IMPACT OF ARTIFICIAL INTELLIGENCE ON JOBS: UNEMPLOYMENT AND DISPLACEMENT

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APRIL, 2024

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A PROJECT SUBMITTED TO THE DEPARTMENT OF STATISTICS, FACULTY OF PHYSICAL SCIENCES, UNIVERSITY OF BENIN, NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE BACHELOR OF SCIENCE DEGREE (B.Sc) IN STATISTICS.

APRIL, 2024

UNDER-TAKING

This Project work was carried out by Precious Omowho Ugoso with the matriculation number PSC1909295. I have not plagiarized any work, rather I have made use of published works, which have been cited, and referenced appropriately.

CERTIFICATION

This is to certify that this work was carried out by Ugoso Omowho Precious of the Department of Statistics, Faculty of Physical Sciences, University of Benin, Nigeria.

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DEDICATION

This work is dedicated to God Almighty, for his infinite love, wisdom, and protection throughout my academic journey in the University of Benin. Also, to my Parents and

family for their thoughtful insights and assistance which made this project a reality, and to my friends and well-wishers, especially the 23’ graduating set of the Department of Statistics.

ACKNOWLEGDEMENTS

My profound gratitude goes to God Almighty for the infinite wisdom, strength, and grace he gave unto me throughout the period of this project.

My sincere appreciation goes to my parents Mr. and Mrs. B.I Ojanero and my family(immediate and extended) for their continous support at every point in time.

Also, I wish to acknowledge my able supervisor; Mr Cyril Oseremen Odijie for his assistance, support, corrections, and suggestions which helped in making this project a success.

I also wish to acknowledge the H.O.D, Prof. N. Ekhosuehi and other Lecturers of the Department of Statistics, Faculty of Physical Sciences, University of Benin, for their teachings and guidance throughout this academic pursuit.

Finally, I thank members of my crew; Musa Racheal, Chiedoziem Nwaorisa, Ejedawe Bethel, Victoria Ama, Omo-ataga Comfort, David Bamigboye, Ogheneovo Tracy, and every other person who helped, and encouraged me in one way or the other during this research work.

ABSTRACT

This study examines the influence of Artificial intelligence on jobs: unemployment and displacement. It captures the implication of Artificial intelligence on the workforce as a whole. The Literature review of the study was segmented into three(3) sections namely; Conceptual review, Theoretical review, and Empirical review.

Major Statistical tools of analysis used includes; data visualizations using histograms and the multinomial logistic regression. All tests done were conducted at the 0.05 level of significance. Major findings show that python, AI algorithms, certifications, problem solving, mathematics, and the other skills have a significant effect on getting an AI-related job.

The study concludes that the impact AI has on jobs, is more on job loss as regards low-skilled workers, however AI has the ability to complement human workers, which will in turn lead o increased efficiency and productivity. Also as regards job displacement, it will affect mainly low-skilled and routine jobs.

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CHAPTER ONE

INTRODUCTION

1. BACK GROUND OF THE STUDY

The term “Artificial Intelligence”, originated from John McCarthy in 1956, when he held the first “Academy Conference on Artificial intelligence” at Dartmouth college. Artificial Intelligence is a branch of Computer science that produces machines which can think and act like humans (G Abuselidze and L Mamaladze, 2020). It is a scientific field which explores the issues of intellectual programming. Given the wide scope of use in practice, the issue is very relevant. According to Klauss Schwab, founder of the World Economic Forum He said, today’s AI revolution is “unlike anything humankind has experienced before”. AI is a metamorphosis of all technology which makes it so revolutionary, it is in short quickly changing the global economy and, fundamentally, everyday life and the self. AI, like electricity is invisible, it is a general-purpose technology that works its magic behind the scenes, it’s contours and consequences are not all known to us, but some consequences as said earlier could be mitigated through up-skilling in new areas (Nils J. Nilsson, 1984).

Machines in general warrants the badge “AI” when it reaches a certain degree of self-learning, self-awareness and sentience. It refers to any computational system which can sense its environment, think, learn, and react in response to data sensing (Anthony Elliott, 2022).

The integration of Artificial Intelligence (AI) in various industries has been increasing rapidly in recent years. As a result, there is a growing concern about the potential impact of these technologies on employment, as regards unemployment and job displacement. According to a study by the McKinsey Global Institute, up to 800 million jobs could be displaced by automation by 2030, with 375 million requiring significant retraining. As AI technologies continue to advance it is expected to automate many tasks which are currently performed by human workers, which in return has led to concerns about job displacement and the potential negative impact on employment opportunities. AI has surpassed some of the limitations of previous technologies. In particular, AI's problem solving, logical reasoning and perception capabilities mean that the automation of some non-routine cognitive tasks is now possible, also AI can work for more than 24hrs, whereas human workers are susceptible to fatigue, but it can only perform a single task at a given period of time. This explains why some high-skilled occupations such as radiologists, lab technicians, engineers, lawyers and actuaries are judged to be highly exposed to AI, i.e. there is overlap between the tasks that these occupations comprise and the tasks that AI can perform. However, high exposure does not necessarily mean that jobs in these occupations will disappear, but that a lot of tasks would be done by these technologies, thereby complementing human workers.

AI has greatly promoted the development and progress of robotics, biotech, medical care, environmental technologies, etc. while being involved in every aspect of industrial production and social life.

Now, the Impact of AI would be considered in two phases: Positive and Negative senses.

Positive sense: AI can perform jobs which are dangerous for humans to perform. Also, innovations and employment opportunities (through up-skilling) into the real economy. Also, jobs which are supported by an increased AI-related economy has also provided more employment opportunities by its growth. (Rudra Tiwari, 2023). AI's benefit is an occurrence which will not happen only in the future, but it will also happen in the present. For example, a scenario, where physical libaries may be inaccessible, search engines services are very much accessible.

Negative sense: Routine-intensive occupations and manual jobs are vulnerable to automation (Carl Benedikt Frey and Osborne, 2013).

The automation of jobs through AI is not a new occurrence. Throughout history, new technology has always had the potential to lead to job displacement and

disorganize the job market. There is an idea that AI can threaten and undermine humans place in it However, AI also has the potential to complement and augment human capabilities which would lead to higher productivity, improved job quality and demand for human labour. Jobs whose tasks are predictable and repetitive are more susceptible to automation.

Occupations which are the most exposed to AI are high-skilled occupations involving non-routine cognitive tasks (Georgios Petropoulos, 2018).

However, high exposure doesn't mean jobs in these occupations will disappear, but certain tasks will still require humans to handle. Such areas include: social intelligence, skills; interpersonal, creative thinking and empathy, and dealing with uncertainty, but AI and other developments are

on the path of performing tasks requiring reasoning, judgement and perception which could be done only by humans before.

The extent in which AI has an impact on workers depends on factors like; a firm's investment on the retraining of staffs, Government funding, Tax incentives, Job-search availability in the country and Social benefit systems. Usually, not all the tasks outlined in a job description can be automated to the same degree. In fact, though machines may take over certain tasks of any given job description, there are others that they cannot. Therefore, whether an occupation can be automated or not depends on how significant the type of tasks are that can be carried out by machines. Hence, even within the same occupation, the automation potential can vary greatly from job to job. An

analysis of automation potential based on the actual task structure of individual jobs produces very different results.

Digitalization is changing job, not replacing them. The implementation of new technologies does not necessarily lead to job losses if employees are increasingly carrying out tasks that are made more efficient by using new technologies without being replaced by these technologies (Autor 2015).

The impact of technology on the work environment is not a new occurrence, only that the pace of its impact has increased. Technological improvements and adjustments have led to the displacement of certain jobs, while creating new employment as well. The work frame of jobs like Agriculture, mining, manufacturing which require non-routine tasks like; problem-solving, decision making has had an increase as a result of AI, whereas, jobs requiring routine tasks; data

entry, assembly line of work has had a tremendous decrease due to the integration of AI in the work force.

