MURRAY STATE UNIVERSITY

Murray State's Digital Commons

Integrated Studies

Student Works

Spring 2023

Artificial Intelligence: Challenges For Future Growth

Jeffrey Forguson
jforguson@murraystate.edu

Jeffrey Forguson
Murray State University, forgusonj@yahoo.com

Follow this and additional works at: https://digitalcommons.murraystate.edu/bis437

Recommended Citation

Forguson, Jeffrey and Forguson, Jeffrey, "Artificial Intelligence: Challenges For Future Growth" (2023). *Integrated Studies*. 433.
https://digitalcommons.murraystate.edu/bis437/433

This Thesis is brought to you for free and open access by the Student Works at Murray State's Digital Commons. It has been accepted for inclusion in Integrated Studies by an authorized administrator of Murray State's Digital Commons. For more information, please contact msu.digitalcommons@murraystate.edu.

Artificial Intelligence:

Challenges for Future Growth

By
Jeff Forguson

Project submitted in partial fulfillment of the
requirements for the
Bachelor of Integrated Studies Degree

Murray State University
May 1, 2023

Abstract

This paper discusses the challenges facing artificial intelligence (AI) as it relates to replicating the human brain and how these challenges are perceived by the human employee. Through my research I found approximately 19 challenges facing the growth and future development of A.I. in the workplace. A.I. is in 93% of all global industries and the remaining 7% are seriously looking into it. I reviewed academic sources to determine the challenges facing the advancement of A.I. in the workplace. A.I. extends all the way back to the 18th century Industrial Revolution. Since that time, human employees have feared becoming dehumanized and losing their livelihoods, causing them to be unemployed. However, their fears have not come to fruition. As A.I has grown, it has not replaced the human workforce, but augmented it.

Keywords: Artificial Intelligence (A.I.), Industrial Revolution, Turing Test, Machine Learning, Automation, Deep Learning,

Table of Contents

List of Tables

List of Figures

Introduction

Artificial Intelligence (AI) has been around since the Industrial Revolution of the 18th century. The sewing machine, the typewriter, and the flour mill are just three examples of the first machines of the Industrial Revolution invented to replicate human tasks. As time progressed, robots were no longer thought of as science fiction, but a true possibility. Throughout the last two centuries, the one thing has remained the same…. how will humans be affected by these machines and/or robotics; will workers become dehumanized? One of the first literary examples of this is the character of the tin man, in the 1900's publication, The Wizard of Oz (Hanlein & Kaplan, 2019).

Of course, these machines/robotics are not invented out of thin air, they are created with the use of A.I. And, although, A.I. has always been the "brains," the term, itself, did not originate until 1955 by Dartmouth University. Today, the definition of A.I. is "the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages," according to the Oxford Dictionary (Library of Congress, 2019).

With that said, A.I. is most often defined as "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation." (Kaplan, 2019 p. 6) In the beginning systems (computers, machines) could be programmed to perform tasks; however, they were unable to remember or store the information to repeat the task without being re-programmed again. It was that way until the 1950's when Mr. Alan Turing began exploring the mathematical possibilities. He wrote a paper called "Computing Machinery and Intelligence." In it, he described not only how to create machines to perform human tasks, but, also, how to test the machine's 'intelligence.' (Kaplan,

2019, p. 61) Basically, the Turing test states: “if a human is interacting with another human and a machine and unable to distinguish the machine from the human, then the machine is said to be intelligent” (Kaplan, 2019, p.61). It is performed almost like a game.

The developer will designate their machine/robot and a human as “X” and/or “Y.” Then, a second human is brought in and is referred to as the interrogator. The interrogator is isolated from the other human and the machine. From their independent location, the interrogator will ask questions of the machine/robot and/or the human in the following example format: Will “X” please tell me if “X” plays chess. Whichever is designated as “X” is the only one allowed to answer the question, as it is addressed solely to that entity. As the questions progress, the interrogator can identify whether “X” or “Y” is the machine/robot. (Hodges, 2009) The Turing test is still utilized today, with greater difficulty for the interrogator to make the differentiation.

After Alan Turing’s discovery, A.I. flourished between 1954 and 1974. By this time, computers were faster, less expensive, and accessible to more people. During this time, the US military Defense Advanced Research Project Agency (DARPA) started to fund AI research. Japan, also invested in their own project, the First-Generation Computer Project. They were trying to fast track a machine that could be programmed to operate with the intelligence of an average human being. Despite all of the funding, however, the advances in AI were very minimal and eventually the funding dropped off.

IBM, however, continued to work on its own projects. In 1997, their machine beat Grand Master Chess Champion, Garry Kasprov at a game of chess. (Kaplan 2019 p. 61) Through the 90s, AI was intertwined with business process management (BPM). BPM looks at how a company creates, edits, and analyzes the predictable processes that make up the core of its

business. In 2002, Honda's first 'humanoid' robot, ASIMO, rang the New York Stock Exchange bell. It was the first multifunctional machine of its kind.

A.I. is part of our everyday lives. It is in our cell phones, our televisions, our appliances, our cars, and our workplaces. A.I. is in 93% of all global industries. The remaining 7% are looking seriously into it. It has the potential to eliminate approximately 30% of all positions world-wide. (Bhargava & Sharma 2021) That is an enormous amount of people negatively affected by A.I.; machines/robots replacing them. But how will that work?

Robotics/machines are enabled to perform complex tasks autonomously through A.I. These tasks were previously performed by a human employee. A.I. is programmed to "act" like the human brain in the workplace. As more industries turn to robotics to reduce costs and increase profits, there are many challenges to creating a replica of the human brain. These challenges are what this paper will address.

Background Information

There are 3 types of A.I. that are classified in four different ways, as follows:

1. Reactive Machines
2. Limited Memory
3. Theory of Mind
4. Self-Aware

Reactive machines have no memory; therefore, they cannot learn. They, also, respond to specific stimuli and respond automatically with a limited combination of inputs. Since they do not operate with a memory, they cannot be relied on to improve future responses. An example of a reactive A.I. machine would be the IBM Deep Blue Machine referenced earlier that was able to win a chess game over Grand Master Garry Kasprov in 1997.

Limited memory machines have the same capabilities as all reactive machines, with the added capability of learning. Just about every artificial intelligent machine of today falls in this category. The ability to learn is referred to as training. This training is performed by adding massive volumes of data to stored memory as a reference to form a solution for future problems. An example of this would be image recognition. The A.I. will store thousands of images and labels to teach the machine/robot how to name objects as it scans new images. This "trains" the machine by having it reference the installed data images to understand the contents. As time progresses and more images are scanned, the A.I. will label new images with better accuracy. Chat bots, virtual assistants, and self-driving vehicles are in this classification.

Theory of mind is the third classification, but it is, currently, just a concept. Nothing, at this time, exists that would fall in this classification. Developers are working on this and when/if it does come to fruition, the A.I. will be able to understand and interact with humans (or other forms of existence) by discerning needs, emotions, beliefs, and thought processes. Machines/robots will be able to perceive human minds as shapeable by multiple factors.

Self-Aware is the final classification and it is also just a concept. With this development, A.I. will be so evolved, it will be able to act just like the human brain; it will have self-awareness. It will not only be able to understand and evoke emotions with the human (or other entities) it interacts with, it will, also, have emotions, beliefs, and even maybe desires of its own.

The first type of A.I. is called Artificial Narrow Intelligence (ANI). This type represents all existing A.I. It refers to A.I. that can only perform a specific task autonomously using human-like capabilities. They can do nothing more than what they are programmed to do, and they correspond to all reactive and limited memory A.I (Warwick 2015).

