

Job Displacement Due to Artificial Intelligence and Machine Learning: A Review

Agrim Jain

Student, Modern High School Delhi

Abstract

The advent of artificial intelligence (AI) has ushered in a transformative era across various industries, yet it has also brought about concerns regarding job displacement. As AI technologies advance, there is a growing realization that certain routine and repetitive tasks may be automated, potentially leading to a shift in the employment landscape. This paper gives an update on the current scenario regarding Job displacements using current literature. Jobs that involve routine data analysis, manufacturing, and customer service, for example, may face automation-related challenges. However, it's crucial to recognize that AI is also creating new opportunities and roles, demanding skills that complement and collaborate with intelligent systems. As societies navigate the impact of AI on the job market, proactive measures such as reskilling and upskilling initiatives become imperative to empower the workforce to adapt to the evolving demands of the digital age. Striking a balance between the benefits of AI-driven efficiencies and addressing the potential challenges of job displacement remains a critical aspect of ensuring a harmonious integration of technology into the workforce.

Keyword: Artificial Intelligence, Machine Learning, future jobs, Industries

Introduction

The integration of Artificial Intelligence (AI) and machine learning (ML) technologies in various industries has raised concerns about their potential impact on job displacement and employment opportunities. This research paper aims to explore the effects of AI and ML development on the job market and provide insights into the potential positive and negative impacts on wages, income inequality, economic growth, and the workforce.

The impact of artificial intelligence (AI) on jobs is a multifaceted and evolving phenomenon that has generated considerable discussion and debate. On one hand, AI has the potential to enhance productivity, automate routine tasks, and create new industries, leading to job growth in certain sectors. On the other hand, concerns arise about the displacement of jobs as AI systems increasingly handle tasks traditionally performed by humans. Routine and repetitive jobs are particularly susceptible to automation, raising questions about the future employability of workers in these fields. However, AI also creates new opportunities by spurring the demand for skills in areas such as data analysis, machine learning, and AI development. The net impact on jobs is likely to depend on various factors, including the pace of AI adoption, the ability of the workforce to adapt through reskilling, and societal decisions about the ethical and equitable deployment of AI technologies. Overall, managing the impact of AI on jobs requires a proactive and holistic approach that balances the benefits of technological advancements with the need for workforce development and societal well-being. Earlier it was expected the low skilled workers will be

the first to be effected by the development in technology but now the notion that many high skilled workers will also be effected as the development of AI and ML can make complex tasks very easy.

It is important to note that even though development in AI can lead to large scale job displacement but it is important to see that they might create many new employment opportunities. Hence a more comprehensive view is important.

Impact on Employment Opportunities

The increasing use of AI and ML technologies in sectors such as transportation, retail, finance, and manufacturing has the potential to automate various tasks previously performed by humans. This automation can lead to job displacement, as machines and algorithms take over routine and repetitive tasks. Low-skilled workers were initially expected to be most affected, but advancements in AI and ML have the potential to impact high-skilled workers as well.

However, it is important to consider that while AI and ML may displace certain jobs, they can also create new employment opportunities. The development of these technologies can lead to the emergence of new industries and the need for skilled professionals to design, implement, and maintain AI systems. The paper recognizes the need for a comprehensive view that takes into account both job displacement and the creation of new jobs.

Impact on Wages, Income Inequality and Economic Growth

The impact of artificial intelligence (AI) on wages, income inequality, and economic growth is a dynamic and complex interplay that varies across sectors and regions. On one hand, AI has the potential to boost economic growth by increasing productivity and efficiency, leading to overall wage growth. However, there are concerns that certain jobs may be automated, potentially leading to wage disparities and income inequality, particularly for workers in routine and low-skilled occupations.

The deployment of AI can result in a demand for highly skilled workers proficient in AI-related fields, leading to increased wages for individuals with specialized technical expertise. Simultaneously, there may be downward pressure on wages for jobs that involve routine and repetitive tasks susceptible to automation. This could exacerbate income inequality unless measures are taken to address the reskilling and upskilling of the workforce to meet the demands of an AI-driven economy.

Moreover, the overall impact of AI on economic growth depends on how effectively societies manage the transition and leverage the benefits of AI technologies. Policies that promote education and training, foster innovation, and ensure inclusive access to AI-related opportunities can contribute to a more equitable distribution of benefits, fostering sustainable economic growth. Balancing the positive potential of AI with considerations for social and economic equity remains a critical challenge for policymakers and businesses alike.