Data from Goldman Sachs estimates that 300 million jobs will be lost and 18% of work globally could be automated which implies that 25% of all jobs would at least be performed by AI. This means that these technologies learn knowledge by themselves, through Algorithms which have been coded to mathematically improve their learning over-time. These algorithms ranges from basic decision trees, through to artificial neural networks, it classifies information by mimicking the Structure of the human brain.

1.1. AIM AND OBJECTIVES:

The aim of this study is to evaluate the impact of AI on jobs: unemployment and displacement.

The objectives are:

1. investigate the relationship between the needed skills/qualifications for AI jobs and AI-related job opportunities.
2. identify occupations and firms most susceptible to job loss and displacement due to AI's integration.
3. quantify the impact of AI on employment opportunities for low skilled workers.

1.2. STATEMENT OF THE PROBLEM

Artificial Intelligence has advanced rapidly over time, and has found its way into various industries, either by automating tasks or by complementing human workers in the workforce. In as much as AI gives a lot of efficiency and productivity, there are still rising concerns about its negative impact in the work environment. This project aims to evaluate jobs which are affected by AI, skills needed for employment in AI-fields, and also analyze its shortcomings in the workforce. It will also look at some strategies which will be used to minimize job loss due to AI's integration.

1.3. SCOPE OF THE STUDY

This project aims to provide a comprehensive breakdown of AI's impact in the work environment, also, the project will assess skill gaps in the labour market, and will give strategies which will address these potential skill gaps. With this defined scope, the study will analyze existing research and data on unemployment and displacement, and develop recommendations for use, which will help in curbing the challenges presented by AI. This study aims to examine the impact, Artificial Intelligence has on Job markets, using the United States as a case study, since it has made advancements in the technological (AI) era.

1.4. SIGNIFICANCE OF THE STUDY

This study on impact of AI on jobs, has the potential to contribute significantly to a more convenient workforce. It helps in understanding its relevance on a large scale, and how it affects employment opportunities, and leads to job displacement. For instance, in the educational sector it could help universities adapt their curriculum to equip students with skills necessary for transition into the AI era. As regards workers and policy makers, this study will help broaden the perspective of workers in low-skilled jobs, so as to see the need to up-skill. Policy makers are not left out as it aids in developing strategies to stop job losses.

1.5. LIMITATIONS OF THE STUDY

This study focuses on quantitative data analysis, supplementing it with qualitative research methods like interviews with industry experts would have helped offer a better understanding of the challenges and benefits related to AI and jobs. The data collected are still evolving, and as such, long-term predictions are uncertain. Statistical analysis like regression rely on assumptions, and may not fully focus on the changes involved in employment opporunities and loss in the AI era.

1.6. DEFINITION OF TERMS

- **Algorithms:** a set of well defined step by step instructions that are used to solve a particular problem or perform a specific task
- **Artificial Intelligence (AI):** A branch of computer science concerned with creating intelligent machines capable of performing tasks typically requiring human intelligence.
- **Job Automation:** The process of AI and its related technology performing tasks previously performed by humans.
- **Job Displacement:** The loss of jobs due to technological advancements or automation.
- **Low-Skilled Jobs:** These are jobs requiring minimal or no formal education or training. It also involves function or routine tasks.
- **Future of Work:** A term referring to the transformations which occurs at job markets as a result of technological advancements.
- **Logistic Regression:** A statistical method which models the probability of an event happening based on independent variables.
- **Multinomial Logistic regression:** This is a single statistical model used to predict the probability of being in one of several categories of a dependent variable, given a set5 of independent variables.
- **Routine jobs:** are occupations that involve repetitive tasks with well-defined procedures and require minimal creativity or decision-making.
- **Robotics:** Robotics is an intelligent connection of perception to action in engineered systems. It is a technology which uses sensors such as cameras, thermal images or tactile

and sound sensors to collect data about the operational environment and then in return give back an automated world of actions.

- **Machine Learning:** This is an important advancement of contemporary AI technologies. It is a process wherein computers perform tasks through ‘learning’, or ‘information gathering’ which is gathered from human intelligence and human-decision-making.

1.7 CONCLUSION

Although AI is said to automate tasks and displace workers, this scenario can only be seen in countries which are at the fore front of technological advancements. Artificial Intelligence requires large investments, and as such will be under the ownership of a few persons.

CHAPTER TWO

LITERATURE REVIEW

Artificial Intelligence has crept into various industries, and its impact has brought about diverse views in the job market. This literature review will be divided into three; Conceptual review, Empirical review, and Theoretical review, which will explore the effects of Artificial Intelligence on unemployment and displacement.

1. CONCEPTUAL REVIEW

David H. Autor. (2015)

He discussed that Automation, complemented in recent decades by the exponentially increasing power of information has driven changes in productivity that have disrupted labour markets.

OECD Social, Employment and migration Working Paper. (2021)

In this report, the impact of Artificial Intelligence on the labour market was studied, and It was said that an AI system is a machine-based system which makes predictions, recommendations, or decisions influencing real or virtual environment.

Mihai Mutascu. (2023)

Automation process transforms the nature and content of jobs, and not the jobs themselves. In fact, he said 'job-to-job replacement means new jobs replacing old ones'.

Chetan Sachdeva. (2023)

He said 'AI's effect on work areas can prompt work polarization, where the work turns out to be progressively isolated into high talented, low-paying position, with a decrease in the center expertise occupations.

2. THEORETICAL REVIEW

Nils J. Nilsson. (1984)

In this report, he argued that Artificial Intelligence is quite different from previous Automation technologies, in that it will lead to machines being capable of performing quite inexpensively most of the tasks that now require or are best done by human labour.

Carl Benedict Frey and Michael Osborne. (2013)

They proposed that in the absence of Engineering solutions, to overcome the problem of whether a computer is creative, it seems unlikely that occupations requiring a high degree of creative intelligence will be automated in the next decades.

David H. Autor. (2015)

'Employment polarization will not continue indefinitely. Some of the tasks in many current middle-skill jobs are susceptible to automation. Many middle skill jobs will continue to demand a mixture of tasks from across the skill spectrum.'

Georgios Petropoulos, et al. (2018)

In the book 'Work in the Digital age' he made some observations, 'looking ahead, a new wave of automation and advanced machines learning techniques is on its way, in which intelligent machines will be increasingly capable of carrying out high-skilled possibly non-routine tasks'.

Meera Sampath and Promod P. Khargonekar. (2018)

In their paper, they wrote, 'To move automation beyond cost and performance efficiencies towards profitable, sustainable business growth with more and better jobs the commercial

interest of a firm with societal values are merged, also social goals are made integral to an organization's core business model.

Kim Parker, Rich Morin, and Juliana Lehmann. (2019)

The report, 'Looking to the future, public sees an America in decline on many fronts', published that Higher income adults and those with a bachelor's degree or more education are somewhat more optimistic that new technology will create better jobs.

G Abuselidze and L Mamaladze. (2020)

They said that AI can promote economic growth, create new jobs and employment, which will reduce costs, and make resources more efficient.

Maguerita Lane and Anne Saint-Martin. (2021)

In their publication on 'Impact of Artificial Intelligence on the labour Market: What do we know so far?' they proposed that Artificial Intelligence is likely to shape the work environment of many people, by changing the content and design of their jobs, the way workers interact with each other, and with machines, and how work effort and efficiency are monitored.

Michaela P Fadenhauer and Tobias Lehmann. (2022)

In this report, they said that 'sectors that are likely to be penetrated by robots in the future are the reproduction sectors: domestic settings, healthcare, entertainment, education, communication, and information and the public sphere.'

