

Analysis on the Negative Impact of AI Development on Employment and Its Countermeasures

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Abstract. While benefiting society, the technological progress of artificial intelligence (AI) has also brought a rising number of unemployed people and bred polarization in income distribution by threatening the low-skill and labor-intensive industry. To solve the negative impact of AI, policies about the taxation and subsidy on AI and the income-supporting program can be proposed. However, neither of them will work well to achieve sustainable social development. In the long run, technological progress will not be influenced by government policies, and capital will find its own path to a rapid growth. Income-supporting programs are short-term solutions, being ineffective and not sustainable. Based on the literature collected, the author came up with two practical methods to deal with the negative impact brought by AI to employment: the industrial relocation as a short-term solution and the reframing of the education system as a long-term solution.

1 Introduction

In 1997, Garry Kasparov, one of the greatest chess players in history, lost to Deep Blue, a supercomputer from the International Business Machine. “I always say I was the first knowledge worker whose job was threatened by a machine”, said Garry [1]. Only after 18 years, in 2015, AlphaGo, a largely self-taught Go-playing AI from DeepMind of Google, won Lee Sedol, one of the greatest modern players of Go from South Korea, with a final score of 4-1. A news title from IEEE Spectrum is interesting: “The AI owes its success to self-training deep neural networks, which can, in principle, be applied to other domains. Like your job” [2]. As defined by the National Artificial Intelligence Initiative Act of 2020, the term “artificial intelligence” means a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments [3]. The sentence “Like your job” is thus easier to be understood because of the definition above. Undoubtedly, the above two GO masters have high intelligence quotient, but still, both of them lose the game with the AI machine, so it is certain that the threat from AI is coming. The government must intervene to address the issues caused by the negative impact of AI. Several previous measures proposed to deal with the progress of AI did not work well to solve the negative impact of AI. In this paper, both a short-term solution and a long-term solution are provided to assist the government to resolve the negative impact of AI on employment and to realize sustainable social development.

2 The government’s attitude toward AI development

William Lee invented the stocking frame, a knitting machine, in 1589, hoping that it would relieve the workload of hand-knitting workers. Queen Elizabeth I, however, denied his application for patent protection. To his disappointment, the Queen was more concerned about the negative impact of his invention on employment and refused to grant him a patent, claiming that: “Thou aimest high, Master Lee. Consider thou what the invention could do to my poor subjects. It would assuredly bring to them ruin by depriving them of employment, thus making them beggars” [4]. At that time, the Queen and the guild could hinder the new technology, but at present, with a global network, it would be impossible.

Nowadays, governments play a key part in the development and application of AI. They have been adjusting their attitudes to AI and recognize that AI is essential to science, economy, and the governments’ self-management. Nevertheless, the governments still need to invest more in time and resources to respond to the challenges posed by rapidly evolving technology [5]. On the one side, the government is required to keep the development of AI against any algorithm bias, while on the other side, it is also supposed to solve the issues caused by the negative impacts of the rapid growth of AI, since “governments may be tempted to focus on the benefits of technological progress, while largely ignoring its negative impacts” [6].

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3 The negative impact of AI development on employment

It is difficult to find a solution to balance the positive and negative impacts of AI, and this kind of imbalance may lead to a large number of unemployed people and a polarization in income distribution, creating social instability. “The Computer Revolution of the twentieth century caused a hollowing-out of middle-income jobs” [7]. A sustainable society can not be realized with high unemployment and a polarization in income distribution. Instead, according to historical experience, they may cause serious problems.

As an example, Yangshan port in Shanghai, China, a key element of the Belt and Road Initiative, handles the cargo of the largest container ships that exist in the world. The port has the largest automated container terminal in the world. The initial transshipment capacity of the new terminal is 4 million TEU (Twenty-foot Equivalent Unit), which is 10% of the global capacity [8]. There are only 9 operators handling the automatic trailers and cranes. This world's No.1 deep water port has caused great concern in South Korea and Singapore, since this new full-automatic facility will pose a great risk on employment with a need of less operators, lower costs, and higher efficiency. Traditionally, 1000 operators are required for a port with such capacity. With AI technical support, only 9 operators are required, i.e., compared to traditional operation, less than 1% of labor is required. In other words, 99% of employees in a traditional port will be facing a risk of losing their jobs. Since the container handling capacity of the Yangshan port is more than the sum of all US ports, if the same AI technology and infrastructure were applied in the USA, the number of unemployed people would be huge. According to the National Oceanic and Atmospheric Administration, ports support more than 13 million jobs [9], and by June, 2022, there are 5.912 million unemployment persons in total in the USA [10]. The total unemployment rate would be tripled by the same AI technology used in Yangshan port. It is unacceptable for neither Democrat nor Republican.