Education, Skills and Job Displacement

The impact of AI and ML on job displacement and employment opportunities can vary depending on factors such as education and skill level. While low-skilled workers may face higher risks of job displacement, it is increasingly evident that high-skilled workers are not immune to these effects. AI and ML technologies have the potential to automate complex tasks that were previously considered the domain of highly skilled professionals.

Investments in education and upskilling programs are crucial to equip workers with the necessary skills to adapt to the changing job market. Promoting lifelong learning and reskilling initiatives can help individuals transition into new roles and industries where their skills remain in demand. Additionally, policies that support the development and adoption of AI and ML technologies should also address the potential negative impacts on workers and provide support for affected individuals.

Implications for the Future of Work

The development of AI and ML technologies has significant implications for the future of work and the workforce. As automation becomes more prevalent, certain jobs may become obsolete, requiring individuals to adapt and acquire new skills. The workforce of the future may need to be more agile and adaptable, with a focus on skills that complement AI and ML technologies.

Furthermore, the ethical considerations surrounding AI and ML must be addressed. As these technologies become increasingly sophisticated, questions arise regarding data privacy, algorithmic bias, and the potential for job discrimination. Policymakers and organizations must work together to establish regulations and guidelines that ensure the responsible and ethical use of AI and ML technologies.

Literature Review

Rudra Tiwari (2023), The research paper titled "Exploring the Influence of AI and Machine Learning on Employment: Job Displacement and Emerging Opportunities" delves into the potential ramifications of the growing integration of artificial intelligence (AI) and machine learning in the job market. The document investigates the likelihood of job displacement in specific industries due to these technologies, as well as the prospective creation of fresh employment opportunities in alternative sectors. Additionally, the study scrutinizes strategies employed by governments and organizations to alleviate adverse effects associated with job displacement and to foster the emergence of new job prospects within the realms of AI and machine learning. In summary, the paper asserts that, despite potential drawbacks in terms of job displacement, the opportunities for novel employment within the AI and machine learning domain outweigh the anticipated negative impacts.[1]

David Paradise (2020), While AI with the potential to replace human labor has been recognized as a transformative force in society's future, past research has overlooked the prospect of extreme scenarios of labor displacement. In order to address this gap, we conducted surveys at three AI conferences in 2018, exploring opinions on both near-to-mid-term AI labor displacement and more extreme scenarios. Surveyed practitioners indicated that a median of 22% of tasks currently performed by humans could be automated with existing AI. They anticipate this percentage rising to 40% in the next 5 years and 60% in the next 10 years. Median forecasts also suggested a 50% probability of AI systems being capable of automating 90% of human tasks in 25 years and 99% in 50 years. Notably, practitioners across different conferences had similar forecasts for AI labor displacement in the current decade, but attendees of the Human-level AI Conference had notably shorter and more precise forecasts for the extreme labor-displacing AI scenarios. It's intriguing to note that the median forecasts for a 10% probability of automating 90% and 99% of human tasks were 10 and 15 years, respectively. In conclusion, researchers focusing on the future of work should carefully consider the relatively high likelihoods of these extreme labor-displacing AI scenarios.[2]

Pegah Moradi (2020), This chapter delves into the impact of artificial intelligence (AI) on employment and the workforce. With the increasing integration of AI-driven technologies into various workplaces and labor processes, concerns have arisen regarding the potential widespread displacement of human workers. However, the chapter challenges the prevailing narrative that predicts a complete takeover of jobs by robots. It argues that economic forecasts emphasizing significant job loss due to AI may offer limited practical insights as they often focus solely on technical aspects of task execution, overlooking broader considerations such as the social dynamics of work, organizational structures, and cross-industry effects. In an effort to provide a more comprehensive perspective, the chapter explores how AI might affect workers beyond mere displacement. It introduces four mechanisms through which companies are employing AI-driven tools to shift risks from themselves to workers: algorithmic scheduling, task redefinition, loss and fraud prediction, and the incentivization of productivity. By examining these mechanisms, the chapter aims to highlight the evolving nature of the relationship between AI and workers. Furthermore, the chapter considers potential policy responses to address concerns related to both displacement and the shifting of risks to workers. By recognizing the multifaceted impact of AI on work and employment, it underscores the importance of nuanced approaches in policy development to ensure a balanced and equitable integration of AI technologies into the workforce.[3]

Carl Frey (2013), In this study, they investigate the vulnerability of various occupations to computerization. Employing a unique methodology, we utilize a Gaussian process classifier to estimate the probability of computerization for 702 detailed occupations. These estimates serve as the foundation for our examination of the potential impact of future computerization on labor market outcomes in the United States. Our primary focus is on analyzing the number of jobs that may be at risk and exploring the correlation between an occupation's likelihood of computerization, wage levels, and educational attainment.