Chetan Sachdeva. (2023)

He said, 'Man-made Intelligence and computerization advances are fit for performing dreary and routine undertakings more effectively than people.'

Rudra Tiwari(2023)

Rudra Tiwari(2023) provides a comprehensive analysis of the potential impact of AI and machine learning on job displacement by examining the susceptibility of different jobs to automation. He found that low-skilled and routine jobs are the most susceptible to automation and that the potential for job displacement is likely to be significant.

3. EMPIRICAL REVIEW

Maite Urretavizcaya-Loinaz and Isabel Ferńandez de Castro. (2002)

In this Report, 'Artificial Intelligence: Technology with a future', they observed that, the combination of new information and telecommunication technologies, and new pedagogical trends, provide the driving force behind a constant evolution from the first computer-assisted learning instruction programs in the 50s through Intelligent tutoring systems(ITS).

Pew Research Center. (2019)

Pew Research Center (2019) has studied the Average Working Person in the US, and it is predicted that 14% of Adults by the year 2050 will have more job security, 49% will have less job security, and 36% jobs will be as secure as they are now.

Maguerita Lane and Anne Saint-Martin (2021)

Artificial Intelligence is expected to increase productivity not only by enabling firms to replace labour with cheaper capital, but also by complementing workers.

Chetan Sachdeva. (2023)

Computer based intelligence fueled chatbots and remote helpers are progressively taking care of client assistance requests and backing capabilities customarily performed by human call place specialists.

Future of Jobs Report. (2023)

In this report, the expected impact of technology adoption is surveyed. The report estimates that Big data analytics, climate change and environmental management technologies, and encryption and Cybersecurity are expected to be the biggest drivers of job growth. The report claims that 19% of the workforce could have over 50% of their tasks automated by Artificial Intelligence and job losses making headlines.

CONCLUSION

The literature review suggests that the implications of AI on the future of work and the workforce has diverse and detailed views. Although AI has the potential to increase productivity, efficiency, and economic growth, its impact on jobs has led to many jobs being displaced through its ability to perform tasks which were previously done by human workers, which could lead to increased efficiency and reduce costs and significant job displacement, particularly for low-skilled and routine jobs. This could lead to increased unemployment and income inequality, and may worsen existing social and economic challenges. Occupations that require subtle judgement (i.e. occupations which do not involve creative thinking and ability to deal with uncertainties) are also increasingly susceptible to computerization.

CHAPTER THREE

METHODOLOGY

3.1. RESEARCH DESIGN

This study adopted the descriptive design.The methodology used in this study includes a thorough search of various academic databases, such as JSTOR, Google scholar, ZENDY, GESIS, and others to identify relevant studies on the 'Impact of Artificial Intelligence on job unemployment and displacement.' The search strategy included the use of keywords such as "Artificial Intelligence," "High risk of automation," and "Impact of Artificial Intelligence on job unemployment and displacement." The reviewed studies were articles published in English within the last years, and those that specifically addressed the impact of AI on jobs and other related Technological articles. The selected studies were analyzed to identify key findings and common ideas related to the research objectives.

3.2. SAMPLE SIZE DETERMINATION AND SAMPLING TECHNIQUE

Sample size for the study was determined through a statistical formula developed by Cochran (1963), which is used when the population is unknown.

The 95% confidence interval is the standard confidence leveI, but due to time constraints, 92% confidence interval was used for the study

The estimation procedure is as follows:

$$n = \frac{(Z^2)Pq}{e^2}$$

Where,

Z= 1.75, C.I = 92%

p= 0.5
q= 1-p = 0.5
e= 0.08

Substituting in the formula, we have:

$$n = \frac{(1.75^2)0.5\times0.5}{(0.08^2)}$$

$$= 119.62 \approx 120$$

However, sample allocation to each company was determined using the equal sampling method, which was developed over the years from early Statisticians works. The procedure is as follows:

$$n = \frac{Es}{Ns}$$

Where,

Es = Estimated sample size = 120

Ns = Number of Strata = 6

Table 3.1

S/N	Companies	Sample Allocation	Percentage Of Total
1	Jobot	20	16.7
2	Microsoft	20	16.7
3	Cross over	20	16.7
4	Deloitte	20	16.7
5	Simply Apply	20	16.7
6	Accenture	20	16.7
	Total	120	100

From **Table 3.1**, the samples were allocated across the companies equally, and the simple random sampling as used in selecting the units of observation.

3.3. METHOD OF DATA COLLECTION AND ANALYSIS

The type of data used for this study is the secondary data type, wherein data for each research objective was gotten from websites and various databanks. The data source for each objective to be examined is as follows:

1. **Investigate the relationship between the needed skills/qualifications for AI jobs and AI-related job opportunities.**

The data was gotten from LinkedIn, a job posting website. The job postings for AI-related fields where searched for, and the search was narrowed down to the United States, and then to six (6) companies in the US. Where 20 jobs were then selected randomly from the six companies, and the skills needed were recorded. The multinomial logistic regression analysis was used to model the likelihood of an applicant getting an AI-related job based on skills or qualifications related to the job. Its aim is to determine which of the factors are statistically significant predictors of employment in AI-related fields in the United States.

Model Specification

Model Structure:

The model can be written mathematically as:

P(Job Type (i)/Python, AI algorithms, certifications, other variables) = $exp(\beta_0 + \beta_1(Machine\ learning * Mathematics) + \beta_2(Python * Problem\ solving) + \beta_3(Analytics * AI\ Algorithms) + \beta_4(Certifications * Education) + \beta\ \ (Computer\ science * Mathematics) + \beta_6(English * Communication) + \sum \beta_i X_i)/$ exp $(\beta_0 + \beta_i X_i)$

Where,

- P(Job Type (i))- represents the predicted probability of being in the specific job title category (i) given the values of the independent variables.
- $\beta_{0=}$ Intercept
- β_1 to β_6= regression coefficients, and interaction terms
- $\Sigma\beta_i X_i$ -summation of the product of each coefficient and it's corresponding independent variable (X) for all variables i.
- $\Sigma exp(\beta_0 + \beta_1)$- represents the sum of the exponentiated terms for all possible combinations of independent variable values.

Coding:

The 120 jobs were coded from 1-120, and each skill was coded '1' for required and '0' for not required.

[Mathematics=0] * [Machine learning=1]- Machine learning required vs no Mathematics

[Mathematics=1] * [Machine learning=0]- Machine learning not required vs Mathematics required

[Mathematics=1] * [Machine learning=1]- Machine learning required vs Mathematics required

[Python=0] * [Problem solving=1]-Problem solving required vs python not required

[Python=1] * [Problem solving=0]- Problem solving not required vs python required

[Python=1] * [Problem solving=1]- Problem solving required vs python required

[Analytics=0] * [AI Algorithms and Learning=1]-Analytics not required vs AI algorithms required

[Analytics=1] * [AI Algorithms and Learning=0]- Analytics required vs AI algorithms not required

[Analytics=1] * [AI Algorithms and Learning=1]- Analytics required vs AI algorithms required

[Certifications=1] * [Education Level=0]-Certifications required vs Education level(BS.c) required

[Certifications=1] * [Education Level=1]- Certifications required vs Education level (MS.c) required

[Certifications=1] * [Education Level=2]- Certifications required vs Education level (Ph.d) required

[Certifications=1] * [Education Level=3]- Certifications required vs Education level (Any degree level) required

[Certifications=1] * [Education Level=4]- Certifications required vs Education level (Technical degree) required

[Computer Science and methods=0] * [Mathematics=1]- Mathematics required

[Computer Science and methods=1] * [Mathematics=0]- Computer science required

[Computer Science and methods=1] * [Mathematics=1]- Computer science required and Mathematics required

[Communication=0] * [English=1]- English required

[Communication=1] * [English=0]-Communications required

[Communication=1] * [English=1]- Communications required and English required

2. **Identify occupations and firms most susceptible to job loss and displacement due to AI integration:** data was gotten from the site 'willrobotstakemyjob.com' and descriptive analysis was conducted, to analyze and summarize the existing data to get the trends related to job loss as a result of automation.

