Jobs and University Skills: Artificial Intelligence Effects on Employment in the Future

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Abstract

In this study, we examine how susceptible automation caused by the rise of Artificial Intelligence (AI) and Machine Learning (ML) is going to affect employment rates in the next two decades. We start by talking about the previous studies that went over AI and ML. In the second part, we explain set of equations that determines the jobs that have low resilience for automation. In the third part, we go through tables and database that can reflect on job automation, the predicted time spent on activities, and database that captures detailed information from country, sector, job, and specific activity level. Lastly, we use information from a previous research paper to approximate the automation percentages of university skills. The report indicates that 42% of the Canadian labor force is at high risk of being affected by automation, For the final part, we link every job with its related set of skills, then provide their probability of computerization.

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1. INTRODUCTION

Job automation has been a key point for many years. Economists have agreed that the biggest threat public should pay attention to is the artificial intelligence revolution. Experts predict that the development and rapid adoption of new technologies including artificial intelligence and advanced robotics may have an impact on automation progressions of occupations at an unprecedented rate.

Throughout the industry, the trend has been to bigger production with a smaller work force, today's new industries have relatively few jobs for the unskilled or semiskilled workers, this covers the case for the jobs that can be automated in the meantime. While these technologies have the potential to threaten many existing jobs; it is also important to recognize the that there are still a significant number of job creators that have the ability to improve productivity and raise overall living standards.

Many of the jobs that can be automated in the next two decades require a college diploma. The answer to advancing technologies was education. Job managers believed that additional learning and more educational credentials would keep their workers one step ahead of automation. But it is not clear that acquiring education on its own, especially in person's early life, will be enough for them to survive the new era threat. In this study, we gather different resources about job automation and relate them to the skills and knowledge most graduates will not be able to apply in their own work due to automation.

- A study done by Brookfield Institute for Innovation + Entrepreneurship (2016) examined how automation will impact the tasks performed in each occupation across Canada. They found that approximately 42% of work activities that Canadian workers are paid for can be automated using existing knowledge. They also came out with a result stating that around 17% of occupations could have 70% or more of their existing job fully automated. This raises the potential that technology has on restructuring major occupations relatively soon.

- Dr. David Autor went over “The Automation Jobless” in his research “Why Are There Still So Many Jobs? The History and Future of Workplace Automation” written in 2015. In his paper, Dr. Autor explains how machines displace rote human activity, complement human expertise, judgment, and creativity. His work assesses the labor market consequences of technological change, focusing on the importance of linking the feedback between the intellectual and social development of children.
- Arntz, M., T. Gregory and U. Zierahn (2016) “The Risk of Automation for Jobs in OCED Countries: A Comparative Analysis” estimates the job automobility of jobs for 21 OCED countries based on a task-based approach. Arntz et al., provide possible adjustment of companies and workers to automation and digitalization. In their paper, they argued that the technological change will also generate additional job opportunities through demand for new technologies and higher competitiveness.
- “Software Engineering in Industrial Automation: State-of-the-Art Review” written by Valeriy Vyatkin (2013) illustrates the software engineering approaches used in the automation domain and put the research about automation in the context of software engineers. He goes over all the concepts related to software engineering including testing, maintenance, and evolution.
- Dr. Amy Eguchi in her course report (2013) about “Educational Robotics for Promoting 21st Century Skills” indicates that the most important skills that developers and employers will not automate in the foreseen future are cooperation skills, creativity and innovation, critical thinking and problem-solving.
- “Providing University Students with Skills for Future Work Environment” is a research done by Dr. Jaroslava Kubatova (2014) points out the most important trends that can reshape the ways of working. Moreover, Dr. Kubatova argues that universities should offer more courses about the virtual world “The Second World”, which will notify students about the urgency of entrepreneurship.