According to the findings, approximately 47 percent of the total employment in the United States is deemed susceptible to computerization. Furthermore, our research reveals a robust negative relationship between an occupation's probability of computerization and both wages and educational attainment. This suggests that jobs at higher risk of computerization tend to have lower wages and require lower levels of educational attainment. These insights contribute to a deeper understanding of the potential repercussions of advancing automation on the U.S. labor market. [4]

Placide Poba (2021), This paper undertakes an exploration of the implications of artificial intelligence (AI) on employment, employing a rapid review approach in accordance with established guidelines. The authors curated relevant insights from industry and government reports available up to August 2017, sourced from Google and Google Scholar, using a combination of keywords such as "job automation" or "work automation" along with technology-related terms like "artificial intelligence" and "machine learning." A total of 11 reports were included in this research.

The findings indicate that the advent of AI technologies is poised to have a significant impact on jobs in the near future, with automation affecting both routine and nonroutine tasks. The envisioned collaboration between humans and robots is expected to usher in unprecedented ways of working. Consequently, changes in employability skills are anticipated as the landscape of work evolves. Given the magnitude of these impending job-related transformations, the consulted reports advocate for comprehensive solutions that extend beyond the boundaries of individual organizations and industries, involving various

stakeholders. Furthermore, organizations are urged to reconsider their human resource (HR) functions, adapting them to align with the evolving realities of AI. This study sheds light on the multifaceted nature of the AI-driven changes in the employment landscape and emphasizes the need for collaborative strategies and adaptive HR practices. [5]

Pissarides (2018), Equally crucial for fostering inclusive economic growth is the social perception of various occupations. Many emerging service jobs, as previously described, often lack high social standing in the public consciousness. Addressing this requires a shift, possibly through the education system, to imbue these roles with greater respectability and allure for the younger generation as viable career paths. A notable illustration is the transformation of the chef's profession, which has gained elevated social status to the extent that top performers are now celebrated as media personalities. Similarly, personal trainers have evolved into highly skilled professionals with commensurate rewards, mirroring the elevated status of athletes. The key catalyst for this elevation in social perception is the recognition that these roles contribute significantly to the well-being of affluent societies, resulting in substantial rewards for outstanding performers. Such positive shifts in societal views not only enhance inclusivity but also contribute to the sustainability of economic growth.

In summary, it is essential to emphasize that the automation of industry, while enhancing productivity and societal wealth, also poses a threat to jobs, particularly those in routine mid-level positions. While the exact impact of the fourth industrial revolution on the labor market remains uncertain, the optimal societal response may involve a reduction in working hours for all, increased educational opportunities for everyone, a rise in labor-intensive service industry jobs, and a strategic combination of high wages and social provisions. This multifaceted approach aims to ensure that the benefits of economic growth are equitably distributed across society, addressing the challenges posed by technological advancements and fostering a more inclusive and sustainable future. [6]

Daren Acemoglu (2016), the research investigates the influence of artificial intelligence (AI) on labor markets, utilizing establishment-level data encompassing a comprehensive range of online job vacancies in the United States from 2010 onwards. Notably, we observe a substantial and rapid expansion of AI-related vacancies from 2010 to 2018, predominantly attributed to establishments where employees engage in tasks aligned with AI's existing capabilities. As these AI-exposed establishments integrate AI technologies, they concurrently exhibit a reduction in hiring for non-AI positions and a transformation in the skill requirements for remaining job postings. While these effects are discernible at the establishment level, the cumulative impact of AI-driven labor substitution on employment and wage growth within more exposed occupations and industries currently remains too marginal to be statistically detectable at an aggregate level. [7]

Sania Kukkar (2023), The rapid progression of computing, including artificial intelligence (AI), and automation technologies poses a significant potential for disruption in labor markets. While AI and automation have the capacity to enhance the productivity of certain roles, they simultaneously have the potential to replace tasks performed by others, fundamentally reshaping most occupations to varying degrees. This transformation occurs amid a period of increasing economic inequality, instigating concerns about widespread technological unemployment and prompting renewed calls for policy interventions to

address the consequences of technological change. This paper explores the obstacles hindering researchers from accurately measuring the effects of AI and automation on the future of work.

