Future of Job Market in the Fourth Industrial Revolution

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ABSTRACT: In the fourth industrial revolution era, artificial intelligence (AI) technologies are rapidly developed and will influence our lives and societies in many ways. In addition, AI technologies can work together with other technologies such as the internet of things, 3D printing, block-chain, and quantum computing, that will make dramatic and rapid changes in society, which people may not be fully prepared for. With these new technologies, millions of jobs will likely be replaced, but there is also an excellent opportunity for new types of jobs to be created. For this reason, this paper will discuss the changes and challenges of the job markets in the future. This paper will particularly explore what kinds of jobs, in which robotics and AI technologies could replace human workers. Besides, this paper will discover some of the soon available AI-related jobs and explore what skills that humans need to develops to become a more attractive candidate to employers in future job markets.

Keywords: industrial revolution, artificial intelligence, human worker.

1 INTRODUCTION

In the Fourth Industrial Revolution Era, most large technology companies such as Google, Amazon, Facebook, IBM, and Microsoft have placed a high priority on the application and development of Artificial Intelligence (AI). In addition, the ability of AI to work together with other emerging technologies such as 3D printing, blockchain, the Internet of Things, biotechnology, virtual and augmented reality, and so on, will make dramatic and rapid changes in our lives and societies. As a result, AI technologies are nowadays impacting nearly every industry sector. Many industries are changing, and some of them are revolutionalized by AI, such as Finance, Travel, Health Care, Transportation, Education, Agriculture, and so on.

According to the report of Accenture Consulting, titled "Banking Technology Vision 2019 – Banking in the Post-Digital Era", 96 percent of bank business executives agree that new technologies have accelerated their pace of innovation over the past three years. In addition, AI technology is ranked by 47 percent of business executives as a leading technology that would have the most significant impact on their organization over the next three years (Accenture, 2019).

Some examples of how AI is improving the financial industry are the use of AI to make a credit decision, the use of chatbots for better customer service, the use of AI for fraud detection, and so on. With AI-powered operations, a bank can expect cost savings of between 20 and 25 percent (Accenture, 2019).

According to the report of the Statista Research Department (2018), the travel and tourism industry is one of the world's largest industries with a global economic contribution (direct, indirect, and induced) of over 7.6 trillion U.S. dollars in 2016. As with other industries, AI and other emerging technologies will affect and change the travel and tourism industry. Many AI services are implemented to improve the travel and tourism industry such as travel service chatbots, check-in by facial recognition, and hotel bookings by voice command.

Supporting AI technologies, the health care industry will be changed to allow people to receive more efficient and safer service. The traditional medical operations, such as analysis of health records or analysis of historical medical trends, are ideally suited to AI-powered tools. For example, one of these tools is AI assistant based on neural networks that were created by DeepMind and is used to identify the early signs of degenerative eye

conditions (Hern, 2016). Another AI assistant is IBM Watson that being used to analyze 1,000 cancer diagnoses (Hackett, 2016). Using these AI-powered tools can change the way diseases are diagnosed and treated.

Thanks to AI technologies, a machine now has three critical sensing capabilities, including the ability to see (*computer vision*), hear (*speech recognition*), and understand (*natural language processing*). For these capabilities, computer vision may be the most beneficial use cases for things like object detection and recognition, self-driving cars, and robotics. As a result, the transportation industry will soon be changed forever. For example, right now, every major car company is developing its own self- driving car. Another is the Kitty Hawk Flyer that is a fully electrical aircraft and can flow over water without a pilot's license (Hawk, 2019). Everything, including bicycles, motorcycles, cars, trains, planes, and ships, will be electric and autonomous in the future.

As we have seen, most of the changes in Financial, Health care, Travel, Transportation, and other industries will occur because of AI and new emerging technologies, and these changes will be happened rapidly, which people may not be fully prepared for. With these new technologies, millions of jobs will likely be replaced, but there is also a great opportunity for new kinds of jobs to be created.

2 DISCUSSION

2.1. Jobs that will be loss

In a paper of Oxford University's researchers namely Frey & Osborne (2013), they attempted to answer the question of how susceptible are current jobs to robotics and AI technologies. To do this, they proposed a novel method to estimate the probability of computerization for 702 detailed occupations. Based on occupations probability of computerization, they distinguish between high, medium, and low-risk occupations and attempt to estimate the number of jobs that will actually be automated. As a result, they indicated that around Forty-seven percent of total US employment will face the high threat of losing their jobs to robotics and AI technologies over the next decade or two.

According to the study of McKinsey Global Institute named "Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages", between 400 million and 800 million human workers could be replaced by AI and automation technologies and need to find new jobs by the year 2030. In total, 75 million to 375 million

may need to learn new skills and switch occupational categories (Manyika et al., 2017).

