Contribution and Development Trend of the Robotics Industry in the Context of Declining Population Growth Rate

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Abstract. In modern society, with a higher level of education for women, the growth rate of the population is dropping. Together with the improvements in AI systems, robots might play a more crucial role in future development than before. However, some may argue that the application of AI may result in a high unemployment rate which is a phenomenon that the government does not want to see. This paper discussed the problems that arise from aging, the obstacles that have been met in the robotic industry and how to solve them. Although robotics is more sophisticated compared to the past and has already had a significant state in the automated production industry, there are still obvious shortcomings in personalized service since it is too difficult for language models to understand human reactions. In the future, this issue might be solved by instilling more expertise in AI, as well as writing new programming code might solve the existing problems.

Keywords: Aging; Industrial and social robots; Unemployment.

1. Introduction

1.1. Background

Recently, with the ongoing upgrading and development of AI systems and chips, the industrial robots applied in manufacturing have a more important status than before and industrial automation has become the norm. As most countries may use automated industrial robots during the process of production, the slow growth rate of labor has gradually become a major dilemma. Meanwhile, whether AI will completely replace labor to put into more efficient production in the future has also become one of the controversial topics.

An early definition of a robot was 'A mechanical device capable of automation specific tasks, mainly in industrial production and related fields.' Which originated in the early 1950s by American scientists Joseph F. Engelberger and George Devol who invented the world's first industrial robot, the Unimate, and developed a control system for it, which marked the beginning of the mass production of robots and is considered one of the most significant events in the history of robotics.

1.2. Related research

The usage of service robots in a variety of disciplines including economic and social growth, including medical rehabilitation, education and entertainment, domestic services, and emergency situations, has developed quickly in recent years. The conclusion is that the services of robots are still in the stage of decentralized development globally, it is needed to strengthen the exploration of robotic perception, decision-making and execution is of great significance to the upgrading and modernization of traditional industries [1]. David H. Autor's view is that the utilization of industrial robots can affect the unemployment rate of the regional labor market and their income, automatic production stimulates the innovation of production, and the wide-spread skill might replace traditional labor, resulting in a high unemployment rate. Also, David H. Autor confirms the substitution effect of manufacturing employment using industrial robots. However, disagrees with the overall employment rate [2].

Despite the heated discussion over how these new automation technologies would affect the labour market, there is little to no factual support from emerging nations. Effects are more pronounced in men, employees in their peak years, and low-skilled workers in general. Results are consistent with

include individual fixed effects and taking advantage of within-worker variations in robot exposure over time. Osea Giuntella and Tianyi Wang's research find a large negative impact of robot exposure on the employment and wages of Chinese workers by using aggregate data from Chinese prefectural cities and individual longitudinal data [3]. According to David H. Autor, many of the functions that are now packaged into these professions cannot be easily unbundled, with machines executing middle-skill tasks and people performing merely a low-skill residue without a significant reduction in quality. Workers that virtuously integrate technical and interpersonal activities are dubbed "the new artisans" by Lawrence Katz, while Holzer reports that "new middle-skill jobs" are expanding fast, even as conventional manufacturing and clerical sectors decrease. Effects are more pronounced in men, employees in their peak years, and low-skilled workers in general. Results are consistent with include individual fixed effects and taking advantage of within-worker variations in robot exposure over time. Artificial intelligence (AI), automation, and new technologies may boost production and growth, which might eventually lead to a rise in the demand for people with more advanced skills [4]. Another study examined the nature of AI activity in the US labour market and its effects on hiring, skill change, and changes in employment and pay at the industry and profession levels. Based on the work of Brynjolfsson, Mitchell, and Rock, we discovered that Webb is still present but less robust with our third measure, SML. Additionally, they predict steady and significant changes in the competencies required for high-exposure companies [5].

However, A great deal of the research on automation and deindustrialization ignores demand factors. In James Bessen's research, whether automation brings a decline in aggregate employment depends not just on these individual industry responses, but also on pullovers, effects on downstream producers, and general equilibrium effects on labor demand. Demand was highly elastic during the early years of automation in these industries, but it became highly inelastic by the mid-20th century [6]. Labour displacement from production can take two forms: employment displacement and labor-share displacement. To conclude from this, the growth of productivity and labour demand at the industry level and the evolution of labour demand in aggregate have no obvious direct bounds between each other. Susskind develops a model contrary to the views of Asimoglu and Restrepo, in which the immobilisation of labour is guaranteed as automation progressively erodes all work tasks and labour is ultimately eliminated, but not because the decline in labour scarcity does not stimulate the endogenous creation of new labour-using tasks or labour-complementary technologies. [7]. To create an endogenous growth model that incorporates automation and horizontal innovation, ndogenous increases in low-skill salaries result in an rise in the skill premium and a reduction in the labour share over time, increasing the proportion of automation technologies. In addition, the model must be calibrated to the US economy and demonstrate that it statistically matches the pathways of the skill premium, labour share, and labour productivity. [8].