3. **Quantify the impact of Artificial Intelligence on employment opportunities for low-skilled workers:** The site 'will robotstakemyjob.com' was a means used in getting data, and descriptive analysis was used to examine the relationship between impact level of AI (measured by categories) on low-skilled workers.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

In this chapter, the analysis and interpretation of the study will be conducted, based on the method described in the previous chapter, using the Statistical Package for Social Sciences (SPSS) software version 20.

ANALYSIS PRESENTATION

1. **Investigate the relationship between the needed skills/qualifications for AI jobs and AI-related job opportunities.**

Table 4.1

Skills/Qualifications for an AI-job	Frequency	
	Num. of **"required"** in total for the 120 Job types.	Num. of **"not required"** in total for the 120 Job types.
1. Python	66	54
2. Scala	24	96
3. Java script	57	63
4. Problem solving	79	41
5. Data analysis	44	76
6. Certifications	97	23
7. Mathematics	102	18
8. Machine learning	101	19
9. AI algorithms and learning	93	27
10. Computer science and methods	114	6
11. English	42	78
12. Data science	66	54
13. Communications	41	79
14. Analytics	117	3
15. C	26	94
16. C++	29	91
17. R	14	106

Interpretation

From Table 4.1, it can be seen that only 14 job types of the 120 jobs required R programming skill which means it is the least required skill for an AI-related job in the US, while Analytics (117 out of 120) is the most required for having an AI-related job.

AIM: To determine the interaction effect of one variable on the other

Wald's Test
Hypothesis
H_0: The variable does not have a significant effect on the chances of obtaining an AI job
H_1: The variable has a significant effect on the chances of obtaining an AI job

Significance level and Decision criteria

$\alpha = 0.05$, Reject H_o, if p-value ≤ 0.05.

Table 4.2

Senior Associate Data Scientist	Intercept	-6.711	.000
	[Mathematics=0] * [Machine learning=1]	-5.480	.000
	[Mathematics=1] * [Machine learning=0]	10.834	.000
	[Mathematics=1] * [Machine learning=1]	0[c]	
	[Python=0] * [Problem solving=1]	-6.961	.001
	[Python=1] * [Problem solving=0]	.947	.000
	[Python=1] * [Problem solving=1]	0[c]	
	[Analytics=0] * [AI Algorithms and Learning=1]	-.047	
	[Analytics=1] * [AI Algorithms and Learning=0]	3.142	.000
	[Analytics=1] * [AI Algorithms and Learning=1]	0[c]	
	[Certifications=1] * [Education Level=0]	4.665	.002
	[Certifications=1] * [Education Level=1]	5.385	.002
	[Certifications=1] * [Education Level=2]	-3.223	.000
	[Certifications=1] * [Education Level=3]	4.950	
	[Certifications=1] * [Education Level=4]	0[c]	
	[Computer Science and methods=0] * [Mathematics=1]	3.898	
	[Computer Science and methods=1] * [Mathematics=0]	0[c]	.000
	[Computer Science and methods=1] * [Mathematics=1]	0[c]	.000
	[Communication=0] * [English=1]	1.146	
	[Communication=1] * [English=0]	2.730	.000
	[Communication=1] * [English=1]	0[c]	.000
Applied Researcher 1	Intercept	-15.546	.000
	[Mathematics=0] * [Machine learning=1]	4.047	

	[Mathematics=1] * [Machine learning=0]	15.667	.000
	[Mathematics=1] * [Machine learning=1]	0[c]	
	[Python=0] * [Problem solving=1]	-8.932	.004
	[Python=1] * [Problem solving=0]	.6860	.003
	[Python=1] * [Problem solving=1]	0[c]	.003
		.997	
		3.043	
		10.71	
		12.569	
		10.038	
		12.52	
		3.170	
		0[c]	
		0[c]	
		3.15	
		10.35	

Interpretation

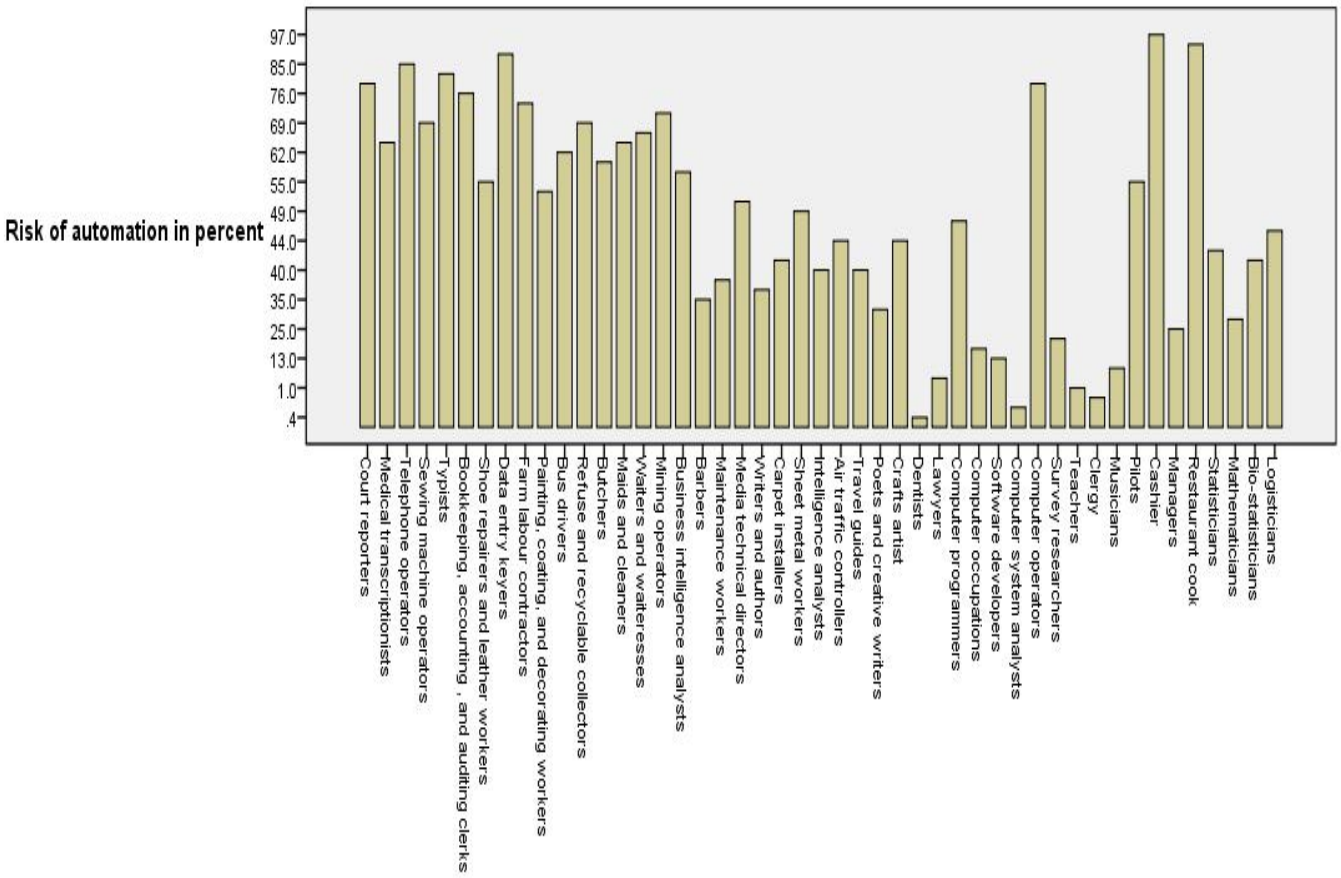
Using two job types as references, since the wald's test for all job types are less than the level of significance.