Artificial Super Intelligence (ASI) is next. This one is the culmination of A.I. research once it is developed. In addition to replicating human intelligence, this type, also will be immensely better at everything they do because of greater memory, faster data processing and analysis, and decision-making capabilities.

ASI and AGI may seem to be solely science fiction; however, they are currently being developed utilizing fetal rodent cortical tissue (brain cells). The cells are grown in chambers with controlled environmental conditions. Electrodes are installed in the base of the chambers and electric signals are sent. The cells connect, communicate, and develop in a matter of weeks. These "brains" are then installed in machines/robots as A.I. (Warwick, 2015).

In the past, A.I. has benefited the higher-skilled, more educated employee and threatened the lower skilled employee/laborer. As AGI and ASI have become more of a reality than a theory, the opposite effect has taken place.

An algorithm can be programmed into a machine/robot to analyze and predict a financial advisor's clients. It can also replace a market specialist position by creating an algorithm for analyzing consumer spending patterns and advising a new strategy to reach more people. This can be done for marketing a new movie to all the way to a new car or even a coffee maker or a child's toy.

This same advanced technology could replace medical staff duties or, at least, perform a great deal more of their tasks. Free time to be available to spend with patients or work on diagnoses that aren't so easily identified.

A recent study indicated an employee with a bachelor's degree is five times more likely to be affected by the increased A.I. technology than those holding a high-school diploma.

Some effected workers will find more time to devote to things such as data analysis or meeting with current and new clients to increase profitability. Still others may find their job so simplified they can be filled by less educated employees, thereby reducing labor costs to the employer and resulting in a loss of wages or their job as a whole.

Effected workers will find more time to devote to things such as data analysis or meeting with current and new clients to increase profitability. Still others may find their job so simplified they can be filled by less educated employees thereby reducing labor costs to the employer and resulting in a loss of wages or their job as a whole.

As of February 2020, there were 6 million fewer factory jobs lost to A.I., than in the late 1970s. There were, however, 62 million more jobs overall since that time with the vast majority being in the service sector.

Top executives are the least likely affected by increased A.I. technology as they mainly manage people and oversee their processes. There is not, at this time anyway, an easy way to come up with an algorithm for that (Bhargava & Sharma, 2021).

Autonomy

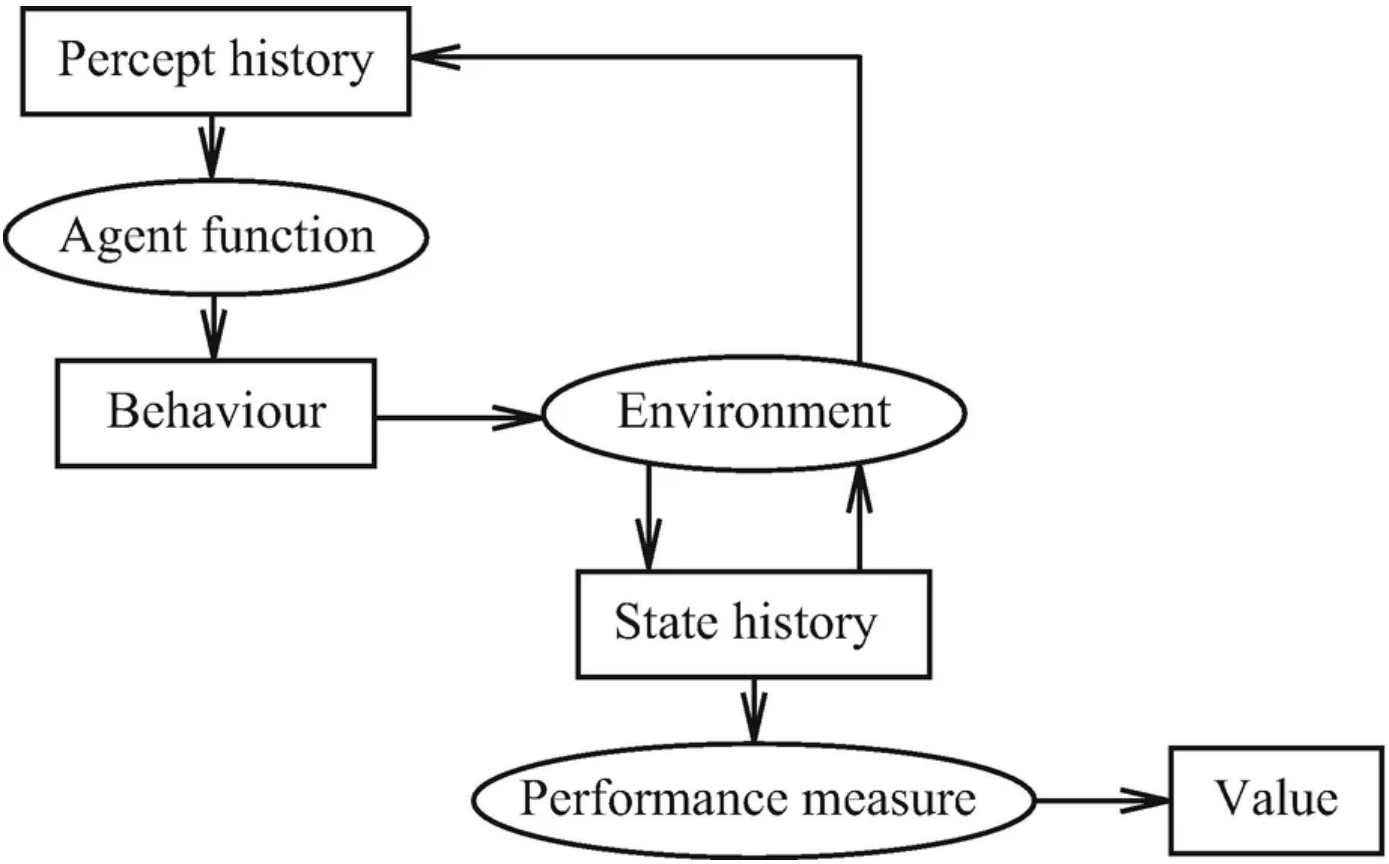
This technology offers not only great opportunities, but, also, great risks. A.I. must perform autonomously. This means it must work independently without any assistance outside of the programming it is created with. Development must include the ability to process data and respond accordingly to avoid or, minimally, lessen the danger/risk that is posed at any given time. There can be no harm to any human worker in the area, as well as no harm to the product or service the robot/machine is processing.

With a human worker, the brain processes what the eyes see, or the body feels and determines the proper response. A.I. utilizes sensors or radar to sense their environment and act

accordingly. These are referred to as ‘agents.’ They ‘perceive and act’ in accordance with their programming. This is considered rationalizing. In the end, it matters what the intelligence instructs the machine to do instead of *how* it does it. Figure 1.1. is a visual chart as to how the A.I. “rationalizes” (Russell, 2016).

Figure 1

Perceptions (Russell, 2016)



One of the draw backs of developing effective A.I. to operate at the level of the human worker, is the limitations of the human brain itself. The individuals creating the machines have their own limits as to what they can program for the intelligence. This can hinder how accurate the artificual intelligence rationalizes and if it will properly respond to what it senses. This is referred to as “computational tractibility.” Basically, this can restrict the machine’s A.I. to get

‘traction’ on a problem - something it senses in order to respond appropriately and effectively (Besold & Robere 2016).