Contrary to the assumption in the majority of the macroeconomics and labour economics that productivity-enhancing technologies usually enhance total labour demand, the displacement effect can lead to a fall in the demand for labour, wages, and employment. The productivity effect might manifest as an increase in the requirement for labour in non-automating industries as well as in the same ones that are automating. [9].

1.3. Objective

This paper aims to find out how robots will perform in separate industries in the future and the current state of robots. Section two will focus on the consequences the reason of declining birth rates and an aging population, as well as the current status and outlook for the use of robots in manufacturing. The third chapter builds on the second chapter by analyzing the shortcomings of existing robots, such as lack of imagination and creativity compared with humans and the methods that people use to mitigate these problems. Finally, it concludes with ideas for the improvement of interactive robots.

2. Drivers and current status of the robotics industry in the context of declining population growth rates

2.1. Problems caused by aging

According to the United Nations (UN), there might be a rise of 2.43 billion people in the world's population from 7.98 billion in 2022 to 10.41 billion in 2080, which could help the economy. The population did, however, rise by around 2.5 billion people during the course of the 31 years between 1970 and 2001, which is about half the time the UN predicts it would take for the population to grow by this amount again in the future. This occurrence indicates that the population growth rate is slowing down, and that it may potentially become negative in 2090 (Fig 1.) [10].

