transactions of

the Royal Society of London, 371.* https://doi.org/10.1098/rstb.2015.0237

U.S. Bureau of Labor Statistics outlook. (2020).

https://www.bls.gov/news.release/ecopro.nr0.htm