The approximate 12 million additional unemployed people are only an assumption of the impact brought by AI. However, according to a report of PricewaterhouseCoopers (PwC) to the Department of Business, Energy, and Industrial Strategy of UK in 2021, around 7% of the existing jobs in UK could face a high probability of automation over the next 5 years, and the proportion will rise to around 18% after 10 years and just under 30% after 20 years [11]. According to the Office of National Statistics, the UK's unemployment rate was estimated at 3.8% in June, 2022 [12], and the 7% mentioned before nearly doubles the current rate. This kind of unemployment rate is undesired to the government and may cause great damage to society as a whole.

4 Countermeasures

4.1 Industrial relocation

To offset the labor replacement effect of AI globally, industrial relocation is a short-term solution. It is a common relocation route starting from USA/Europe to Japan/South Korea, then to China, and now to Southeast Asia. AI automation is the same route. Therefore the industrial relocation is only a short-term solution to the negative impact of AI on employment [13]. The industrial relocation usually means the transfer of employment. For example, a US shoe maker dismissed hundreds of workers in US plants and moved the machines to China for production, with design and sales teams still maintained in the US. However, this route is for labor-intensive industries, or low-end manufacturing, like garment and shoe production, in which the labor cost is still an essential factor in the cost composition. The unemployment in the USA will be compensated for the employment in China, thus the net impact on employment would be neutral. These kinds of relocation are still feasible and profitable since the cost of labor in these industries is still much lower than AI's automation process, but, anyway, sooner or later, these kinds of labor-intensive operations will be replaced by an AI automation process.

4.2 Education system reframing

In addition to industrial relocation, a relatively more effective solution against the negative impact of AI on employment is the long-term reframing of the education system to adapt to the labor market restructured by AI.

According to the New Occupation-Status Analysis Report of the Employment of Network Delivery Personnel issued by Ministry of Human Resources and Social Security of People's Republic of China on August 25, 2020 [14], there were around 13 million deliverymen (most of them with electrical motorbikes), while most of them were with an educational background of junior or senior high school. However, around 15% of them were with a college degree (junior college, undergraduate, master degree or higher), i.e., about 200K college students deliver the take-out to customers while this occupation only requires its employees to know how to operate an APP on the mobile phone. It is a huge waste of the resources for higher education, and a differential education system is required to cope with the employment pressure from AI and to adapt to the changing demand in the labor market.

According to the study of Carl Benedikt Frey and Michael A. Osborne, 47 percent of the total US occupations are in a high-risk category, meaning that nearly half of the associated occupations will potentially become automatable over an unspecified number of years, perhaps a decade or two [15]. In their study on the impact of computerization on employment, the probability of computerization for the employment is roughly a U-shape curve, i.e., 47% of occupations are at a high risk of substitution by AI, 19% of occupations are

at a medium risk, and 33% of occupations are at a low risk, according to the data from the Bureau of Labor Statistics in the USA. From the U-shaped curve illustrated in Figure 1, it is clear that the occupations, such as Transportation and Material Moving, Production, Office and Administrative Support, and Sales and Related, are at a high risk while Healthcare Practitioners and Technical, Education, Legal, Community Service, Arts, Media, Management, Business, and Financial, as well as Computer, Engineering, and Science are at a low

risk. The trend is supported by the study of John Hawksworth and Yuval Fertig. They stated that the sectors that would see the largest net increase in jobs in the long run include health (+22%), professional, scientific and technical services (+16%), and education (+6%). The sectors estimated to see the largest net long-term decrease in jobs due to AI include manufacturing (-25%), transport and storage (-22%), and public administration (-18%) [16].