Rationality

Rationality is directly related to the agent’s ultimate goal; responding correctly to the problem or issue that the agent senses. There are four types of rationality: Perfect, Calculative, Metalevel, and Bounded Optimality. As with all of A.I. programming, they are expressed mathematically.

Perfect rationality is defined as the agent does the best it can based on a “well-defined function of the task.” Given the available information, the agent has the capacity to successfully respond to the problem/issue sensed (as cited in Russell, 2016 p. 10).

Calculative rationality is defined as “the in-principle capacity to compute the perfectly rational decision given the initially available information.” This type of rationality is “concerned with programs for computing the choices that perfect rationality specifies” (as cited in Russell, 2016 p. 12).

Metalevel rationality is a second decision-making process that selects the best combination of “computation sequence plus action.” The action must be selected by the computation to process the best response with this type of rationality (as cited in Russell, 2016 p. 13).

Bounded Optimality is the same as Perfect Rationality, except that it takes into account computation, as well as the information available. Of the four, this is the most well-rounded type of rationality that offers the most effective and efficient rationality. However, it is difficult to develop this type of A.I. for all industries (as cited in Russell, 2016 p. 16).

Anticipation

Anticipation is, also, something the human brain does, that needs to be developed into A.I. in order for there to be autonomy in the processing. There are two approaches to this: Predictive Brain and Interactivist.

Predictive Brain is where "sensory inputs are analyzed via some sort of synthesis of those inputs." Whereas, The Interactivist Model considers the "flow of interaction that is anticipated, not the inputs (or outputs) that participate in that interaction (Muller, 2016). These are, again, computed into the building of the A.I. required for all machines/robots to perform human tasks. This is especially important in the workplace.

Without accurate and complete computations, the safety of the human in the surrounding areas of these machines/robots can be in danger. It is clear to see a broad range of computation models is necessary for the best possible autonomous outcome (Muller, 2016). These computations must mimic human thinking as close to perfect as possible.

Without clear and concise autonomy, real world environments may become challenging for machines/robots to comprehend and take the proper corrective action. To do this, the Allen Newell's Single Complex Task Analysis is what is currently followed (Dudzik, 2018).

Allen Newell's Single Complex Task Analysis consists of the following 3 steps when integrating real-world environments into A.I.:

1. Create computational models that are able to complete the task they are focused on
2. Study only one complex task in great detail
3. Develop computational models that can complete multiple tasks

This is used in many different task analysese, not just A.I.. It is imperative to consider the vast variety of real-world environmental interruptions that can occur within any given industry.

Failure to do so can result in detrimental results to the human worker within the surrounding areas.

Regulations

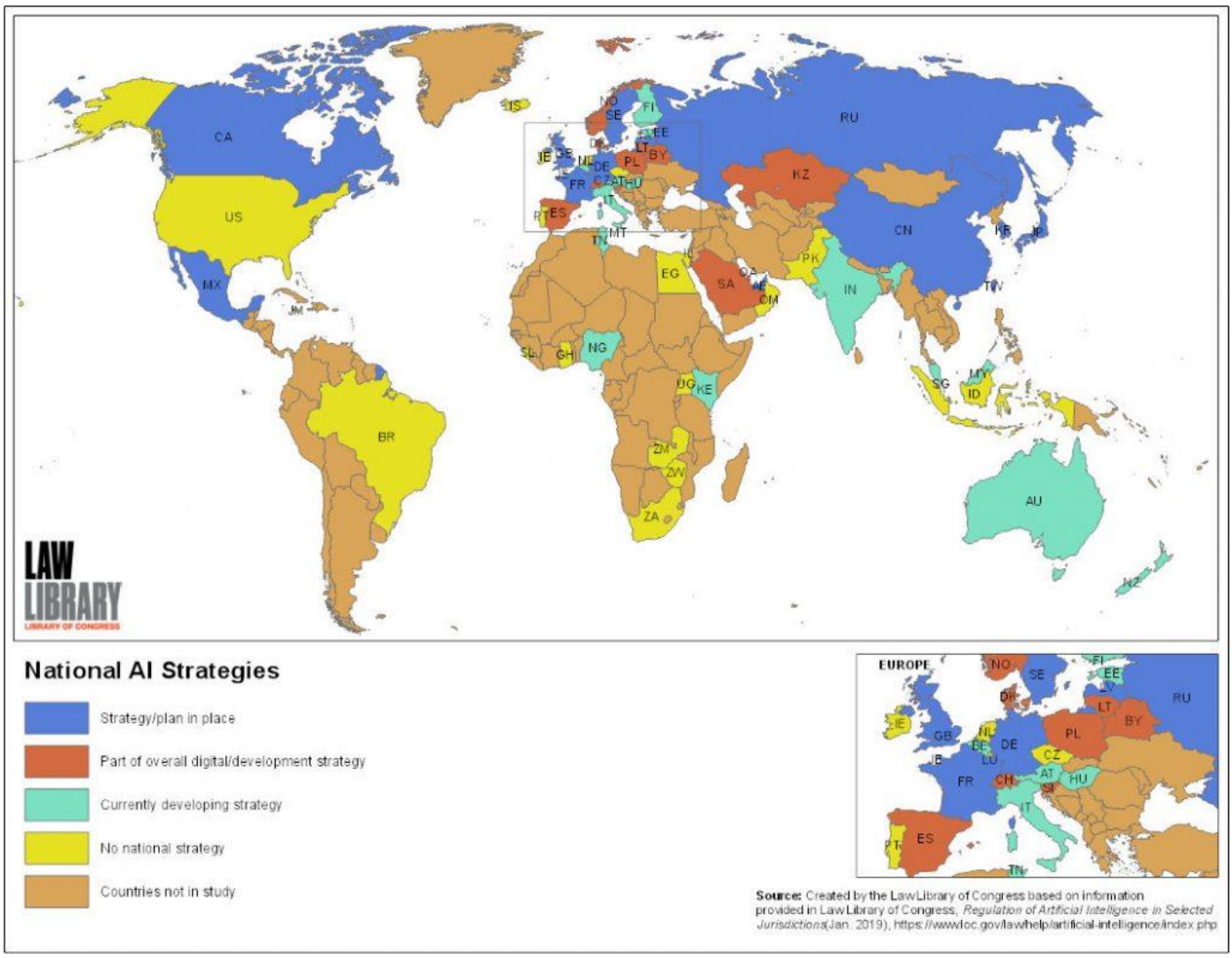
Another area to review, is regulation. As of January 2019, world wide governments were looking into placing or had already placed regulations on A.I. in many industries. The majority of regulations are on autonomous vehicles and the testing of them. This is for the safety and security of the people that could be hurt in some fashion if the A.I. fails.

In 2017, Canada was the first country to develop a National A.I. strategy. It is focused on the need to develop ethical and legal guidelines to ensure all A.I. is created and applied based on Canada's values and citizen's rights. The following year, the EU (European Union) issued ethical guidelines to ensure A.I. is designed to be trustworthy (Library of Congress 2019).

Figure 1.2 is a map of the various differences between countries and A.I. strategies.

Figure 2

Regulations (Library of Congress, 2019)



Individual states are more active in seeking to regulate A.I. to protect their citizens. Although there are not any federal regulations and/or laws, seventeen states introduced legislation specific to A.I. during 2022. Some of the laws are geared to protect applicants and/or employees, specifically, as well.