Since, the p-values are less than the level of significance, we reject the null hypothesis and conclude that there is a significant interaction effect between having the skills, and having an AI-related job.

Therefore, the skills are necessary for having an AI-related job.

2. **Identify occupations most susceptible to job loss and displacement due to AIs' integration.**

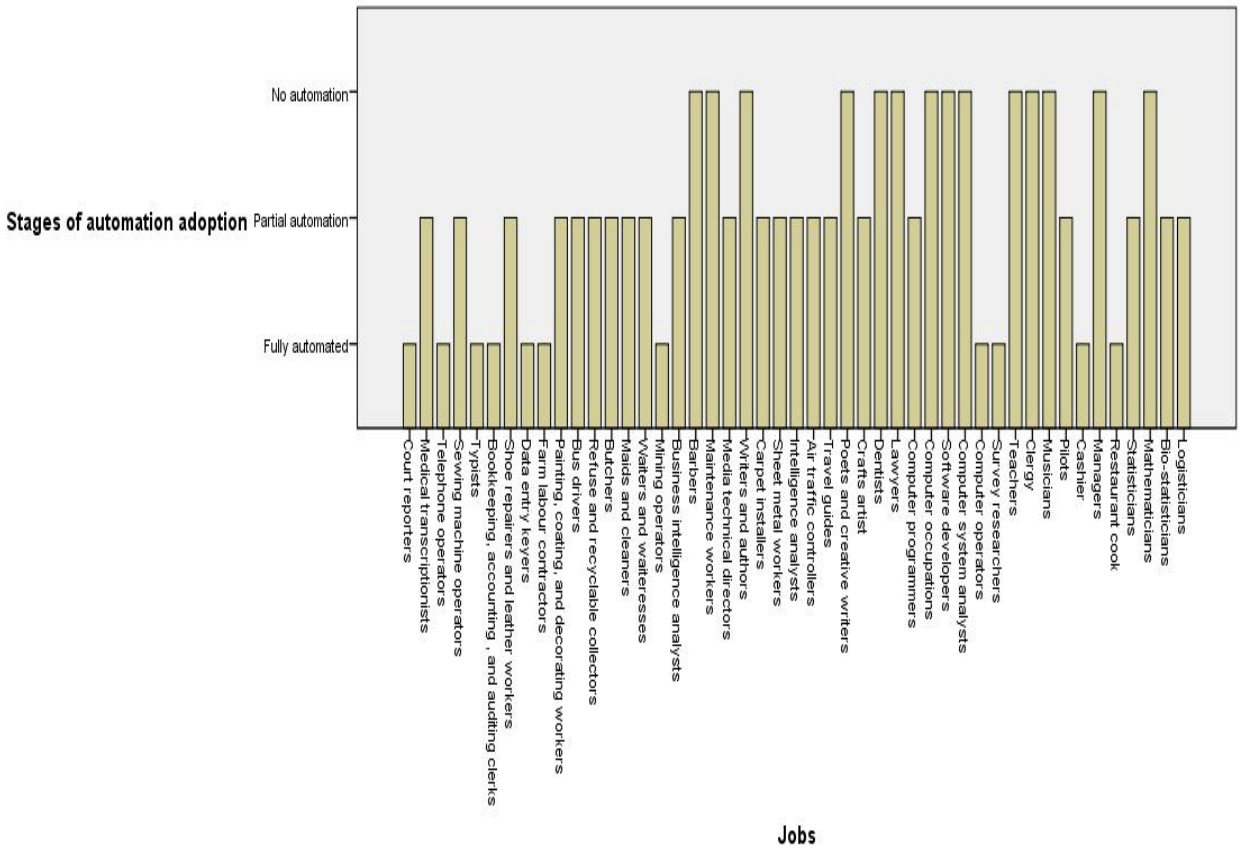
CHART 4.1



Stages of automation adoption

	Frequency	Valid Percent	Cumulative Percent
Fully automated	11	23.4	23.4
Partial automation	22	46.8	70.2
No automation	14	29.8	100.0
Total	40	100.0	

CHART 4.2



Interpretation

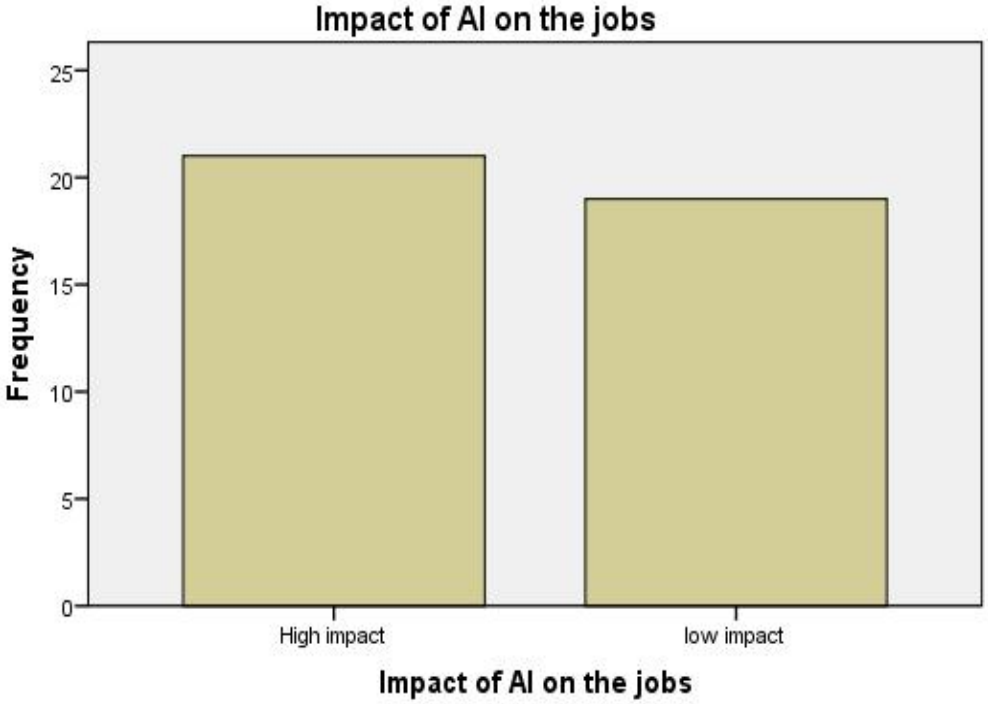
From chart 4.1 above, it can be seen that court reporters, telephone operators, typists, book keeping operatives, mining operators, and computer operators are at a high risk of being automated, also, clergymen, musicians, software developers, teachers, lawyers, survey researchers, dentists, computer system analysts, system analysts, barbers, and so on are less susceptible to automation.