- “Disappearing Routine Jobs: Who, How, and Why?” is a study done by Guido Matias Cortes, Nir Jaimovich, and Henry E. Siu (2017). In their study, they go over the deterioration of the employment in middle-wage, in the United States in the previous 35 years. They describe the compromise between reallocating employment across occupations and workers towards non-routine employment.
- Yuval Noah Harari talks about “Reboot for the AI Revolution” (2017) in the Nature Journal. Harari argues that artificial intelligence puts many employees out of work, for that reason, we must forge new economic, educational and social systems. He predicted that by 2050, it would become increasingly difficult to know what to teach students at university and what type of skills they should acquire before graduation.
- Four researchers, Stuart Russell, Sabine Hauert, Russ Altman, and Manuela Veloso, touch upon the ethics of artificial intelligence in their article “Robotics: Ethics of Artificial Intelligence”. They share their concerns and suggestions for reducing the predicted social risk that intelligent machines possess. They indicate the importance of raising a generation that embraces a robot-human world and distributes the AI benefits equally.
- A study done by Bo Cowgill, (2017) entitled “Automating judgment and Decision-making” describes what types of decision-making tasks are better automated. Cowgill developed a model that compares advantages between human judgment and machines in decision-making. His experiment is based on candidates that lack job referrals, those with poor job experience, those with atypical credentials and those completing a PhD.
- Lisa Goddard who was the manager of Information Technology Services at Mermorial University of Newfoundland indicates in her research “The Integrated Librarian: IT in the Systems Office” (2003), that the technological complexity of current systems prohibit new librarians from entering the field without some previous expertise. She also outlines the benefits and importance of cultivating librarians with IT knowledge.

- “The Future of Employment: How Susceptible Are Jobs to Computerization” is a research written by two University of Oxford professors, Frey and Osborne (2013). Through their study, they suggested that advances in machine learning and artificial intelligence can happen more easily in non-routine tasks. The study went over 700 different types of occupations and their related skills. Using these factors along with the obstacles preventing computerization, they came up with tables and mathematical equations predicting the trend that automation will most likely take in the next two decades.

- Building off the information found by Frey and Osborne, a 2017 research done by McKinsey Global Institute entitled “A Future that Works: Automation, Employment, and Productivity” analyzed automation impact from a task point of view rather than occupation one. They used 18 human-related performance capabilities to estimate the automation potential of more than 2000 work activities from more 800 occupations across the US economy. They even extended their results by drawing on industry experts and developing scenarios for how rapidly the performance of technologies could improve in each of the capabilities that can only be performed by humans so far.

In the last part of this research, we apply some of McKinsey’s Global Institute equations and graphs to link every job that is at high risk of automation with its set of human based skills that are being taught at universities and have at least over 50% of being replaced by other skills and abilities required by the occupation manager.

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[1] We refer to computerization as jobs that are controlled by computer-controlled equipment. For more information regarding the most recent studies about the impact of automation, please see: The future of jobs: Employment, skills, and workforce strategy for the fourth Industrial Revolution, World Economic Forum, January 2016.

2. JOB AUTOMATION AND ADOPTION

Machine Learning has reached the level where it can find out unexpected similarities between old and new data. As a result, computerization is no longer limited to routine tasks that can be written by software queries and performed by robots, but it is spreading to non-routine tasks where big data[2] becomes available.

Frey and Osborne came up with an equation that classifies the probability of computerization for around 702 occupations across US economy. Taking into account that their estimation for automation may or may not occur at some intermediate point in the future, approximately ten years; they took a logistic approach,

$$\boldsymbol{P(z_* = 1 \mid f_*) = \frac{1}{1 + \exp(-f_*)}}$$

where z is a label denoting whether an occupation is computerizable or not, *f* can be considered as a continuous-valued variable for automation: the higher its value, the higher probability of automation will be.

Similar approach done by McKinsey Global Institute considered adoption of these technologies and the deployment rate. They stated that adoption could start acting as soon as solutions have economically positive implications, considering several factors that can prevent or enable timing and the pace of adoption. Some of the aspects might be human talent and organization structures, policies and law, and finally, consumers have different preferences for automated solutions due to their fears and emotional reactions. All of that will play a role in adoption timing.

Researchers at McKinsey took into account all of these factors and with the help of Bass diffusion model, a used function in forecasting, to write down a mathematical equation to predict the adoption of new technologies:

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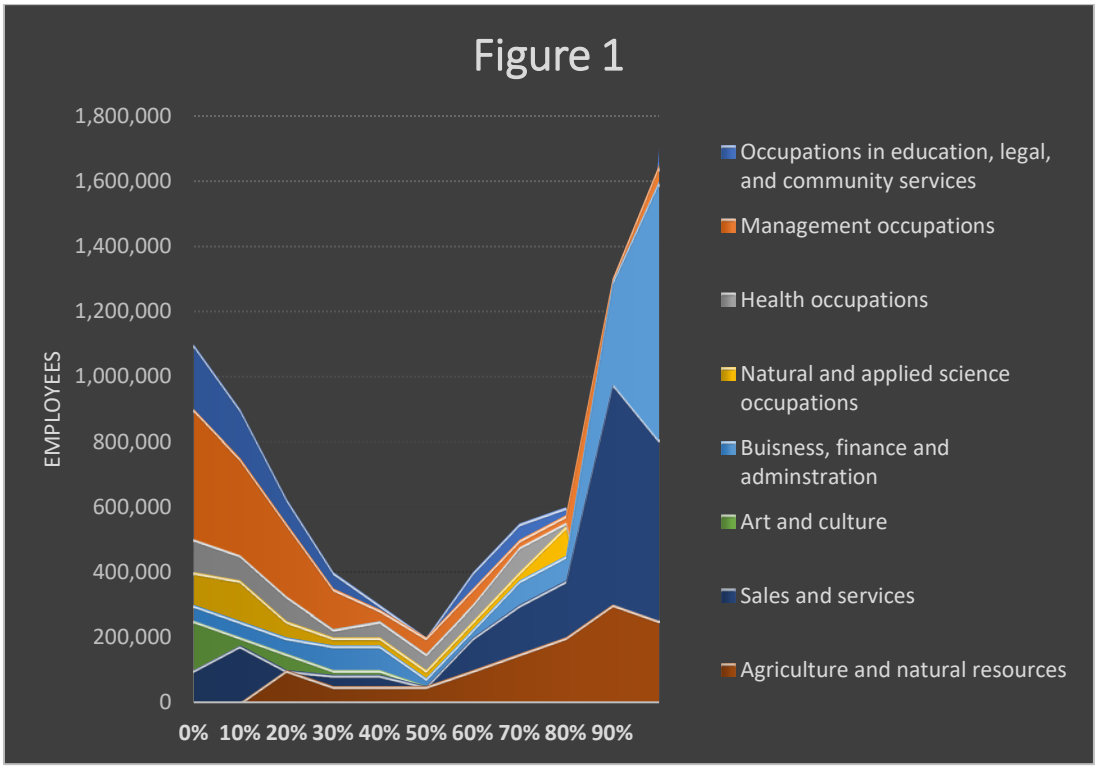
[2] To read more about big data and the interaction of digital technology, employment, please read: Race Against the Machine, Erik Brynjolfsson and Andrew McAfee, 2011.

$$\frac{f(t)}{1 - F(t)} = (p + qF(t))$$

F(t) in this equation describes the base fraction (adoption of given technology) and $f(t)$ is the correlated rate of change. The two parameters in their case: ***p*** parameter is the inherent tendency of consumers to adopt new technology, whereas ***q*** is the consumers' tendency to adopt new technology based on peer adoption. They clarified that the fitted values for ***p*** and ***q*** are consistent with another academic research[3].

Considering the previous two equations and adding the research provided by Brookfield Institute, a chart (Figure 1) indicating the high-level Canadian occupations and probability of being affected by automation was estimated in 2016 as follows:



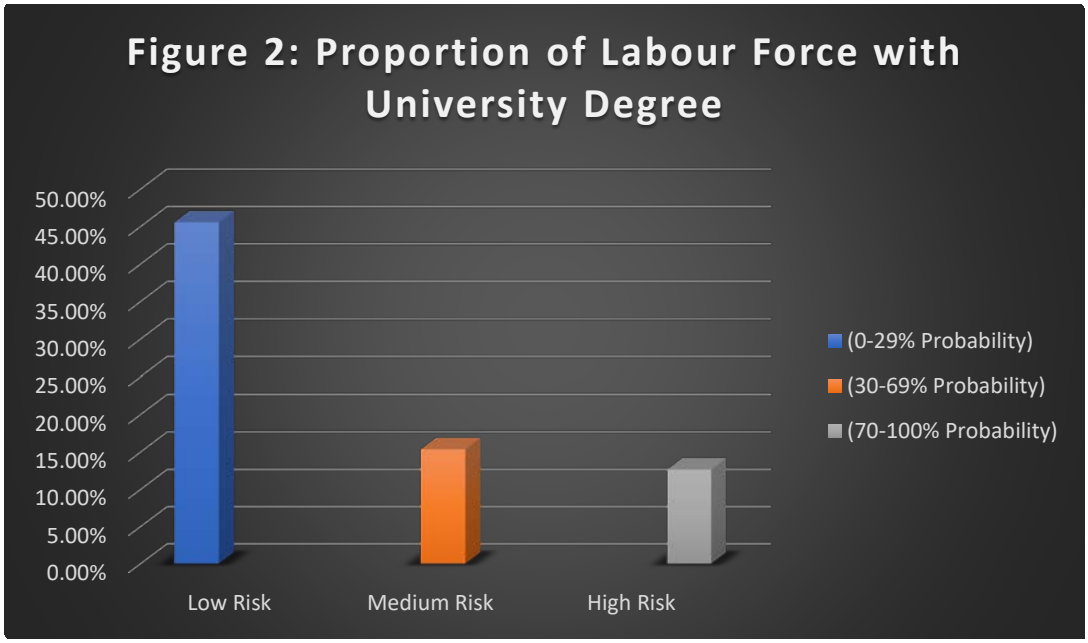
Source: The Talented Mr. Robot, Brookfield Institute, June 2016