A. Illinois enacted the A.I. Video Interview Act. This bill states any employer that relies solely on A.I. to determine who qualifies for an in-person interview, must gather and report certain demographic information to the Department of Commerce and Economic Opportunity. The department, then analyzes the data provided and reports whether the data discloses a racial bias in the use of A.I.. Illinois, also, has pending legislation that will amend the Equal Pay Act and the Consumer Fraud and Deceptive Business Practices Act. It provides when using predictive data analytics in determining credit worthiness or in making hiring decisions.

B. Massachusssetts has pending legislation that relates to the Future of Work Special Commission that was established to conduct a omprehensive study relatie to the impact of automation, A.I., global trade, access to new forms of data and the internet of things the workforce, businesses and economy.

C. Michigan has pending legislation that would require the review of computer system algorithms and logic formulas used by the unemployment agency.

D. New Jersey has pending legislation that will require the Commissioner of Labor and Workforce Development to study and report on the impact of A.I. on the growth of the state's economy.

E. New York – pending legislation – to establish a commission on the future of work within the department of labor to research and understand the impact of technology on workers, employers, and the economy of the state. New York, also, has pending legislation to establish the criteria for the sale of automated employment decision tools; providing a civil penalty for violation criteria.

F. Vermont – failed legislation that was in relation to A.I. and workforce development.

The following is a list of state task forces or commissions as of 2022:

- Alabama Commission on A.I. and Associated Technologies, created by SJR 71 in 2019
- California Future of Work Commission, created by executive order 2 in 2020
- A.I.: A Roadmap for California, Little Hoover Commission, created in 2018
- Hawaii A.I. Advisory Committee, created in 2019
- New Jersey Governor's Future of Work Task Force, created in 2018
- New York Future of Work Commission, created in 2019
- Utah Deep Technology Talent Advisory Council, created in 2020
- Vermont A.I. Task Force, created in 2018
- Washington Automated Decision-Making Systems Workgroup Report, created in 2021
- Washington Future of Work Task Force, created in 2017

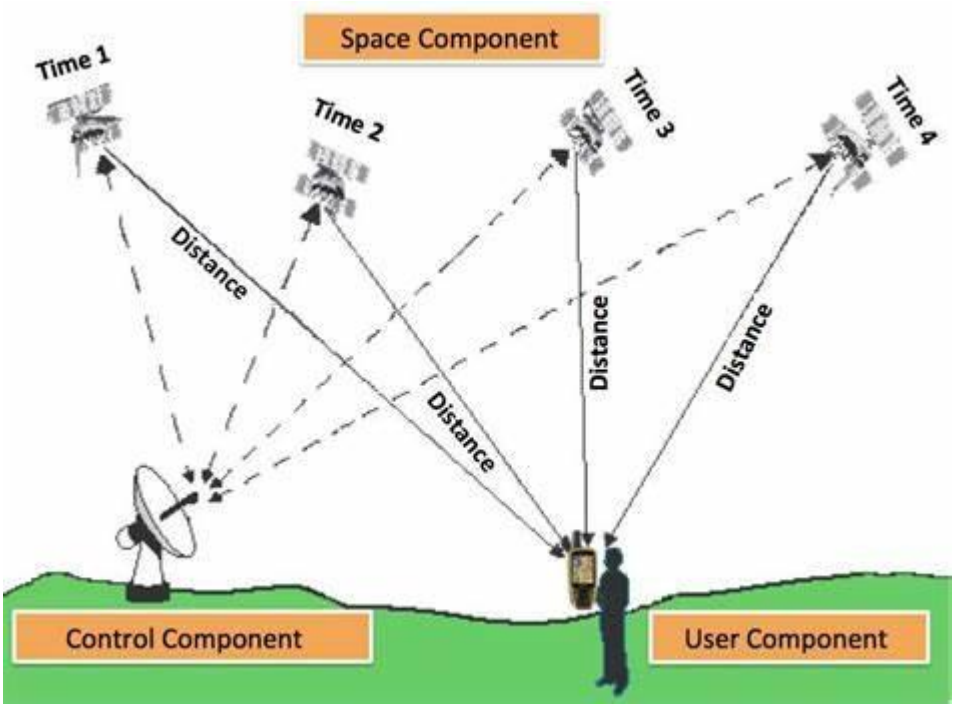
The list is not very long considering the number of states that make up the United States of America, but it shows that concerns about A.I. and it's effects on the human employee are becoming more prevalent than ever before.

Navigation

GPS or road mapping apps have made life a lot easier in getting from one location to another by any means of travel. Airplanes, trains, cars, even military vehicles utilize A.I. for the fastest most efficient way to travel to their next destination. According to Ellison, there were 5.5 billion smart phone subscriptions and that is expected to increase to 7.5 billion by 2025. The following is a diagram of how GPS navigation works. A signal is sent from the device seeking a new location and receives a signal back from a satellite as follows:

Figure 3

GPS (Schroeder, 2017)



However, there are roads always being developed and road under construction and sometimes these things are behind in reporting despite all of the high tech satellite information there is to rely on. That is just in relation to travel. GPS can be used for so much more. Employers can use A.I. GPS to track employees calls, texts, chats, emails, key strokes, internet searches, phone calls, location, length of conversation, and even tone of voice and movements in video and this list is not all inclusive.

According to an Aberdeen Group Study, 54% of companies in 2014 with field operations were tracking their field staff in real time. This number is up from 37% in 2012. This is clearly a fight between an employer's right to monitory and the employee's right to privacy. The artifical

intelligence utilized for navigation is not only affecting the human worker, it is possible to use it at the same time as replacing the human worker.

Trust

Trust is fundamental in all relationships. It means to believe in someone or something's trustworthiness. Trust can, however, be misplaced. For instance a patient can misplace trust in their doctor or doctor's office that is not deserved. To trust someone or something, is to place confidence in them/it to carry out specific action/task. Often times the algorithm programmed into the A.I. is inadvertently biased. For instance, Amazon's same day delivery algorithm was biased against an all black neighborhood. Another example was the Correctional Offender Management System (COMPAS). Their algorithm was unintentionally biased against African American offenders. There have, also, been instances when the artifical intelligence acted as a black box. In these situations, the developers did not have a good understanding of the basis on which the A.I. executed the trade. There are three types of trust: rational account, affective account, and normative account.

1. Rational account states trust is logically made by weighing pros and cons to determine if something or someone is trustworthy.
2. Affective account states trust is based on confidence and belief "in the goodwill of the trustee." It is believed the trustee will do as expected solely because they/it knows the trustor is counting on them/it.
3. Normative account states the trust is just there based on the belief the trustee will do what is right and expected of them.

In other words, with the rational account, the trustor has confidence in the trustee, with affective account, the trustor believes the trustee is competent, and with normative, the trustor is

vulnerable to the actions of the trustee. With A.I. there is a mix of all three when it comes to employees/human workers. They have confidence in the developers that the A.I. is accurate and trustworthy, they believe the developers have created a competent machine/robot, and they believe the machine/robot will do as it has been programmed to do just because that is what it was made to do.

As stated with the examples from Amazon and COMPAS, however, developers are only human and mistakes in programming can happen. Sometimes these mistakes are not caught before the machine/robot has been put to use in the field they were created for.

Table 1

Trust (Ryan, 2020)

Trust Component	**Rational Account**	**Affective Account**	**Normative Account**
Confidence	X	X	X
Competence	X	X	X
Vulnerability	X	X	X
Betrayal		X	X
Motivation		Affective	Normative

A.I. cannot be fully 100% trusted. It is nothing more that software development. Instead of the industry making statements of 'trustworthy A.I.,' they should refer to it as 'reliable artificial intellignce, as it is human made and humans make mistakes (Ryan, 2020).