These barriers encompass the scarcity of high-quality data regarding the dynamic nature of occupations, a lack of experimentally informed models for key micro-level processes such as skill substitution and human-machine complementarity, and a limited understanding of how cognitive technologies interact with broader economic dynamics and institutional mechanisms, including urban migration and international trade policy. Overcoming these hurdles necessitates improvements in the longitudinal and spatial resolution of data, along with enhancements to information on work skills. These improvements will facilitate multidisciplinary research aimed at quantitatively monitoring and predicting the intricate evolution of labor in tandem with technological progress. Lastly, recognizing the inherent uncertainty in predicting technological change, the paper proposes the development of a decision framework that prioritizes resilience to unforeseen scenarios along with considerations for general equilibrium behavior. [8]

Badet J (2021), the study analyzes the advantages that automation presents for the job. The main new feature of our framework is that, in addition to the part of jobs that are displaced by automation, it also leads to the creation of new, more complex versions of existing tasks, which leads to the demand for employment. We focused more on the essential factor which is the degree of skill to take advantage of these new jobs. We carry out research based on information relating to automation and jobs. Also, by using the output of the final good model, we show that the creation of new tasks in which the labor has a comparative advantage is one of the positive aspects of automation. We find that automation will create new jobs (smart jobs) and eliminates repetitive jobs which will be replaced by machines in the future. However, these new jobs will need high skills. Therefore, the level and quality of education will play important role in the new jobs that automation will generate. Workers and future students must prepare themselves by focusing their training more on the skills that new technologies will require. Automation may prepare us for a future in which workers with low skills will be forced to change occupations or lose their occupations, which will be completely occupied by machines. We find also that the job loss depends on the speed of automation in each country. Based on the economic structure, the investment policy in new technology, and the level of education of countries, the speed at which automation spread is slower in some countries and intense in others. Therefore, the job is more at risk in countries with high automation than in those with medium or low automation. [9]

Pedro Bacao (2022), This study investigates the potential threat of artificial intelligence (AI) to sectoral employment in Portugal by examining its impact on productivity improvements. The theoretical framework is based on a supply and demand model for sectoral output, predicting that the influence of AI hinges on the response of labor demand to two opposing forces: the reduction in labor required due to improved productivity and the increased demand for output driven by lower production costs, subsequently creating more jobs. Utilizing a Bayesian multilevel approach, our estimates of industry-level elasticities of employment with respect to productivity for a sample of 32 industries spanning from 1995 to 2017 reveal consistently negative trends across sectors, suggesting a surprising uniformity in the relationship between productivity and employment levels. [10]

Conclusion

The impact of artificial intelligence (AI) on jobs is a topic of significant concern and speculation. As AI technologies continue to advance, there is a growing recognition that they may lead to job displacement in certain sectors, particularly those involving routine and repetitive tasks. While this raises concerns about potential unemployment, the future job landscape is expected to undergo significant transformation rather than outright elimination of employment opportunities.

In the future, jobs are likely to evolve, with a shift towards roles that complement and collaborate with AI systems. This transformation will demand a workforce with enhanced digital literacy, adaptability, and the ability to work alongside intelligent technologies. Industries that focus on developing and implementing AI solutions are expected to experience growth, creating new job opportunities in areas such as AI development, data analysis, and machine learning.

To navigate the evolving job market and safeguard against potential displacement, individuals should prioritize continuous learning and upskilling. Emphasizing education in STEM (Science, Technology, Engineering, and Mathematics) fields and cultivating skills that are uniquely human, such as creativity, critical thinking, and emotional intelligence, can enhance job security. Additionally, fostering a proactive attitude towards technological change, embracing new tools, and staying informed about industry trends can contribute to individual resilience in the face of AI-related disruptions.

In conclusion, while AI will undoubtedly impact jobs, the future holds opportunities for those who are prepared to adapt. Continuous learning, skills development, and a positive approach to technological change can empower individuals to thrive in the evolving job landscape shaped by AI.

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