[3] The related research is entitled: "Reflections on A-meta-analysis of applications of diffusion models" Journal of Marketing Research, volume 33, number 2, May 1996, written by Fareena Sultan, John U. Farely, and Donald R. Lehmann.

Figure 1 illustrates that the clear majority of occupations that are at high risk of automation and university-related are agriculture and natural resources; business, finance and administration; sales and services; in addition to health, natural, and applied sciences.

An interactive table webpage[4] describing all Canadian occupations that are university and non-university-related, and their probability of being affected by computerization has been provided by Brookfield Institute through Mr. Robot project. Detailed tables about jobs, university skills, and activities automation percentages are provided in part 3 of our report.

Securing a university degree is inversely proportional to job automation; the higher the knowledge required to perform the task, the harder of it to be computerized. Only 13% of the Canadian labour force is at high risk of automation which requires a university education at a bachelor's level or higher. (Figure 2)



Source: The Talented Mr. Robot, Brookfield Institute, June 2016

[4] To check the interactive table, please visit the website: http://brookfieldinstitute.ca/data_visualizations/talented-mr-robot/ , labeled as The Talented Mr. Robot: The impact of automation on Canada's workforce, Creig Lamb, June 2016.

On the other hand, Frey and Osborne have indicated some of the jobs that are going to be automated in the future which require at least a bachelor's degree. For instance, Mathematical Technicians tasks have 99% percentage of being automated in the next one to two decades. Mathematical Technicians are responsible for resolving math-related problems, understand, and explain math concepts.

Legal Secretaries position is predicted to be computerized by 98%. Their main tasks are to prepare documents, do research, and schedule witnesses. Most of the of employees in this category have a post-secondary degree.

Another occupation that has 94% of automation according to Oxford University professors is Accounting. To be able to secure a job in accounting you need at least a bachelor's degree, and master's degree might be required. The main duties are maintaining financial records for businesses, tax documents, and day-to-day management of funds.

Interviewers' occupation except for eligibility and loan ones which requires commun-

ication skills has 94% potential of being automated in the next decade.

All these occupations[5] that employees must at least have a bachelor's degree share a predictable pattern of repetitive activities, which opens the possibility of replicating most of them through Machine Learning (ML) algorithm.

Many types of research have studied and analyzed how likely jobs will be automated, yet, none of them have talked about the importance that universities can play in order to educate students on the importance of some skills that can be really valuable in the workplace future, and other skills that are predicted to be completely computerized shortly and replaced by machines and robots that can be more accurate, time managers, and provide optimum support to costumers in the best possible way.