Fear

Throughout this paper fear has been touched on. Workers fear A.I. will replace them in the workplace. As far back as 1589 when Queen Elizabeth refused to allow a stocking frame

patent for fear it would cause her subjects to be unemployed, to two centuries later when Ned Ludd and his followers smashed automated weaving machines, for certain they would replace them and their skills, to more recently in the 1970s when Wells Fargo gave warning that the ATM would surely cause unemployment in the banking industry by reducing the number of bank branches. Fear of being replaced by A.I. has remained steady.

With history showing the fears to be null, why all the fear still to this day? Many say the A.I. of today is different. It is developing in more human like ways that people believe will be the downfall of their jobs. However, current trends support history in that the human worker won't be affected as harshly as believed. Although A.I. continues to grow and develop a great strides, the labor force has remained stead fast with historical averages. In the US, there were four people of working age per retiree in 2010 and by the year 2060, there will just two. This indicates there is very little that A.I. is going to affect.

Of course there will be some displacement, however, that displacement curves into other jobs. For instance, Amazon replaced 140,000 retail jobs with full artificial automation. Although that sounds like 140,000 people lost their jobs, they, in turn created 400,000 warhouse and e-commerce jobs. Thereby offsetting the loss exponentially. Additionally, truckers can, currently, run 11 hours a day with a 30 minute break in the middle of that somewhere. The system in place to track their hours and breaks, however, continues tracking despite any problems they may encounter along the way, such as being stuck in traffic or waiting for their trailer to be loaded or unloaded at a customer's. The clock keeps on ticking. The American Trucking Association believes A.I. is the answer to this issue. A.I. will allow the truck driver to work more convenient hours, organize their inventory, communicate with customers, and have more home time with their family. It will, also, ease the regulatory burdens and make it a more appealing career

choice. Recent trends show there is a 900,000 driver shortage on the horizon. So, although A.I. is replacing some of the job duties of the driver, a driver is still required – so they will work together in harmony. A.I. may be the answer to current critical concerns in varying industries; just working together with the human worker (Walker 2018).

Bias

A.I. is created with the human intelligence of one person or a specific group of people. This limits the capabilities to only their knowledge. Unfortunately, with that comes the ability to manipulate and control the information and algorithms. With this come bias, as well. It is inevitable.

Bias in A.I. has to be a serious consideration as it is used in hiring practices, criminal justice processes and procedures, and in healthcare decision making. Human decisions can be flawed and shaped by individual and societal bias that is, often, unconcious. And, honestly, it can go either way. A.I. can reduce bias, but it can, also, cause unknown bias based on the developer(s) knowledge and personal bias'.

Bias can be established through the data based on how it is collected and/or selected for use within the algorithm. For example, oversampling an already over policed neighborhood can lead to more recorded crimes, thus resulting in even more over policing. Whereas undersampling can lead to approval of a group of applicants at a lower a rate.

The choice of variables can, also, bring about bias. For instance, if an algorithm analyzes how sick patients are based on their cost of care, and it costs less to treat African American patients with the same level of sickness as white patients, then the algorithm will enroll African American patients in supplemental programs at a lower rate.

Data generated by users can also cause feedback that is bias. For example, Latanya Sweeney performed research seeking racial differences with online ads. The search for African American identifying names resulted in more online ads with the word “arrest” in them, than the search for white identifying names. This shows the number of algorithms reacting to billions of users interactions every day, increases the potential for user-generated bias.

Another way bias can be generated into an algorithm is through statistical correlation that may be unacceptable or, even, illegal to society. For example, if a mortgage lending algorithm finds the older population has a greater chance of defaulting on their loans, the outcome could result in reduced lending based on age.

There is not a clear cut answer to offset bias in A.I.. Some suggest including a way to program fairness constraints, but even those come with fault. For instance, if a fairness contraint is programmed into a lending institution’s algorithm, it could backfire. The very people it is built in to protect could be hurt by approving funds that cannot be repaid back, and resulting in hurting their credit score.

As researchers continue to define the definition of fairness, devlopers are working on programming techniques that will enforce fairness constraints. There are currently three techniques:

1. Pre-processing data – focuses on training data
2. Post-processing data – occurs after training data is complete and developers want to equalize the outcomes
3. Imposes fairness constraints OR uses an adversary to minimize the system’s ability to predict data (Silberg & Manyika, 2019)

Data Privacy

Data privacy is to ensure the leak of sensitive information does not take place. There are large amounts of data collected and processed all day every day by both companies and governmental offices. The data remains the most secure when analysis is performed within the walls of the collecting organization. On the other hand, when analysis is performed by third parties, disclosure of sensitive information is much more likely. Additionally, leaking of sensitive information increases even more when there are others that are not directly involved with the data analysis process. An example of this would be if a software developer needed to develop and test procedures on data they are not, technically, allowed to see. Another way that increases the risk of leaking sensitive information is when the analysis of data requires data collected from more than one source. For instance, when financial institutions track fraud detection or hospitals are analyzing diseases and treatments. The data is collected from several organizations, thereby increasing the likelihood of leaks (Torra, 2017).

Data in A.I. is in electronic bits with encryption as the form of protection. Encryption transfers sensitive data into code. It acts like a safety box that only opens with a password as the key.

The average person has several ‘boxes’ of data on their own personal computer, as well as financial information on bank and supplier systems and health and official data on medical and governmental office systems. Each one of these systems requires a unique password that is strong and, preferably, different to reduce the risk of disclosure of sensitive information. This is not always enough protection, however, and nowadays, there is a secondary way to protect the data with biometric recognition, such as facial recognition or a fingerprint (Harvey, 2013)

A.I. is used in the majority of applicant services and tracking and human resources activities overall. What used to employ several human resource office staff, now accommodates only 1 or 2 people in even the largest of companies because of the developments in A.I. It offers greater efficiency, enables connecting with those not necessarily looking for a new career, but may be interested in an open position, improves communication and interaction among current employees. For instance, some of the applicant services A.I. does is read cover letters and scan resumes to identify the most qualified candidates, as well as being able to identify training needs in current employees. According to a 2019 survey, 61% of all companies were using A.I. for HR management functions that are time consuming and labor intensive in recruitment (Palos et al., 2021). These functions include the analyzing of a lot of private data for each candidate and/or employee. Privacy failures have become more and more common place with high profile cases setting the stage for seeking more regulations. This is, not only, due to the harm caused to the applicant and/or employee, but also the damage done to the organization's reputation. Companies face challenges managing a greater volume of sensitive data caused by increased digital practices.

Data security is about protecting individual's private information from unauthorized access and, possible alteration. The goal is to protect the individual from misuse of their own data, but it is still very insufficient as it stands today. There are a few protections in place, however.

The first line of protection is the US Constitution, then there is case law, then employment labor and contract laws. As stated earlier, there are a few states that have some regulations over A.I., but more are needed it would seem based on the following table. This is a list of reported employee data breaches between January 2010 to February 2012.