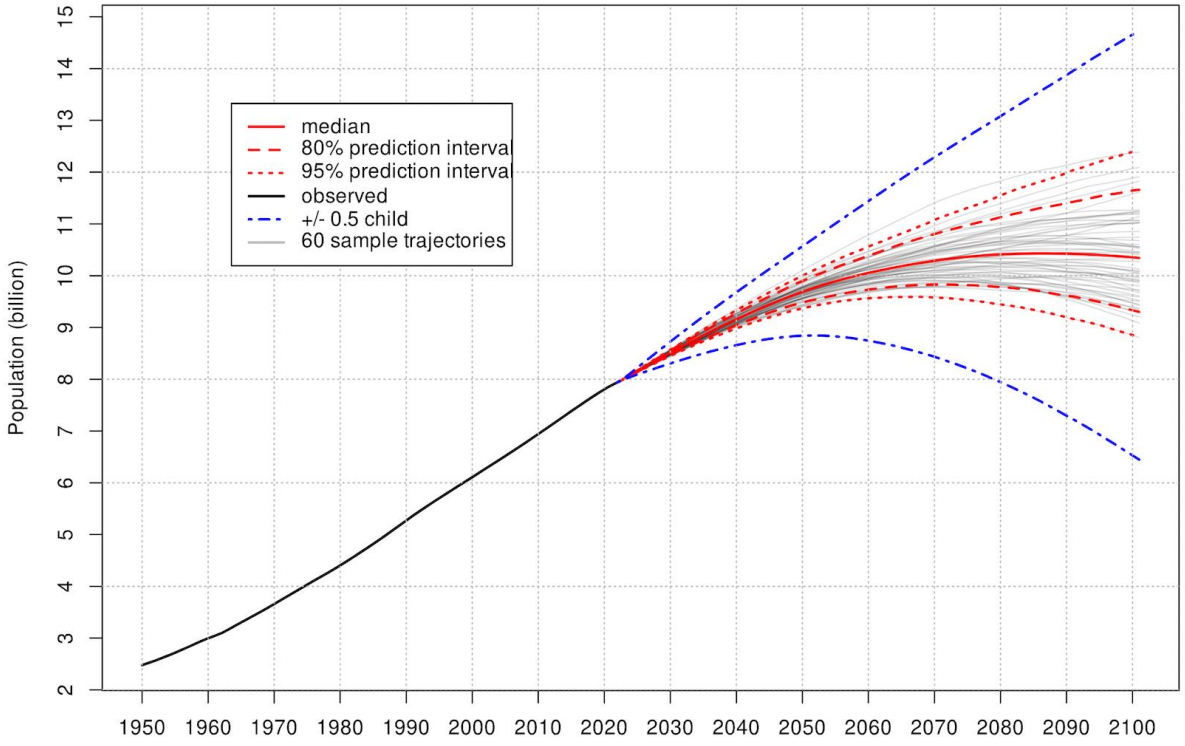

Fig. 1 World: Total Population

This phenomenon might be caused by the longer education time for women which can bring about empowerment of women, later marriage, later onset of childbearing, and smaller family size [11]. Although the effect might differ from each household due to various levels of wealth or other factors the precise mechanism is not well known [12]. The fact that there are more wealthy families is also one of the major reasons for this outcome. The time cost of caring for a child is often high, this means that the opportunity cost of raising a child is always larger for the rich, so the rich are reluctant to have children. In addition to this, the rich would argue that quality is often more important than quantity. Therefore, they will make every effort to raise one, rather than having more and more children. Thus, in general, if there are more rich families, the willingness of people to have children will decrease [13].

Based on this situation, as the working-age population declines due to aging, the industry depending on physical labor and manual work might face the issue that there is a shortage of skilled workers. Also, some personalized services might be influenced. On the other hand, improvements in automated factories could partially alleviate this problem.

2.2. The future of industrial robots in manufacturing

Through the production line, robots are employed in various assembly processes, performing tasks such as picking, placing, and joining components. They enhance speed, precision, and repeatability while reducing errors and labor costs. Since that labor may feel bored in the production line, the

intensive work is decreasing. Although specialization can help enhance the efficiency in short run, in the long run, automatic robots might be the better choice [14].

When working with people, cleverly mechanical robots do not as it were get what they got to do but moreover get what people are doing. In the future, the commerce show of the long-term fabricating industry will be to illuminate client issues, fabricating companies will not as it was offering equipment but moreover offer following administrations to urge more added esteem [15].
Also, Robots support personalized care for patients and elderly individuals. They can help with activities of daily living, monitor vital signs, and provide companionship, enhancing healthcare outcomes and improving the quality of life.

2.3. The current status of automatic robots

Currently, several studies show that artificial intelligence (AI) can help to achieve sustainable growth of the economy which is environmentally friendly. Since they are less energy-consuming, more nonrenewable resources can be saved for the next generation to achieve sustainable growth [16].

Early in the 1970s, serious studies on Chinese robots for industrial use began. Industrial robot technology has been heavily subsidised under several policies in China. This is due to the early sluggish expansion of the economic restrictions. Multiple domestic universities and research centres have collaborated extensively on driving and controlling research for industrial robots, including several Chinese universities and collages. Such accomplishments have provided a solid foundation for China's robotics research and manufacturing growth. China's industrial robot development is progressing according to schedule. By 2023, more than 50% of the industrial robots in use worldwide were in use in China's manufacturing sector, where there were 392 robots for every 10,000 workers. The installed capacity of industrial robots is increasing quickly, but service robots and special robots in China are also developing quickly. The application landscape is expanding, and the process of localizing fundamental components is speeding up. China produced 3.53 million service robot units in the first half of this year, increasing 9.6% over the same period last year.

The United States has several enterprises with global significance thanks to massive purchases of servers and related equipment for designing, research, development, and debugging.

In Europe, The manufacturer of factory robots assumes and fulfills the responsibilities of the industrial robot manufacturer in the design and integration of industrial machine manufacturing and application processes [15].

To sum up, intelligent manufacturing enables a faster integration of conventional manufacturing with technological advances. The emergence of intelligent machines—smart industrial robots that can sense, connect, and analyze—replaces some of the mental labour performed by humans in production and dramatically raises the level of manufacturing. Using digital control and network data, intelligent industrial robots may improve accuracy, quality, and efficiency. [15].

3. Problems, Mitigation Strategies and Prospects

3.1. Existing problems with robotics

Different cultures can have an impact on the implications of green conduct that AI can bring. While social impact, severity perception, response efficacy, response costs, effort expectation, performance expectancy, and other factors are important motivators of green behaviour in Malaysians, they are less important in Turkish. Integrating UTAUT and PMT theories to explain green behavior, explaining around 50% of the variance in Turkish and Malaysian individuals' green behavior [16].

In the field of human-robot interaction (HRI) which mainly concentrates on how self-driving machines are incorporated into our daily lives and how humans may interact with robots through all aspects of the environment. This study industries including rehabilitation, exoskeletons, and cooperative robotics. Each sector deals with similar problems that might arise while creating robotic services for people. When creating robots, safety must come first, and they must complement human labour while doing tasks safely. For instance, consider programming robots to recognize human

movements and gestures to avoid disturbances or collisions. In addition, user-friendly services and interfaces are necessary for productive human-robot collaboration [17].