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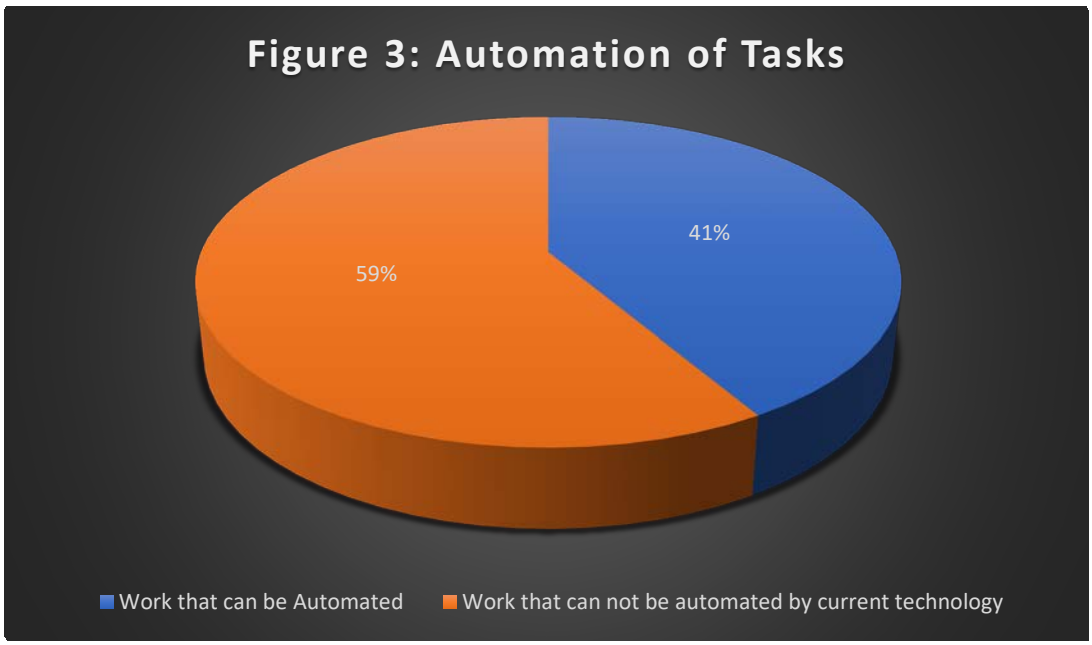
[5] A detailed table of jobs, skills, and employees automation percentages is provided in the Appendix at the end of this research.

3. IMPACT OF AUTOMATION ON ACTIVITIES AND HIGHER EDUCATION SKILLS

Beyond simply conferring degrees, the foundational purpose of universities and colleges is to educate people, at all stages of their careers. For that reason, universities must take further steps to make students robot-proof.

According to Brookfield Institute, based on the information they collected from McKinsey Global Institute and National Household data, they estimated that around 42% of the Canadian work activities could be computerized using current technologies. Nevertheless, nearly 18% of the Canadian labour force could have more than 70% of their activities and tasks automated. This opens up the argument that computerization could happen in the majority of these occupations in the near term.



Source: National Household Survey (2011), McKinsey & Company (2015), Brookfield Institute Analysis

Figure 3 illustrates the margin between the percentage of tasks that can be automated with the current knowledge of technology and machine learning and the ones that cannot be computerized.

To start studying the skills that can be automated, McKinsey & Company surveyed industry leaders and other predictors of technical advances. Moreover, they looked into recent commercial successes showcasing capabilities. As a result, they were able to highlight the activities that must advance to the required technical level.

The following table, describes the database that McKinsey & Company built. It captures detailed information from country, sector, job, and specific activity level. At each industry, they calculated the corresponding impact using wage and FTEs (Full-time employees). It was clarified that approximation was applied to the data since data are not absolute.

Database structure

Country
- Industry
  - Job title
    - Activity
      - Ease of Automation (high, medium, low)
      - Time per year spent
      - Annual wage spent on this activity ($)
      - Average wage (hourly and annual)
      - Number of FTEs

Impact definition

Impact by job title ($ per year) =

Number of FTEs **X** Annual wage ($)

Impact by activity ($ per year) =

Number of FTEs **X** Time spent on activity per year (hours) **X** Average hourly wage ($)

Impact by industry =

$\sum_{\text{Job title}}$ {Number of FTEs **X** Annual wage ($)}

Source: McKinsey Global Institute Analysis

To find all the activities that are university-related and have a probability higher than 50% of automation, we link the previous table with figure 4. Then we examine Mr. Robot research to find the Canadian jobs that are at high risk of automation. As a result, a table is conducted that illustrates the occupation, its related activities that are mostly taught at universities, the proportion of tasks being automated, and overall job computerization percentage.

Figure 4 includes 18 capabilities that are human-related and correspond to the meantime technology. They cover five areas: sensory perception, cognitive capabilities, natural language processing, social and emotional capabilities, and physical capabilities.

- **Sensory perception:** This involves complex external perception through integrating and analyzing data from wide range of sensors in the physical world.
- **Cognitive capabilities:** This part includes recognizing known patterns; generating novel patterns/ categories; logical reasoning, and problem-solving using contextual information; optimization and planning across various constraints; creativity; information retrieval; coordination with multiple agents; output articulation/presentation.
- **Natural language processing:** This consists of two types: natural language generation, which stands for the ability to deliver spoken language, and natural language understanding.
- **Social and emotional capabilities:** This consist of three parts: social and emotional sensing, which means identifying social and emotional state, social and emotional reasoning, and finally social and emotional output.
- **Physical capabilities:** It includes four capabilities: fine motor skills/dexterity that manipulates objects with dexterity; gross motor skills, which depends on moving objects with multidimensional motor skills; navigation that autonomously search in various environments; Mobility that requires the workers to move across different environments and terrain.