Table 2

Employee Data Breach (Beans, 2012, p. 17)

Reported Employee Data Breaches (From January 2010 to February 2012)

Reason for Compromised Data	Number	Percentage of Total
Stolen computer or laptop	38	21.2%
System hacked	24	13.4%
Third-party loss of data	18	10.0%
Stolen—Other storage devices for data	17	9.5%
Public posting on Web due to lack of training/security to prevent this	17	9.5%
Data e-mailed to an unauthorized individual or group	14	7.8%
Breakdown in access or absence of physical security	11	6.2%
Virus, malware, spyware, or file sharing	11	6.2%
Inappropriate disposal of data through waste collection	7	3.9%
Data in paper form stolen	7	3.9%
Data exposed and viewable in a mailing	6	3.4%
Data lost, tampered, or stolen during mail transport	4	2.2%
Access device fraud by temporary employees	3	1.7%
Sold computer equipment without removing sensitive data	2	1.1%
TOTAL	179	100%

On December 15, 2010, the Department of Commerce issued the Internet Policy Task Force paper which recommended the development of a bill of rights for employees (and consumers). It was referred to as HR Privacy Solutions 2010. After this, the Whitehouse proposed a 52-page document called Consumer Data Network Privacy in a Networked World: A Framework Protecting Privacy and Promoting Innovation in the Global Digital Economy. It was released February 23, 2012. The key elements of this paper were as follows:

1. Consumer Bill of Rights
    a. Individual Control
    b. Transparency
    c. Respect for Context

   d. Security
   e. Access and Accuracy
   f. Focused Collection
   g. Accountability
2. Multi-Stakeholder Process
   a. Specify how privacy principles apply in business, in voluntary but enforceable code of conduct
3. Effective Enforcement of Privacy Commitments by the FTC
   a. Using both current and additional authority requested by Congress
4. A Commitment to Increase Interoperability with the Privacy Framework of International Partners

There are 46 states (with the exceptions of South Dakota, Kentucky, Alabama, and New Mexico) that have laws requiring notifications of breaches to individuals and law enforcement agencies in the even covered personal data is acquired without authorization, unless it is encrypted (Bean, 2012, p.14).

As A.I. in HR management increases and evolves, applicants/employees have serious concerns about their personal sensitive data being breached, as well as uncertainty over being dehumanized and replaced by A.I.

Deep Learning

Deep learning is a set of techniques to implement machine learning based on artificial neural network that is inspired by the human brain. It loosely models the way brain neurons interact. Neural networks have many deep layers of simulated interconnected neurons. Deep

learning has 10+ layers with millions of neurons whereas earlier networks only had 3 to 5 layers with dozens of neurons.

There are 3 types of deep learning:

1. Supervised – this is labeled data that is available with preferred output variables for known objects such as in image recognition
2. Unsupervised- this is labeled data that is available for cluster or pattern recognition such as an image of a group of buildings with similar architectural style in a set of existing data.
3. Reinforcement – this is where AI receives virtual rewards or punishments, often on a scoring system, such as trial and error… this is an evolving technique and currently being developed

Although deep learning is the best A.I. programming for high variety and high velocity data, it is not as safe for data privacy and security as would be preferred. Recently, it was found that deep learning can be stolen or even reverse engineered. For example, the face of a victim that has been secured and unable to be identified, can, in fact, be reverse engineered and recovered. It has, also, been found that deep learning is vulnerable to adverse examples, resulting in A.I. making wrong predictions, thus incorrect outcomes (Vasudevan, 2022 p. 31).

Economic

A.I. can do a lot to lift the global economy. Productivity growth is critical for long term economic growth, especially at a time of aging and falling birth rates. Global productivity dropped an average of 0.5% between 2010 and 2014 from 2.4% only 10 years earlier (Lewis 2019, ch 1).

A.I's impact on productivity growth is through labor market effects including substitution, augmentation, and contributions to labor productivity. Research suggests labor substitution could account for less than ½ the total benefit. A.I.'s augmentation of human capabilities, enable the worker to be more productive in higher-value tasks and increases job demand for jobs associated with A.I. development technologies.

A.I. can boost innovation, allowing companies to improve their top line by reaching underserved markets more effectively with existing products and over long term, create entirely new products and services.

A.I. can create positive externalities, facilitating cross-border commerce and enabling data flow across borders, as well. The increase of economic activity and income can be reinvested into the economy, contributing to further growth.

There are, however, negative externalities, as well. A.I. could lower, not eliminate completely, but lower positive impacts on the economy through:

- Increased competition
- Costs associated with managing the labor market transitions
- Offer potential loss of consumption for citizens during periods of unemployment

Ethics

Many consider the emergence of A.I.'s superintelligence as inevitable, just a matter of how long before it is here. It may involve complex robotics or the manipulation of vast amounts of data. It may involve how we relate to each other or how, as individuals, do we think, remember, and reason. It may involve how we trade or who has access to what type of information and how they have access to it. A.I. involves economies, politics, and cultures. There are implications to those directly using A.I., like a robot butler and to those that are remote, such

as when a developed algorithm helps make a public policy. There are ethical implications at all levels.

A.I. is applied in many different ways and often in different ways in the same area. For example, A.I. in the medical field can be used to diagnose and/or treat illnesses, as well as be used to assist a surgeon during a medical procedure. With all the A.I is involved in, there are several ethical initiatives underway. There are projects specific to focusing on examining ethics in A.I. as well as corporations and individuals. All of them have the same goal – ensuring A.I. ethics are solid (Boddington, 2017).

The government has, also, looked at A.I. ethics and wrote a report in 2016 called, The White House Report on the Future of A.I. They also wrote a draft report on robotics and law by the Committee on Legal Affairs of the European Union. Government work focuses on wider societal issues such as unemployment, funding and economics, all with great ethical implications (Boddington 2017).

Also, the Institute of Electrical and Electronic Engineers (IEEE) has written Standards Association Global Initiative for Ethical Considerations in the Design of Autonomous Systems. This publication is an ongoing project to produce both industry standards and discussion documents on various topics. It includes research funding councils like Engineering and Physical Science Research Council's Principles of Robotics produced in 2011. This council is designed to specifically to encourage ongoing discussion. Additionally, there are projects funded by non-profit organizations like the A.I. grant from the Future Life Institute. Although a true code of ethics of A.I. has not been created yet, there are at least strategies currently in place that are followed to seek ethical success in developing A.I.

Sharing and publishing research results online and making results as broadly accessible as possible is one strategy that is in place and is successful. This strategy tries to make A.I. operations transparent and seeks to reduce uncertainty. There are, also, technological strategies to ensure safe and beneficial A.I. This involves verification and validation. It also, tries to ensure human control of A.I. Moral strategies look at cases and seeks to ensure threats of A.I. can be balanced against the benefits, suggesting A.I. will help us make better moral decisions. These strategies also, bring about the ideal of A.I. running against the difficulty that one person's comfort could be another person's panic.

With all of this said, there are three (3) common theories regarding ethics in A.I.:

1. Consequential – right action is the one with the best consequences
2. Deontological – what matters is if the action is of the right kind and in accordance with a general principle such as do not lie or do not take an innocent life
3. Virtue – focuses on the character of the ideal moral agent; describing the range of different values and claims to do the right thing in any given situation based on what a fully virtuous person would do (Boddington 2017).

A professional code of ethics is created by a professional with certain expertise that either produces something specific or delivers a specific service within an area in which they are writing a code of ethics. The codes they create are centered on the specific product or service they are involved with, and only minimally refer to the public.

With A.I being a part of so many varying industries, products, and services, there is no way to create code of ethics to go by that would be all encompassing. As A.I. grows, it appears each individual area, product, or service will have their own code of ethics to follow. With

regard to HR management functions, applicants and employees have fears regarding the code of ethics that may be lacking that can put their data privacy at an even higher risk.