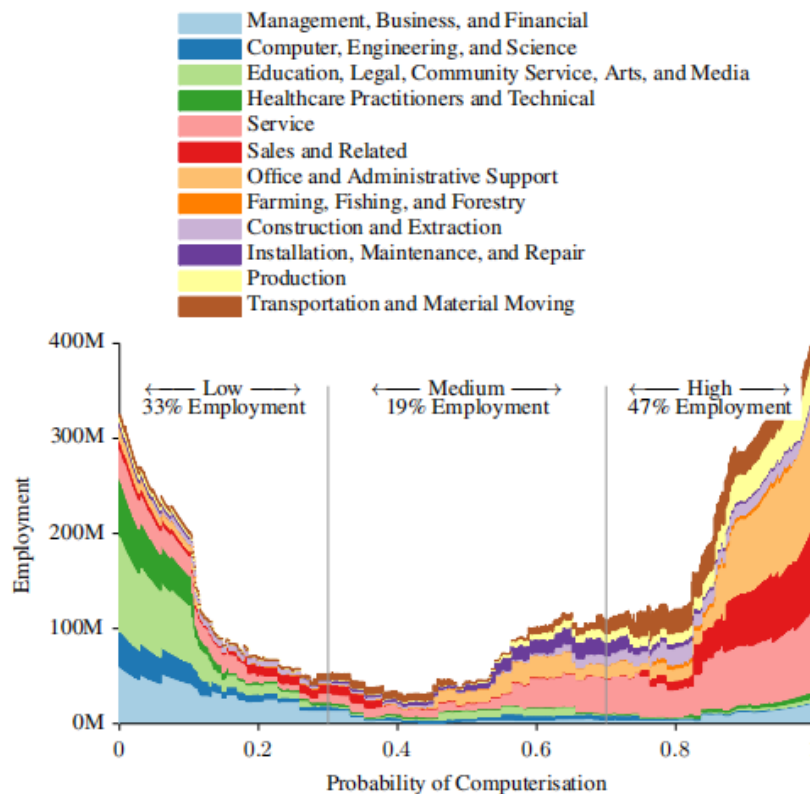


Fig. 1. The distribution of BLS 2010 occupational employment over the probability of computerisation, along with the share in low, medium and high probability categories. Note that the total area under all curves is equal to total US employment [15].

Therefore, in order to adapt to this AI employment substitution trend, it is required for the current education system to reduce the investment and resources on those occupations at a high risk, and meanwhile, there is a need to increase the investment and resources on those occupations at a low risk, thereby realizing a proper education resources allocation. For example, it does not seem to be reasonable for a college degree to deliver the take-out, which only requires the ability to operate mobile apps and the attention to the safety of others, without demands for calculus or Macro-Economics, etc. Instead of the discrimination for children's education opportunity, this is more from a perspective of a rational distribution of the education resources and a rational plan for education investment. For the mismatch between the demand on labor market and the occupational change caused by AI progress, it is the duty of the government to provide the right education and training in the right occupations for the individuals.

As Martin Ford mentioned in his research, in spite of the fact that there are only a few jobs available at the top

of the skill pyramid, more investment in education is still needed, especially the education of community colleges, since it can at least help employees without necessary skills grasp the existing job opportunities [17]. Although a community college may not be comparable to a TOP 50 or TOP 100 university in the USA, it can resolve the problem in the retraining of the labor force. This is already reflected in the USA National AI Initiative. In the initiative, the Education and Training is regarded as one of the six pillars. Besides, the STEM (science, technology, engineering, and math) education is also emphasized since it is necessary for the nation to conduct more effective education, training, and re-skilling [18].

5 Conclusion

In 2017, AlphaGo "retired" since it could not find a rival. Meanwhile, based on its deep learning strategy, a number of other AI Go systems are developed and improved at a rate not imaginable for a human player. Even a world championship is organized to check which AI Go system

is the best. What is more, the FineArt from Tencent, the champion in the 10th AI GO World Cup, is a “coach” of the Chinese GO team. It seems that the AI GO system has no obvious impact on human players since there are very few professional jobs in this occupation. Although the technical progress of AI has brought a huge increase in productivity, the negative impact of AI is still a deep concern for the government. The negative impact of AI on the labor market, employment, and income can cause a Mathew Effect, a polarization effect referring that the strong ones will be stronger and the weak ones will be weaker. This kind of polarization may cause turmoil or even riot in society. In order to better realize the stability and sustainability of the community, the government shall take actions in advance to offset the negative effect of AI. One of the feasible solutions is the industrial relocation, and another one is to provide specialized and differential education and training/retraining to the students and workers, responding to the polarization between the occupations with a low risk and a high risk caused by AI progress.

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