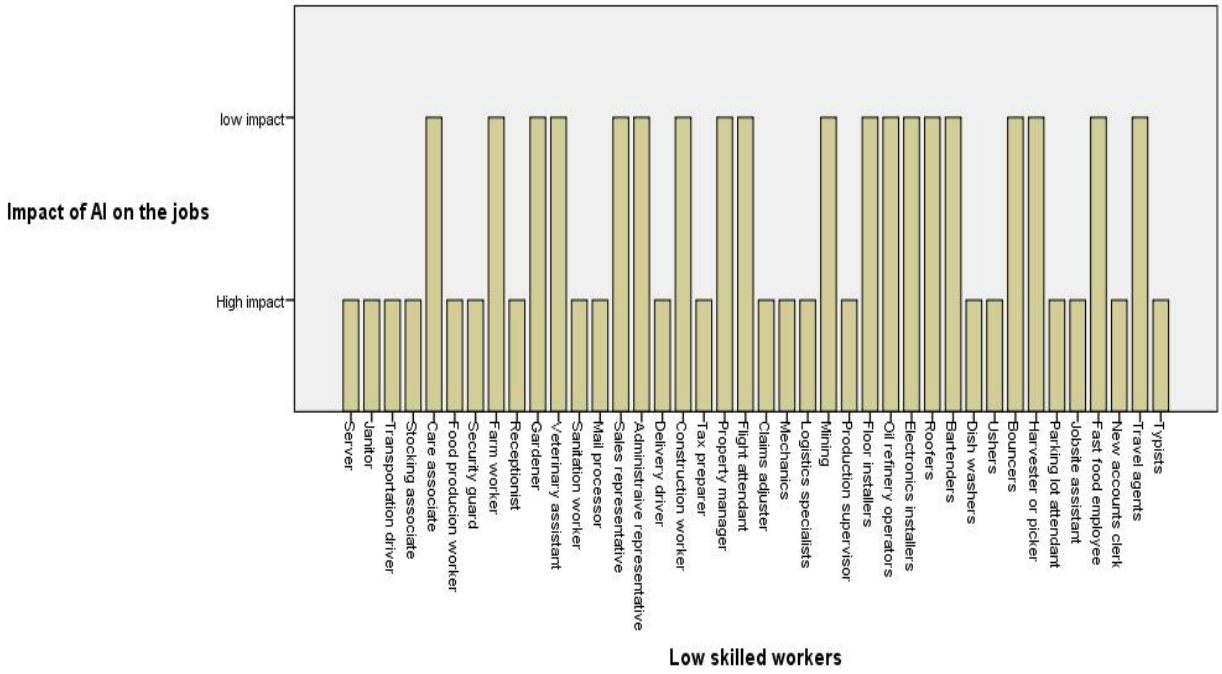
Also, in chart 4.2 above, it is seen that 11 jobs (typists, court reporters, office clerks, cashiers…) can be taken over completely by machines, while 22 jobs (Statisticians, Bus drivers, programmers, pilots, transcriptionists, logisticians, travel guides…) are partially automated, this means some tasks required for these jobs have to be done by humans. Also, 14 jobs (Mathematicians, managers, clergy, teachers, dentists, barbers, writers, authors…) are seen to be free from automation as a result of the tasks (non-routine tasks, and ability to deal with uncertainty) required for these jobs.

3. Quantify the impact of Artificial Intelligence on employment opportunities for low-skilled jobs

Impact of AI on the jobs

	Frequency	Percent	Valid Percent	Cumulative Percent
High impact	21	52.5	52.5	52.5
low impact	19	47.5	47.5	100.0
Total	40	100.0	100.0	





Interpretation

From the figure above 40 low-skilled jobs are examined, and out of the 40 jobs assessed, 21 are highly susceptible to automation, this means that AI is fast replacing these jobs, thus leading to unemployment in those areas, whereas 19 jobs are at a lower risk of being displaced from their jobs, irrespective of the low level skills involved in the job.

CHAPTER FIVE

5. SUMMARY, SUMMARY OF FINDINGS, RECOMMENDATIONS, AND CONCLUSION

5.1 SUMMARY

Artificial Intelligence is changing the work force as regards employment and displacement. As AI automates tasks and displace some jobs, It also creates new jobs and changes some existing roles.

Job displacement-AI displaces jobs which are routine and repetitive, such as data entry clerks, customer service. Sectors like Finance (e.g, Book-keeping, auditing clerks) and transportation (e.g.,self-driving vehicles) experience significant changes as a result of AI

5.2 SUMMARY OF FINDINGS

The availability of relayed jobs as shown in the study is based on an individuals' skill level or the readiness to up skill in the various required fields. It is also seen that AI has the potential to automate many jobs that do not require creative and social intelligence, reasoning skills, and dealing with uncertainty.

Low-skilled workers are seen to be more susceptible to automation, but this study shows that out of the 40 low-skilled jobs assessed, 19 had a lower risk of being automated by AI, which could be as a result of the skills involved (physical strength, communication, problem solving, and hand performing tasks).

However, the study shows that the impact of Artificial intelligence on jobs has both potential benefits and disadvantages.

5.3 RECOMMENDATONS

Based on the findings made from the study and the conclusions drawn from the study, the following recommendations were made:

1. Training and retraining of workers to equip them with the necessary skills needed for employment and transitioning in AI-related fields.
2. Create public awareness on the benefits of AI as regards complementing humans, so as to speed up technological advancements .
3. Develop policies which will help displaced workers adapt to the AI era.
4. Schools should create a platform which will help students think of career choices whose tasks are not predictive and repetitive.

5.4 CONCLUSIONS

This study 'Impact of Artificial Intelligence on jobs: employment and displacement' is a controversial topic, and as such, has led to different opinions as regards its impact. However, with its ability to create new opportunities in the workforce, its disadvantages shouldn't be overlooked, rather it should be minimized, so as to create a conducive working environment for workers.

AI is different from previous technological innovations, as it can perform tasks and complement humans on various tasks. This will increase efficiency and quality of goods and services, and reduce cost of production.

REFERENCES

Anthony Elliott (2022) 'Social science approaches to artificial intelligence'. *The Routledge Social Science Handbook of AI..*

Carl Benedikt Frey and Michael A. Osborne (2013) ' The future of Employment: How susceptible are jobs to computerisation?. *Oxford Martin Progremme on Technology and Employment.*

Chetan Sachdeva(2023) 'AI can lead to Job displacement'. *International Journal of Innovative Science and Research Technology.*

David H. Autor (2015) 'Why are there still so many jobs? The history and future of Workplace Automation'. *Journal of Economic Perspectives -Volume 29, Number 3-Summer 2015- Pages 3-30*

G Abuselidze and L Mamaladze (2020) 'The impact of AI on employment before and during pandemic: A comparative analysis'.*Journal of Physics: Conference Series.*

Georgios Petropoulos (2018) ‘ The impact of Arificial Inelligence on employment’. *Library of Congress Cataloging-in-Publication Data Library of Congress Control Number: 2018941712*

Kim Parker, Rich Morin and Juliana Lehmann (2019) 'Looking to the future, Public sees an America in Decline on Many Fronts'. *Pew Research Center.*

Marguerita Lane and Anne Saint-Martin. 'The impact of AI on the labour market: What do we know so far?. *OECD Social, Employment and Migration Working Papers, No 256.*

Maite Urretavizcaya-Loinaz and Isabel Fernandez de Castro (2002) ‘Artificial Intelligence and Education: an Overview’. *The European Online Magazine for the IT Professional.*

Meera Sampath and Promod P. Khargonekar (2018) ’ Socially Responsible Automation: A Framework for Shaping the Future’. *National Academy of Engineering, 2101 Constitution Avenue NW, Washington, DC 20418.*

Michaela P Fadenhauer and Tobias Lehmann (2022) ‘Affects after AI- sociological perspectives on Artificial companionship’. *The Routledge Social Science Handbook of AI.*

Mihai Mutascu (2023) ‘AI and unemployment: new insights’. *Economis analysis and policy, 2021 69,pp. 653-667.*

Nils J. Nilsson (1984) 'Artificial Intelligence, Employment and Income'. *Artificial intelligence center SRI International Menlo park, California 94025*

Rudra Tiwari (2023) 'The impact of AI and Machine learning on job Displacement and Employment opportunities'. *International Journal of Scientific Research in Engineering and Management*