Environmental Impact

A.I. has many applications in environmental conservation, to include managing smart cities, energy, agriculture, natural disaster prediction, and adaption to climate change. It also, can use large amounts of power and energy, causing negative effects on the environment.

Smart cities use technology, data, and intelligent systems to improve their citizens' quality of life, by making the city more efficient, sustainable, and livable. A.I. is used, for instance, to manage traffic lights more efficiently. This reduces the amount of time vehicles are stopped, thus reducing emissions by 20% (Pachot & Patissier 2022).

A.I. can be used to anticipate energy resource needs and limit unnecessary expenses. It can also, be used to reduce the efforts of climate change or, even natural disasters. All of these possibilities help cities have more environmental responsibility, as well as improve the lives of the city's citizens.

A.I., also, plays a role in transitioning to renewable energy. It does this by analyzing very large amounts of data. This analyzation can help optimize wind farm and other renewable energy system's performance. Using renewable energy to replace fossil fuels is one way to save energy and A.I. is seeming to be very useful in this area.

Due to A.I., it is now possible to improve the performance of wind farms by analyzing meteorological data. It is used to correlate the speed of each propellor with the direction and power of the wind. This allows for the best optimization of electricity production from the wind turbines.

By collecting and analyzing data from different sources, A.I. has been able to help farmers make better decisions regarding crop production, water usage, and pest management. This assists farmers in reducing the use of pesticides, increase crop yields, and decrease water waste. A.I. further assists farmers to protect their crops by analyzing and predicting weather forecasts, such as with extreme weather events. Farmers have been able to avoid losing entire crops due to unexpected weather thanks to the developments in A.I (Pachot & Patissier 2022).

A.I. has been able to play a huge role in preserving the Earth's ecosystem. Again, large amounts of data are analyzed, and climate change researchers have been able to understand the effects of climate change on biodiversity and make predictions about which species are at most risk. A.I. can, also, help detect and prevent illegal activities such as poaching and deforestation (Pachot & Passitier 2022). Using A.I. to understand and protect the ecosystems of Earth, helps work toward preserving the diversity of life. As an example, there is an initiative called "Ocean Cleanup Project." This initiative utilizes robots to clean up large bodies of water. In another example, A.I. is being used in Massachusetts to rehabilitate an area destroyed by cranberry production. The MIT Media Lab researchers "utilize microphones and A.I. to listen to the interactions between species to determine the effectiveness of their restoration efforts" (Pachot & Passitier 2022, p. 3).

As mentioned earlier, A.I. is very involved in the automotive industry. However, it is also used in the automotive industry on the environmental level, as well. A.I. can be used to reduce pollution with fuel-efficient driving and optimizing engines to be more efficient. Currently, manufacturers are working on the development of shared, smart, and ecological transport to continue to further reduce emissions and vehicle pollution.

Global warming and depletion of natural resources are of utmost concern in today's world, causing public debates worldwide. After many years of denial, the impact of technology on the environment is ow seen as a serious issue. This includes the impact on the environment from terminal manufacturing. Terminal manufacturing is the energy required to use digital services and the "end of life" analysis of equipment. Due to the large amounts of data and computer power needed for A.I., researchers have determined there is a significant impact on the environment (Pachot & Patissier 2022).

Researchers have measured CO2 emissions associated with A.I development and found the same amount as that of 5 cars over their lifetime. "That is equivalent to 315 round trips by plane between New York and San Francisco" (Pachot & Passitier 2022, p. 4). This is significant because A.I. evaluations mainly focus on precision and accuracy without any consideration for impacts on the environment.

Researchers are working on a way to offset A.I. environmental impact. Some of the challenges A.I. entails are the vast amount of data it has to analyze and the amount used for training data to achieve good performance. The brain, however, learns much more quickly. It learns from smaller examples using prior knowledge, attention, and memory.

If these things could be incorporated into A.I, it would make A.I. more efficient and more effective at learning from smaller amounts of data. By using the inspiration of the learning abilities of the brain and developing new algorithms, researchers may be able to develop A.I. that is more efficient at learning from smaller amounts of data, thereby potentially reducing the emissions into the environment.

A.I. uses non-renewable natural resources, thus its use must be managed responsibly. Just as ethics and regulatory controls need to be kept at the forefront of A.I. development, so do the environmental concerns (Pachot & Patissier 2022).

Limited Acceptances

Despite the enthusiasm for the positive results of A.I., there are obstacles facing those industries that do not utilize it as of yet.

1. Lack of labeled data
    a. Most algorithms require large amounts of good quality training images for input data. The industries that are not utilizing A.I. do not have this type of data set readily available to put into A.I. development.
2. Pervasive availability
    a. Not all patterns can be understood by computational algorithms
3. Dimensionality obstacles
    a. A great deal of the image available to A.I. are larger than 50,000 by 50,000 pixels. This is much larger than the average of 350 by 350 pixels. Even with ‘patching’ as a solution to this issue, the sample still needs to be much smaller than what is available for programming A.I.
4. Turing test dilemma
    a. As mentioned in the introduction, all A.I. must pass the Turing test; the level of machine intelligence. It is the ultimate validation of A.I. The theory is a machine is only as smart as the human programming it. Often it is hard to perform the Turing test, making full automation not possible, at least not as the Turing test states.

5. Uni-task orientation of weak A.I.
    a. Weak algorithms are designed to perform only one task. Unfortunately, with the larger set of training data required for some industries, it is a big downfall. They need to design, develop, and train solutions for many different sections which would require a multitude of resources.
6. Affordability of required computational expenses
    a. A.I. is dependent on GPUs (graphical processing units); highly specialized electronic circuits for fast processing of pixel-based data, such as digital images or graphics. This is financially limiting for an industry to request GPUs for A.I. development.
7. Adversarial attacks
    a. This is the targeted manipulation of a very small number of pixels within an image can mislead A.I. outcomes. Researchers are still trying to find out how to create deep networks that would avoid these attacks.
8. Lack of transparency
    a. The pathway to reliable A.I. outcomes must be transparent and fully comprehensible. This is not an option when one takes into account the previously stated issues facing those few industries not utilizing A.I.
9. Realism of A.I.
    a. Although the concept of the possible outcomes of A.I. is very optimistic and promising, the implementation, plus the tools needed for the industries not involved with A.I. at this time is not foreseeable in the near future; not where

A.I can function accurately, efficiently, and effectively on a daily basis (Tizhoosh & Pantanowitz, 2018).

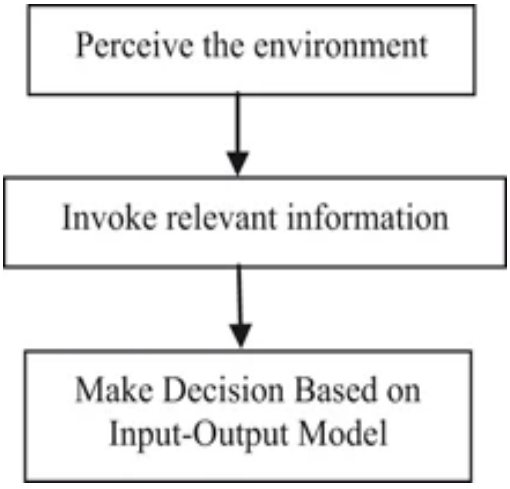
Due to advances in non-medical image applications, many researchers believe A.I. and deep learning are set and ready for every industry out there to utilize. However, developers of deep learning believe their models need greater documentation and they need further technical decisions before fully advancing forward to all the lagging industries. Regardless, there is clear potential for A.I. to continue to grow and invade even more industries and affect even more human employees (Tizhoosh & Pantanowitz, 2018).