Although AI can process large amounts of data and make pattern-based predictions, they often lack human-like thinking, judgments and creativity. For example, they may have difficulty understanding context, making nuanced decisions, or adapting to rapidly changing situations which limits their efficiency and effectiveness in certain areas.

Furthermore, in some cases, AI systems can only deal with the data they are trained on and the algorithms they use, such as ChatGPT. They cannot answer or react to any emotional issues and may even give wrong answers.

3.2. Methods to mitigate existing issues

Personalization and localisation are two features of social robots and factors that might influence their actions. In order to support a specific user or group of users, a personalised robot tailors its skills to their needs. It can conclude the preference, needs, personality, and even characteristic of individuals and gives them a hand in certain situation. In contrast, localization describes how a product is tailored to a certain nation or area. It incorporates the idea of "culture." Not only the residents in different countries may experience culture shock, but the robots, in order to help the robots better work in every region, designing them with various local cultures is the most critical part [17]. Robots with these skills are what are referred to as adaptable social robots (ASR). ASRs are described as an autonomous or semiautonomous robot [18]. As a result, an adaptable robot that learns from people may adapt and change its behaviours to be semiautonomous.

Some robot models like ChatGPT, are powerful language models which lack some professional knowledge and school words in certain areas like medicine, law and finance. In this case, users can apply a large amount of domain-specific data to train them. This can help them to better understand and deal with the issues in certain areas and can provide accurate responses in the future. However, the effect of the train depends on the quality and quantity of the material. Besides, the emotions and expressions of humans are still too hard for the language model to understand.

3.3. Perspectives on Interactive Robots

For social robots, scientists are now designing them in a human-liked way, since the public used to define that to provide better services, the social robots should have the same outlook as humans have. However, the "Valley of Terror" effect might be an issue. Thus, the major of social robot improvement should still focus on localization. For instance, they can learn more internet terms so that they can better understand young people's daily communication. Maybe in the future, social robots can replace labor efforts in some industries.

For language models like ChatGPT, how to make them understand the human language and mode is still a challenge. This goal is hard to achieve in the short run as human emotions are still a mystery. Thus, the only way to mitigate this situation is to explore the base of knowledge of certain areas.

4. Conclusion

The current states and limitations of robots, and the consequences of the aging population have already been discussed in this paper. Finding that due to factors such as longer school time for women, later marriage, childbearing, and smaller family sizes, the growth rate is expected to decrease, potentially negatively by 2090. As the working-age population declines, industries relying on physical labor may face a shortage of skilled workers and personalized services. Advancements in industrial robots could help address this challenge.

At the present stage, enterprises use automatic manufacturing to integrate technology and traditional industries, utilizing smart industrial robots to replace humans in the labor market, improve precision, quality, and efficiency through digital control and network information and have already achieved wide application in manufacturing. Since they are already used to working with people,

providing some basic personalized care and monitoring vital signs. In the future, they may focus on addressing customer issues and providing additional services, ultimately improving healthcare outcomes and quality of life.

On the other hand, the drawbacks of human robots are obvious. AI systems often lack human-like thinking, judgments, and creativity, and struggle with context understanding, nuanced decision-making, and adapting to rapidly changing situations. They may also struggle with emotional issues and give incorrect answers. Such as example, a lot of students may use to help them find some idea about their assignment, ChatGPT may give them the incorrect answer in specific areas such as finance, law and medicine. In order to solve the existing issues, social robots are now specialized in aiding based on individual preferences, needs, and characteristics. Also, they provide localization service that involves adapting products to specific countries or regions, considering cultural differences. Adaptable social robots (ASRs) are autonomous or semiautonomous robots that use human-controlled speech to make decisions. Some models, like ChatGPT, can be powerful language models but lack professional knowledge in specific areas. Users can use domain-specific data to train these robots, improving their understanding and future responses.

In the future, the robotic industry still faces the challenge that the "Valley of Terror" effect may have an impact on users' experience. Meanwhile, in the short term, making AI fully understand human emotion and expression is a tricky task. So more experimental data, analysis and more advanced technologies are still needed to make breakthroughs in human-computer interaction. At the same time, one should also weigh the pros and drawbacks of a robot that fully understands the human mind: will the robot transcend the human mind and have its own subjective consciousness?

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