APPENDIX

S/N	JOB TYPE	EDUCATION LEVEL	R	PYTHON
1	Senior Associate Data Scientist	Ms.c	Required	Required
2	Applied researcher 1	PhD	Not required	Not required
3	Senior data scientist	Ms.c	Required	Required
4	Applied researcher 2	PhD	Not required	Not required
5	Software development-AI trainer	Bs.c	Not required	Required
6	Manager data scientist	PhD	Required	Not required
7	Manager (machine learning, cyber risk and analytics)	Bs.c	Not required	Not required
8	Data analytics	Bs.c	Required	Required
9	Senior machine learning engineer	Ms.c	Required	Not required
10	Director, generative AI platform- agents and tooling	PhD	Not required	Required
11	Machine learning engineer	Ms.c	Required	Required
12	Data scientist	Bs.c	Not required	Required
13	Senior machine learning engineer specialist	Ms.c	Required	Required
14	Senior engineer	Bs.c	Not required	Required
15	Lead Machine learning engineer	Ms.c	Required	Required
16	Senior Manager, software engineering	PhD	Not required	Required
17	Senior manager, generative AI product engineer	PhD	Not required	Required
18	AI specialist	Any degree level	Not required	Required
19	Machine learning researcher	Ms.c	Not required	Required
20	Machine learning specialist	Ms.c	Not required	Required

21	Content writer	Any degree level	Not required	Not required
22	Python developer	Bs.c	Not required	Required
23	Content strategist	Any degree level	Not required	Not required
24	Junior software engineer	Bs.c	Not required	Required
25	AI super engineer	Ms.c	Not required	Required
26	Associate software engineer	Bs.c	Not required	Required
27	Software engineer	Any degree level	Not required	Required
28	Associate, Alpha	Bs.c	Not required	Not required
29	Consultant, Alpha	Ms.c	Not required	Not required
30	Camp coordinator	Bs.c	Not required	Not required
31	Life coach, Alpha	Bs.c	Not required	Not required
32	Coach, Alpha	Ms.c	Not required	Not required
33	Lead EQ Coach, Alpha	Ms.c	Not required	Not required
34	Senior principal software engineer	PhD	Not required	Required
35	Deep learning data science manager	PhD	Not required	Required
36	AI partnerships lead	Ms.c	Not required	Required
37	AI solution architect	PhD	Not required	Required
38	Learning and development specialist	Bs.c	Required	Required
39	AI automation consultant	Bs.c	Required	Required
40	Data scientist consultant	Bs.c	Not required	Required
41	Data scientist- Generative AI	Bs.c	Not required	Required
42	Generative AI developer	PhD	Not required	Required
43	Data science manager	Bs.c	Not	Required

			required	
		Any degree	Not	Not
44	Technical product manager	level	required	required
45	Watchlisting intelligence analyst	Bs.c	Required	Required
			Not	Not
46	AI advise specialist leader	Bs.c	required	required
			Not	
47	AI data scientist	Ms.c	required	Required
			Not	
48	AI partnerships lead specialist	Ms.c	required	Required
			Not	Not
49	Cloud developer	PhD	required	required
50	Data engineering consultant	PhD	Required	Required
			Not	
51	Machine learning- software engineer	Bs.c	required	Required
	Machine learning ops with research		Not	Not
52	background	Bs.c	required	required
			Not	Not
53	Product manager	Ms.c	required	required
			Not	
54	Robotics programmer	Ms.c	required	Required
		Technical	Not	
55	Applications technician	degree	required	Required
		Technical	Not	Not
56	IT Technical support call center specialist	degree	required	required
		Any degree	Not	Not
57	Automation technician	level	required	required
			Not	Not
58	.NET AI engineer	PhD	required	required
			Not	Not
59	Robotic technician	Ms.c	required	required
		Any degree	Not	Not
60	Project engineer	level	required	required
			Not	
61	Controls engineer	Bs.c	required	Required
			Not	Not
62	Applications automation engineer	Bs.c	required	required
			Not	Not
63	Sales engineer	Bs.c	required	required
			Not	Not
64	Research scientist	Ms.c	required	required
			Not	Not
65	Research intern	Bs.c	required	required

66	Principal data scientist	PhD	Not required	Required
67	Research engineer	PhD	Not required	Not required
68	Supply chain data scientist	Bs.c	Not required	Required
69	Manager- cloud & AI strategy	PhD	Not required	Not required
70	Research intern- quantum information and computation	Bs.c	Not required	Required
71	AI product manager	Ms.c	Not required	Required
72	Principal metrics data scientist	Ms.c	Not required	Not required
73	Technical program manager	Technical degree	Not required	Not required
74	Senior applied scientist	PhD	Not required	Not required
75	Senior director of AI infrastructural strategy	PhD	Not required	Required
76	Principal researcher	Ms.c	Not required	Not required
77	Software engineer personnel	Bs.c	Not required	Required
78	Data and AI solution	Bs.c	Not required	Not required
79	Data and AI security consultant	Bs.c	Not required	Not required
80	Data science research specialist	Bs.c	Not required	Required
81	Microsoft offering lead	Bs.c	Not required	Required
82	Advanced AI research scientist associate	PhD	Not required	Not required
83	Principal architecture	Bs.c	Not required	Not required
84	T&D Grid operations consultant	Bs.c	Not required	Not required
85	Full stack LLM developer	Any degree level	Not required	Required
86	Data and AI security personnel	Bs.c	Not required	Required
87	Generative AI application lead	Any degree	Not	Required

		level	required	
		Any degree	Not	Not
88	Oracle data and AI	level	required	required
			Not	Not
89	Data and AI solution architecture	Bs.c	required	required
			Not	
90	Microsoft offering lead consultant	Bs.c	required	Required
			Not	
91	Advanced analytics manager	PhD	required	Required
			Not	Not
92	AI market research performance	Bs.c	required	required
		Any degree	Not	
93	AI builder specialist	level	required	Required
			Not	Not
94	General data annotator for AI models	Ms.c	required	required
		Any degree	Not	
95	AI engineer	level	required	Required
			Not	Not
96	Data science(machine learning)	Bs.c	required	required
		Any degree	Not	
97	NLP data scientist	level	required	Required
			Not	Not
98	Data specialist for AI models	Bs.c	required	required
			Not	
99	AI (python developer) at YC backed start-up	Ms.c	required	Required
		Any degree	Not	Not
100	Data specialist with generative AI	level	required	required
			Not	Not
101	AI/ML data science intern	Ms.c	required	required
		Any degree	Not	Not
102	Coders- AI training	level	required	required
			Not	Not
103	LLM model architect	Bs.c	required	required
	Applied scientist , Artificial general		Not	
104	intelligence	Bs.c	required	Required
			Not	Not
105	Data annotator for AI models	Bs.c	required	required
		Any degree	Not	
106	Machine learning expert engineer	level	required	Required
			Not	Not
107	Online data analyst	Bs.c	required	required
	Machine learning engineer for game	Any degree	Not	
108	technology	level	required	Required

109	Applied scientist 2, AGI intelligent decisions	Bs.c	Not required	Required
110	Data center applied scientist	Ms.c	Required	Required
111	Senior computer vision engineer	PhD	Not required	Required
112	Founding full stack engineer	Ms.c	Not required	Not required
113	Senior backend engineer	PhD	Not required	Required
114	Quantitative researcher, autonomous car start	Any degree level	Not required	Required
115	AI prompt creator	Any degree level	Not required	Required
116	AI developer	Ms.c	Not required	Required
117	Seldoncore AI developer	PhD	Not required	Required
118	Cognitive linguist	Ms.c	Not required	Not required
119	Data labeller	Bs.c	Required	Required
120	Data and AI contractor	PhD	Not required	Not required

CONTINUATION

S/N	JAVA SCRIPT	C++	SCALA	C	DATA SCIENCE
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CONTINUATION

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72	Not required	Not required	Not required	Required	Required
73	Required	Not required	Not required	Required	Not required
74	Not required	Not required	Not required	Required	Required
75	Required	Not required	Required	Required	Required
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79	Not required	Not required	Required	Required	Not required
80	Not required	Not required	Not required	Not required	Required
81	Not required	Not required	Not required	Required	Not required