Figure 4:

Automation capability	level	Description (ability to …)
Sensory perception	Sensory perception	Autonomously infer and integrate complex external perception using sensors
Cognitive capabilities	Recognizing known patterns/ categories (supervised learning)	Recognize simple/complex known patterns and categories other than sensory perception
	Generating novel patterns/ categories	Create and recognize new patterns/categories (e.g., hypothesized categories)
	Logical reasoning/problem solving	Solve problems in an organized way using contextual information and increasingly complex input variables other than optimization
	Optimization and planning	Optimize and plan for objective outcomes across various constraints
	Creativity	Create diverse and novel ideas
	Information retrieval	Search and retrieve information from a large scale of sources (breadth, depth, degree of integration)
	Coordination with multiple agents	Interact with others, including humans, to coordinate group activity
	Output articulation/ presentation	Deliver outputs/visualizations across a variety of mediums other than natural language
Natural language processing	Natural language generation	Deliver messages in natural language, including nuanced human interaction and some quasi language (e.g., gestures)
	Natural language understanding	Comprehend language, including nuanced human interaction
Social and emotional capabilities	Social and emotional sensing	Identify social and emotional state
	Social and emotional reasoning	Accurately draw conclusions about social and emotional state, determine appropriate response
	Social and emotional output	Produce emotionally appropriate output (e.g., speech, body language)

Physical capabilities	Fine motor skills/dexterity		Manipulate objects with dexterity and sensitivity
	Gross motor skills		Move objects with multidimensional motor skills
	Navigation		Autonomously navigate in various environments
	Mobility		Move within and across various environments and terrain

Source: McKinsey Global Institute analysis

The appendix links every skill with its corresponding capability level and associated education background.

4. RECOMMENDATIONS

- **Adjust education with employment demand:**

Employers will not just count on workers graduated with college degrees, there is an accelerating need for graduates with training in specific specialties, in scientific and technical fields to be exact. Thus, professional training in selected occupations, such as medical technicians, and dental assistants, etc. – jobs that demands associate degrees can be beneficial. As a result, young students will be able to choose the most useful training program and increase their chances of securing jobs.

- **Adopt new technologies for education**

Adopting innovative technologies will open the chance for educational institutions to reach many students at low cost. Online learning is a great tool that gives millions of students the chance to learn and gain access to the world's best teachers and teaching systems. Human interaction concept can be solved by providing remote interactive online features and face-to-face interactions.

The recommendations are built on previous industry experts and university professors. While there is a worldwide movement towards artificial intelligence, universities need to be updated with the possibilities that automation is predicted to possess in the near term

5. CONCLUSION

Although automation has been restricted to routine tasks, new studies show that artificial intelligence has the potential to extend to non-routine tasks. Robots are gaining enhanced senses and dexterity, which will give them the ability to perform a wider range of manual tasks. As a result, the nature of the work environment across industries and occupations will most likely change.

The goal of this report is to identify the skills, activities, and subjects being taught at universities and predicted to be computerized and displaced by artificial intelligence in the 10-20 years. We investigate the role that higher education in the forthcoming disturbance caused by AI will have on jobs, university students, and society in general.

Canada's highly-skilled workers, by no doubt, are the ones that have the lowest risk of being negatively affected by computerization. Planned efforts from governments and educational institutions are fundamental to ensure that graduates can upgrade their skills through education, securing the important soft and technical skills that future jobs will require.

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APPENDIX

Occupations	Potential set of skills and activities taught at universities	Associated educational background	Proportion of tasks being automated (McKinsey & Company)	Employed Canadian labour force, 2011	Probability of the job being automated in the next 1-2 decades (Frey and Osborne)
Insurance and financial managers	Industry knowledge Achieving results Result orientation Multitasking Interpersonal skills Handling different situations	Accounting, Economics, or Business Administration	16.00%	48,670	81.00%
Administrative services managers, officers, & assistants	Client relations including answering telephones and calling them Editing, emailing, and filling Greeting Running office machines Accuracy Presentation Prioritizing Issues resolution Teamwork	Business, Engineering, Facility Management, or Information Technology	35.00%	29,725	73.00%
Financial accountants	Attention to detail Profession in Microsoft Office Financial reporting Interest Calculations Tax reporting and end-year reporting Motivation Leadership Relationship management Accounting analysis and principles	Disciplines may vary	12.00%	203,470	94.00%