Based on another study of McKinsey Global Institute called "A future that works: Automation, Employment, and Productivity", nearly 50% of human work tasks will be performed by automation technologies by the year 2055. Nonetheless, depending on the various factors, it could happen up to 20 years earlier or later (Manyka, 2017).

2.2. Jobs that will be replaced

According to Dr. Kai-Fu Lee, who is the founder of Sinovation Ventures, many jobs are most likely to be replaced by AI and robotics technologies in the future. He has developed a formula in which says that every kind of job that takes less than 5 seconds to think will be done by robots (Quartz, 2017).

Based on Martin Ford, who is the author of a book named "Rise of the Robots: Technology and the Threat of Jobless Future", the AI and robotics technologies will have an impact on the labor market. He supposed that many jobs are going to disappear, especially any kind of job that is routine or repetitive on some level (Ford, 2015).

Besides, according to several experts, AI and robotics technologies will take over many human jobs that require and rely on an analysis of data and trends, including jobs in healthcare and financial industries. Based on other experts, human jobs that require little human qualities such as emotional intelligence, creativity, intuition, negotiation, coaching, empathy, and complex communication will probably be replaced by robotics technologies. The McKinsey report proposed kinds of human jobs that involve physical labor in a predictable environment such as assembly line, fast food, or cleaning jobs will be the first to be replaced by robotics technologies (Manyika et al., 2017).

Besides, with the proliferation of AI technologies, including computer vision, machines such as cars, boats, trucks, and drones now can see. As such, self-driving machines now began to replace traditional jobs in the transportation industry, like taxi drivers, bus drivers, shippers, and so on. According to futurist Thomas Frey, 64 jobs will likely be replaced by AI and robotics technologies in the self-driving car era.

2.3. Jobs that are harder to be replaced

In the near future, there are many human jobs will be replaced by AI and robotics technologies. However, according to the study of Oxford Martin School, there are still many human jobs that will be

harder to be replaced by AI and robotics technologies. These jobs are grouped into three categories based on required skills, such as jobs that require hands-on manipulation, creativity, and social perception (Frey & Osborne,2013). There are examples of jobs of these groups, and their probability of becoming automated is shown in Table 1.

Table 1. Regression Result

Job	Prob. (%)
Hands-on Manipulation	
Oral surgeons	0.36
Makeup artists	1
Chiropractors	2.7
Fire fighters	17
Creativity	
Choreographers	0.4
Curators	0.7
Art directors	2.3
Social perception	
Mental health workers	0.3
Clergy	0.8
Nurses	0.9
Coaches and scouts	1.3

According to Rouhiainen (2018), several additional factors make some human jobs harder to be replaced by AI and robotics technologies. These jobs include jobs that do not involve large quantities of data, human interaction-based jobs, jobs with minimal repetition or routine, and jobs that are difficult to learn through simple observation.

2.4. New job opportunities

2.4.1. New job fields

Even though AI and robotics will replace human workers in many kinds of jobs and will make many jobs to be disappeared, but both will also generate many new kinds of jobs for people. According to Koetsier (2017), 13 fields will offer new innovative jobs and opportunities in the future. These 13 fields include:

- Artificial Intelligence: Making smart machines (including machine learning, deep learning, and neural networks).
- Augmented or Mixed Reality: Layering virtual data and images over the "real" world.
- Virtual Reality: Creating entirely virtual spaces.
- Drones: Flying, driving, walking, and swim-ming robots.
- Brain-machine Interfaces: The ultimate user interface: brain to a computer.
- Internet of Things: Connecting every "thing".

- Robotics and Automation: Manufacturing, science, assistive, companionship, and other types of robots.
- Genomics: Understanding, treating, and even (perhaps) enhancing natural DNA in us and other organisms.
- Data Science: Understanding, cleansing, and operationalizing data.
- Blockchain: Radically democratizing and publicizing records and structures of all kinds.
- Nanotechnology and Swarm Intelligence: Molecular-level engineering.
- Quantum Computing: Atomic-level computing.
- 3D Printing: Just-in-time one-off manufacturing and building.

Based on a study of Forrester Research, as a direct result of AI and robotics technologies, approximately 15 million new jobs will be created in the USA by the next decade (Passy, 2017).

In addition, according to a study of McKinsey Global Institute, as many countries will soon need to implement renewable energy technologies, up to 10 million new jobs will be created in the field of wind energy, solar energy, and energy efficiency (Chamberlain, 2017).

2.4.2. AI-related jobs

At present, most of the leading companies have placed a high priority on AI development and application to their work. According to Lasse Rouhiainen, there are six kinds of job that will be in demand in the future as follows (Rouhiainen, 2018):

- AI Chatbot Designer: know how to design a chatbot powered by AI to work as primary customer service and provide a positive user experience.
- AI Digital Marketing Expert: understand how to use AI-based tools to create more effective marketing strategies.
- AI Business Strategy Consultant: analyze and recommend ways to use tools like IBM, Watson, Microsoft Azure, Amazon Webservices, or existing solutions from well- known providers for developing AI services and products of a company.
- AI Strategy Consultant for the Public Sector: identify potential due to the introduction of AI into society and solve problems through AI training for helping society to become familiar and comfortable with the use of new AI technologies.
- Tech-Addiction Counselor or Coach: under- stan and know how to treat the emotional and physical impacts, the problems of the rapid growth of new AI technologies.