82	Not required	Not required	Not required	Required	Required
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87	Not required	Not required	Not required	Required	Required
88	Not required	Not required	Not required	Required	Required
89	Required	Not required	Not required	Required	Required
90	Not required	Not required	Not required	Required	Not required
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93	Not required	Not required	Not required	Required	Required
94	Required	Not required	Not required	Not required	Not required
95	Not required	Not required	Required	Required	Required
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97	Not required	Not required	Not required	Required	Required
98	Not required	Not required	Required	Required	Required
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100	Not required	Required	Required	Required	Required
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102	Not required	Not required	Not required	Required	Required
103	Required	Not required	Required	Required	Required
104	Required	Not required	Required	Required	Required
105	Not required	Not required	Required	Required	Required

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107	Not required	Not required	Required	Required	Not required
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112	Not required	Not required	Required	Required	Required
113	Not required	Not required	Required	Required	Required
114	Not required	Not required	Required	Required	Required
115	Not required	Not required	Required	Required	Required
116	Not required	Not required	Not required	Required	Required
117	Not required	Not required	Not required	Required	Required
118	Required	Not required	Required	Required	Required
119	Not required	Required	Required	Required	Required
120	Not required	Not required	Required	Required	Required

CONTINUATION

S/N	MATHEMATICS	COMPUTER SCIENCE METHODS	MACHINE LEARNING	ENGLISH	CERTIFICATIONS
1	Required	Required	Not required	Not required	Not required
2	Required	Required	Not required	Not required	Required
3	Required	Required	Required	Required	Required
4	Not required	Required	Not required	Required	Not required
5	Required	Required	Required	Required	Not required
6	Not required	Required	Required	Not required	Not required
7	Required	Required	Required	Not required	Not required
8	Required	Required	Required	Required	Not required
9	Required	Required	Required	Required	Required
10	Required	Required	Required	Required	Not required
11	Required	Required	Required	Required	Required
12	Required	Required	Required	Not required	Required
13	Not required	Required	Required	Not required	Not required
14	Required	Required	Required	Not required	Required
15	Not required	Required	Required	Not required	Not required
16	Required	Required	Required	Not required	Required
17	Required	Required	Required	Not required	Required
18	Required	Required	Required	Not required	Required
19	Not required	Required	Required	Not required	Required
20	Not required	Required	Required	Not required	Required
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31	Required	Required	Not required	Required	Required
32	Required	Required	Not required	Required	Required
33	Required	Required	Not required	Required	Required
34	Required	Required	Required	Not required	Required
35	Required	Required	Required	Required	Required
36	Required	Required	Required	Required	Required
37	Required	Required	Required	Required	Required
38	Required	Required	Required	Required	Not required
39	Required	Required	Required	Required	Required
40	Required	Required	Required	Required	Required
41	Required	Required	Required	Required	Required
42	Required	Required	Required	Required	Required
43	Required	Required	Required	Required	Required
44	Not required	Not required	Required	Required	Required
45	Required	Required	Required	Required	Required
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49	Required	Required	Required	Not required	Required
50	Required	Required	Required	Required	Required
51	Required	Required	Required	Not required	Required
52	Not required	Not required	Required	Not required	Required
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62	Required	Required	Required	Not required	Required
63	Required	Required	Not required	Required	Not required
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92	Not required	Not required	Not required	Not required	Not required
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94	Not required	Required	Required	Not required	Required
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103	Required	Required	Required	Not required	Required

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110	Required	Required	Required	Not required	Required
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112	Required	Required	Required	Not required	Required
113	Required	Required	Required	Not required	Required
114	Required	Required	Required	Not required	Required
115	Required	Required	Required	Not required	Required
116	Required	Required	Required	Not required	Required
117	Required	Required	Required	Not required	Required
118	Required	Required	Required	Required	Required
119	Required	Not required	Required	Not required	Not required
120	Required	Required	Required	Notrequired	Required

LOW-SKILLED WORKERS	RISK OF AUTOMATION	IMPACT OF AI
Server	68%	High risk of being automated
Janitor	59%	High risk of being automated
Transportation driver	73%	High risk of being automated
Stocking associate	75%	High risk of being automated
Care associate	8%	low risk of being automated
Food production worker	75%	High risk of being automated
Security guard	57%	High risk of being automated
Farm worker	25%	low risk of being automated
Receptionist	83%	High risk of being automated
Gardener	38%	low risk of being automated
Veterinary assistant	31%	low risk of being automated
Sanitation worker	65%	High risk of being automated
Mail processor	86%	High risk of being automated
Sales representative	30%	low risk of being automated
Administrative representative	25%	low risk of being automated
Delivery driver	79%	High risk of being automated
Construction worker	22%	low risk of being automated
Tax preparer	53%	High risk of being automated
Property manager	42%	low risk of being automated
Flight attendant	39%	low risk of being automated
Claims adjuster	72%	High risk of being automated
Mechanics	75%	High risk of being automated
Logistics specialists	58%	High risk of being automated
Mining	35%	low risk of being automated
Production supervisor	57%	High risk of being automated
Floor installers	36%	low risk of being automated
Oil refinery operators	36%	low risk of being automated
Electronics installers	21%	low risk of being automated
Roofers	23%	low risk of being automated
Bartenders	44%	low risk of being automated

Dish washers	72%	High risk of being automated
Ushers	90%	High risk of being automated
Bouncers	35%	low risk of being automated
Harvester or picker	29%	low risk of being automated
Parking lot attendant	79%	High risk of being automated
Jobsite assistant	76%	High risk of being automated
Fast food employee	35%	low risk of being automated
New accounts clerk	80%	High risk of being automated
Travel agents		
Typists		

JOBS	AUTOMATION RISK IN %	STAGES OF AUTOMATION ADOPTION
Court reporters	78.0	Fully automated
Medical transcriptionists	65.0	Partial automation
Telephone operators	85.0	Fully automated
Sewing machine operators	69.0	Partial automation
Typists	80.0	Fully automated
Bookkeeping, accounting , and auditing clerks	76.0	Fully automated
Shoe repairers and leather workers	55.0	Partial automation
Data entry keyers	90.0	Fully automated
Farm labour contractors	75.0	Fully automated
Painting, coating, and decorating workers	54.0	Partial automation
Bus drivers	62.0	Partial automation
Refuse and recyclable collectors	69.0	Partial automation
Butchers	57.0	Partial automation
Maids and cleaners	65.0	Partial automation
Waiters and waiteresses	68.0	Partial automation
Mining operators	70.0	Fully automated
Business intelligence analysts	56.0	Partial automation
Barbers	35.0	No automation
Maintenance workers	38.0	No automation
Media technical directors	52.0	Partial automation
Writers and authors	36.0	No automation
	41.0	Partial automation

Carpet installers	49.0	Partial automation
Sheet metal workers	40.0	Partial automation
Intelligence analysts	44.0	Partial automation
Air traffic controllers	40.0	Partial automation
Travel guides	33.0	No automation
Poetss and creative writers	44.0 .4	Partial automation
Crafts artist	3.5	No automation
Dentists		Partial automation
Lawyers	48.0	No automation
Computer programmers	22.0 13.0	No automation Partial automation
Computer occupations	.7	No automation No automation
Software developers	78.0	No automation Fully automated
Computer system analysts	23.0 1.0	Fully automated No automation
Computer operators	.8	No automation No automation
Survey researchers	7.4	Partial automation
Teachers	55.0	Fully automated
Clergy	97.0	No automation
Musicians	25.0	Fully automated
Pilots	96.0	Partial automation
Cashier	42.0	No automation
Managers	28.8	Partial automation
Restaurant cook	41.0	Partial automation
Statisticians	45.0	
Mathematicians		
Bio-statisticians		
Logisticians		