Executive assistants	**Answering the phone** **Photocopying** **Mailing** **Filing** **Word processing** **Judgment** **Decision Making**	Disciplines may vary	51.00%	40,545	86.00%
Health administrators	Marketing Computer skills including Microsoft Office Research, investigating, and reporting Overseeing the implementation of a new Medical Records System Budget and controlling expenses Patient satisfaction Recruit and management Collaboration Motivate co-workers Leadership Coaching	Public Health, Business, Hospital or Nursing Administration	49.00%	4,555	91.00%
Statistical officers and related research support officers	Compile charts, tables, and graphs Summarize statistics for later reference Process data using statistical software Prepare technical documents and monitoring reports Supervising statistical and research support workers	Disciplines may vary	60.00%	4,455	66.00%
Geological technologists and technicians	Mathematical skills Adoption to new technologies Problem solving Work ethics Management	Disciplines may vary	50.00%	11,315	91.00%

General office support workers	Billing Data entry Computer and internet troubleshooting Time management Verbal and written communication Client relations Money Handling Teamwork	Disciplines may vary	61.00%	218,825	96.00%
Librarians and library assistants	Troubleshooting Catalog and database search Digital archiving and preservation Referencing materials and tools Customer service and facilitation Supervision Training Lecturing	Library Science, or Information Science	80.00%	17,200	95.00%
Production managers and logistics coordinators	Ability to meet deadlines Analytical Forecasting sales Customer analysis Documentation Software skills including Microsoft Word Developing pricing framework Critical thinking Creativity	Requirements may vary	49.00%	19,245	88.00%
Meteorologists and climatologists	Computer literacy Mathematical abilities Edit and record tables Decision making Consulting Interviewing Teamwork	Meteorology, Atmospheric Sciences, or a related discipline	34.00%	1,345	67.00%

Chemical technologists and technicians	Equipment maintenance Troubleshooting Writing Mathematics Speaking Reading comprehension Judgment and decision making Monitoring Persuasion Critical thinking	Disciplines may vary	53.00%	26,180	57.00%
Landscape technicians and specialists	Reading and writing Computer skills Finding information Numeracy Problem solving Oral communication Teamwork	Disciplines may vary	9.00%	16,685	95.00%
Civil Engineering technologist and technicians	Develop engineering specifications and drawings Inspect construction projects Test construction materials Prepare construction specifications, cost, and material estimates	Civil Engineering Technology	21.00%	20,075	75.00%
Electrical technologists and technicians	Analytical Evaluating risks Mathematics Manual dexterity Critical thinking Teamwork	Electrical Engineering Technology	23.00%	45,130	84.00%
Industrial instrument technicians and mechanics	Practice principles Risk assessments Train appetences Repair and maintain equipment Collaboration Consulting	Industrial Instrument Diploma	41.00%	8,185	67.00%

Aircraft instrument electrical mechanics, and technicians	Equipment maintenance Writing Troubleshooting and repairing Quality control analysis Speaking Critical Thinking Complex problem solving Judgment and decisions making	Aircraft Maintenance Engineering	71.70%	7,370	63.00%
Architectural technologists and technicians	Design buildings assistance Review conceptual drawings Scale sketches Research structural materials Meet client's design requirements Site planning	Architectural Technology	21.00%	9,255	52.00%
Draft technologists and technicians	Operate CAD and drafting workstations Complete documentations packages Write technical reports Verify design drawings Develop and preparing engineering designs Supervise other technologists and drafters	Degree in Computer-Aided Design Technology	19.30%	31,390	67.00%
Engineering inspectors and regulatory officers	Inspect transportation vehicles Weigh and measuring devices Teamwork Judgment Ethics Problem solving	Disciplines may vary	46.00%	5,290	61.00%