- Creativity Coach: help others to develop human-based skills, including social and emotional intelligence, and creativity.

Besides, there are also many impressive AI-related jobs like the gathered list from the Glassdoor website as follows (Chamberlain, 2017):

- AI Journalists: write articles about AI technologies for mainstream news.
- AI Attorneys: handle intellectual property and technical cases related to AI.
- AI Technical Sales Directors: understand and market products powered by AI to consumers.
- AI User Interface Designers: apply user interfaces on AI to improve their experiences.
- AI Marketing Managers: promote companies that sell AI-powered products and services.

2.5. Skills to strive for future

According to Lassen Rouhiainen, new AI and robotics technologies will bring considerable changes to the future job markets. Because of that, human needs to start developing skills that will make them a more attractive candidate to employers. In his opinion, there are 24 demand skills for the future grouped into two categories: people skills and business skills (Rouhiainen, 2016).

2.5.1. People skills for future

Self-awareness and Self-assessment: this skill helps people to recognize their full potential, weaknesses to be improved, and identify their uniqueness.

- Emotional Intelligence: this skill is people's capacity to be aware of and express emotions.
- Social Intelligence: this skill helps people to communicate and interact with others in various situations, including an understanding of the thoughts and opinions of others.
- Interpersonal Intelligence: this skill helps people to have a more balanced life, well-being and happiness by the ways that we communicate and socialize with our close family and friends.
- Empathy and Active Listening: this skill helps people to move forward in business and personal lives by a deep understanding of the ways in which people experience things.
- Cultural Flexibility: this skill helps people to quickly adapt to new cultures and new ways of working and living.
- Perseverance and Passion: this skill relates to patience for long-term gratification, which can be taught by sharing inspiring role models and case studies of successful people.

- A Focus on the Common Good: this skill helps people to work together by recognizing the value of the common good, rather than focusing on individual wants and needs.
- Mindfulness and Meditation: this skill helps people to success and achieve something high in various industries.
- Physical Training: this skill helps people to enjoy clarity, mental focus, and a healthier life instead of spending more time in front of the screen.
- Storytelling: this skill is one of the most natural ways for people to communicate with each other, which helps to evoke emotion and understand complex situations (Rouhiainen, 2016).

2.5.2. Business skills for future

- Problem-solving: this skill helps people to understand their co-workers, environments, tools, and machine which they interact with.
- Creativity: this skill will be a critical part of many career markets and helps people to develop unique and innovative ways to implement new technologies.
- Adaptability to New Technology: this skill helps people to adapt to new technologies that make them moving forward instead of falling behind or missing out.
- Entrepreneurial Mindset: this skill helps people to be able to experience the benefit changes in the job market caused by new AI and robotics technologies.
- Sales and Marketing: this skill helps people to understand the fundamentals of sales and marketing techniques, including how to communicate what they can offer and how to acquire new customers.
- Data Analysis: this skill becomes more important due to more things become digitalized, and data is the oil of the 21st century.
- Presentation Skills: this skill relates to the ability to speak and present to preserve groups of people.
- Environmental Intelligence: this skill helps people to understand how new technologies can help to preserve resources over time.
- Large-scale of Thinking: this skill relates to big-thinking that accounts for complexities and interwoven elements and will be very valuable.
- Accounting and Financial Management: this skill helps people to understand basic accounting principles in their personal lives and the complexities of starting, running, or participating in a business.

- Ability to Unplug: this skill helps people to be able to disconnect from their devices and spend more time with other peoples.
- Spotting Trends: this skill relates to the ability to recognize the signals of potential opportunities in the future and helps people to take advantage of their lives and businesses.
- Design Thinking and Design Mindset: this skill helps people to find desired solutions to complex problems and to be able to create the products and services that we cannot even imagine today (Rouhiainen, 2016).

3   CONCLUSION

Because of the proliferation of new AI and robotics technologies, the job markets will face potential changes and challenges in the future. As a direct result of these technologies, they will influence and make dramatic and rapid changes in our lives and societies. Many industries will be changed and revolutionized by these technologies such as Finance, Travel, Health Care, Transportation, Education, Agriculture, and so on.

Even though AI and robotics will replace human workers in many kinds of jobs and will make many jobs to be disappeared, but both will also generate many new kinds of jobs for people. In order to be fully prepared for these changes, people must start developing skills that will be the most valuable in the future. These skills will make them become a more attractive candidate to employers in future job markets.

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