User support technicians	Answer Clients' inquiries Resolve technical problems Maintain company's network, and software Computer skills Communication Problem solving Judgment	Computer Science, or related field	65.00%	53,445	65.00%
Medical laboratory technologists	Read comprehension Use scientific rules and methods Active listening Service Orientation Management of personnel resources Negotiation	Medical Laboratory Sciences	45.00%	19,570	90.00%
Dental hygienists and therapists	Stamina Technical skills Inspect people's teeth Clean gingivitis Give oral x-rays Attention to detail Interpersonal skills Judgment	Dental Hygiene	13.00%	23,325	68.00%
Dental technologists and laboratory assistants	Attention to detail Basic computer skills Comply with protocols and standards Conserve dental materials Documentation Schedule appointments Manual Dexterity Prioritizing Teamwork	Dental Technology	97.00%	7,165	97.00%
Dental technologists and laboratory assistants	Attention to detail Basic computer skills Comply with protocols and standards Conserve dental materials Documentation Schedule appointments Manual Dexterity Prioritizing Teamwork	Dental Technology	97.00%	7,165	97.00%

Post-secondary teaching and research assistants	Stay up-to-date with any changes in the field Assess students' progress Advise students Teach courses in the subject-related area Develop instructional plans Plan lessons and assignments (Creativity)	Disciplines may vary	23.00%	59,050	65.00%
Archivists	Evaluate records for preservation and retention Maintain computer-aided search system Arranging retrieval of records Promote exhibitions, and presentations Advise the ongoing organizations Identify ways of protecting archives	Library Science, or Archival Science	7.00%	2,430	76.00%
Insurance agents and brokers	Keep detailed computer skills Marketing services Analytical skills Research insurance policies and products Time management Negotiation skills Reliability and honesty Decision making Interpersonal skills	Disciplines may vary	60.00%	66,205	92.00%
Library and public archive technicians	Assist library users in accessing the library facilities Perform on-line reference research Purge and sort archives Time management Instruct and assisting users Codify and classify archival materials	College program in Library and Information Technology	59.00%	10,725	99.00%

Broadcast technicians	Attention to details Proficiency with tools and technologies Computer skills Physical dexterity Problem solving	Electrical Engineering, Broadcast Technology, or Computer Networking	62.00%	2,950	74.00%
Sales representative (non-technical)	Costumer service Computer program knowledge Stamina Interpersonal skills Self-confidence	Disciplines may vary	21.00%	131,060	85.00%
Tours and travel guides	Memory and storytelling Flexibility Punctuality Sensitivity Passion Communication	Tourism and Travel Services Management	45.00%	4,355	91.00%
Machinists and machining and tool inspectors	Mathematical Skills Select the appropriate tools Measure and test completed units Monitor the speed of machines Problem solving	Disciplines may vary	84.00%	42,095	65.00%
Industrial maintenance technicians	Assist in setup of tools and facilities Inspect alarm systems Manual dexterity Budget preparation Problem solving	Disciplines may vary	88.00%	2,260	65.00%
Aircraft inspectors and mechanics	Attention to detail Computer skills including database software Manual dexterity Oral communication Judgment	Avionics, Aviation Technology, or Aviation Maintenance Management	85.00%	16,520	81.00%
Electrical technician	Proficiency in using tools and electrical systems Read blueprints Creativity Modifying existing systems Collaboration with engineers and architects	Requirements may vary	69.30%	8,490	70.00%

Automotive service technicians	Perform basic care and maintenance Disassemble and reassemble parts Test equipment Identify mechanical problems using computerized diagnostic equipment Communication skills	Vocational Education	91.00%	137,530	59.00%
Printing press operators	Monitor equipment Documentation Critical thinking Realistic Communication skills	Print Technology	86.00%	14,390	83.00%
Nursery	Resourcefulness Adaptability Patience Responsibility Creativity	Disciplines may vary	49.00%	15,110	87.00%
Central control and process operators, mineral and metal processing	Attention to details Mechanical aptitude Strong computer skills Responsibility Oral Communication	Disciplines may vary	82.00%	2,795	62.00%
Chemical process operators	Operation monitoring Mathematics Quality control analysis Active listening Critical thinking Judgment	Chemical Process Technology	84.70%	18,775	78.00%
Power engineers and power systems operators	Mechanical and electrical aptitude Ability to learn Efficiency Physical strength Manual dexterity Vision	Power Engineering	83.50%	29,565	90.00%
Machining tool operators	Blueprint knowledge Verify dimensions of parts Prepare solutions Perform routine maintenance Codes entry	Disciplines may vary	91.40%	9,415	87.90%

Chemical plant machine operators	Monitor equipment Coordinate maintenance efforts Record test results Suggest adjustments Communication with supervisors	Disciplines may vary	90.00%	9,025	76.00%
Photographic and film processors	Control equipment Correct defects Inspect rolls of photographic prints Check motion picture film Splice film on reels	Disciplines may vary	97.00%	4,850	99.00%