Decision Making

Rational decision making is defined as "the process of making decisions based on relevant information in a logical, timely, and optimized manner (Marwala, 2014 p. 2).

The 4.4.

Rational Decision-Making Steps



A.I. moves from adopted technology to making decisions every day from medication to navigation. Algorithms and A.I. models are how decisions are made with A.I. They are designed

to extract useful information from data input. The information is, then, used for making predictions, forecasts, and interpretations that support decision making.

Although algorithms perform impressively, many situations can be more problematic in nature and the decision made is not guaranteed to be the best one in those circumstances. This makes the decision-making system of A.I. kind of shaky.

Sometimes A.I. decision making is referred to as data-driven decision-making; however, that is misleading. If it was data driven only, and data was all that was considered, it would be like driving a car down the highway while looking in the rearview mirror. As A.I. continues to expand in applications and industries in order to make humans lives better and more fulfilling, most people do not even think about the models or algorithms. Algorithms and models are completely invisible and, usually, incomprehensible. They are designed using advanced computing from mathematics and statistic that most people are not trained to understand. It is amazing how often the algorithms produce proper or positive results. Often giving decisions better than a person may make on their own. This is the value of data and the power of models and algorithms that use the data to make decisions (Marwala, 2014).

Many companies are using A.I. for business decision making. For instance, in the healthcare field A.I is used to review CT scans to detect signs of lung cancer. A.I. can review scans a lot faster than a single radiologist can do on his own. In the energy industry, they use A.I. to collect data such as temperature, humidity, vibration, and more to make operational decisions that will improve efficiency and provide cost-savings. The automotive industry uses early warning systems that analyze over a million events every week in order to predict breakdown and failure in their cars. The financial services industry uses a system to apply advanced A.I.

algorithms to acquire portfolio data to find patterns for good and/or bad loan applications. As one can see, A.I. decision making technologies are in every aspect of people's lives.

Human resource management decisions are no different. They are just another area decisions are being made by A.I. for humans. A.I. determines schedules, screens resumes, assesses video applications by analyzing body language along with verbal analysis, and offering personalized career coaching to name just a few things. These can all generate many benefits like improving the depth, diversity, and quality of applicant pools and deepening human resource management services. These benefits are not guaranteed, though. As A.I. use is increased in human resource management, concerns from applicants and employees increase regarding how this could affect their livelihoods.

With data being the key ingredient for A.I., if it isn't any good, the results will be vague or distorted. Data sets in the field of human resources tend to be narrower compared to other areas. Quantity and quality of the data needs to be considered, as well as, how to embed it in a context and time interval that encourage analysis and decision-making by collecting the appropriate data, just in time interventions can be made.

By design, as mentioned earlier, algorithms can induce bias and that is not any different with decision-making. They can, also, incorporate ethical considerations, decision-making processes, and manager's knowledge in order to avoid this bias. This enables A.I. to determine the most appropriate human resource strategy in each situation (Rodgers et al., 2023).

Creativity

A problem developers run into is convincing people their A.I. software is ore than just an extension of their own creativity. A.I. relies on human judgements during development. This can be seen as an extension of the developer's creativity. To be considered independent, A.I. must be

able to independently apply and independently change the standards it uses. This is called "creative autonomy" (Jennings, 2010, p. 489).

Once a program has started to run, any contact between the system and a human can lead to questions about the A.I.'s independence. A.I. is considered to have creative autonomy if it meets the following criteria:

1. Autonomous Evaluation – The A.I. can evaluate its liking of a creation without outside sources.
2. Autonomous Change – The A.I. can initiate and guide changes to its standards without being told when and how.
3. Non-randomness – The A.I.'s evaluation and standard changes are not random (Jennings, 2010 p. 490).

Autonomous evaluation states the A.I. can issue opinions without human or outside. machine interference. The A.I. is free to ask for or observe other's opinions at times and share the information. This can be achieved by any pre-programmed standard.

Autonomous change requires A.I. to be able to independently change its standards even though external events may guide changes, the A.I. cannot exclusively rely on another source to tell it when to change standards or when new standards are acceptable.

Non-randomness is meant to prevent random criteria changes at random times. Not all randomness is included as some developer's program small amounts of randomness. Either way, it does not guarantee predictable outcomes.

After discussing these items, it begs the question, how does a developer learn to judge the quality of the finished A.I. product?

1. Subjectivity

2. Making evaluations
3. Communication

With subjectivity, developers need to keep in mind different people have different standards or opinions. A developer can target an audience knowing all the opinions that are available on their specific subject for their A.I. program.

Making evaluations requires a mathematical formula where the developer evaluates what their own opinion is and what their own social background knowledge is against differing opinions and social backgrounds. Although developers could make the A.I. issue the majority representative opinion, it proves more interesting and accurate if the A.I. imitates some opinions more than others

Communication consists of the following three classes:

1. Evaluation – the user either likes or dislikes the standard
2. Correction – the developer creates a modification that the user will input what standard they like better
3. Criticism – the developer attempts to initiate justifications for an evaluation or a correction (Jennings, 2010 p. 494)

In each case, the developer adjusts their formula in order to reproduce their evaluation.

The concept of creative autonomy requires an A.I. to be able to evaluate its creations by consulting others and adjust how it makes these evaluations without being explicitly told when or how to do so. These processes cannot be random. Initially, the A.I. does not have independently held opinions to form its own. This can change when the A.I. justifies its evaluations.
A.I., whose creations had a style that was not easily traced back to its developers would be a major accomplishment.

Developers are human and can proactively change their opinions. Although, A.I. can make proactive changes by looking for patterns in how others change with time, these are still programmed into the A.I. by the developer. Therefore, it is not autonomous.

The concern that creativity will be lost to A.I. can be understood as A.I. can only be as creative as the developer programmed into it. However, with the growth and constant development of A.I., developing creative A.I. might still amount to solving a information processing problem. Creative A.I. in the workplace can still affect employees when the opinion or standard entered by the user differs from the programming. Employees could be hurt if the outcome is not congruent to the programmed task at hand (Jennings, 2010).

Liability

The combination of growing abilities of A.I. technology, human curiosity, and industrial needs direct the global trend to expand the use of A.I. More and more traditional human social functions are being replaced by A.I. For example, South Korea uses A.I. for border patrol soldiers along the border of North Korea, as prison guards, and as teachers (Halevi, 2014). With A.I. taking over so many of the human social functions, it begs the question, who is liable when things go wrong, and a crime happens?

There are two requirements needed to impose criminal liability. The first one is called "in-rem" and the second one is called "in-personam." In-rem has four requirements to fulfill its definition.

1. Legality – This forms the rules of how determining what is right and what is wrong criminally. To be legal, these four conditions must be met in order for an offense to be considered illegal:
    a. Legitimate legal source

   b. Applicability in time
   c. Applicability in place
   d. Legitimate interpretation
2. Conduct – This is required from the specific offense for it to be considered legal. The conduct is the objective external expression of the commission of the offense.
3. Culpability – The event must occur due to an individual's actions or inactions
4. Personal Liability – A person is responsible for their own actions or inactions and regardless of whether they act alone or with others. If the other three requirements are fulfilled, criminal liability is imposed.

In-personam, also known as the offender's requirements, must fulfill two general requirements.

1. The external or factual element
   a. What has happened?
   b. Who has done it?
   c. When has it been done?
   d. Where has it been done?
2. The internal mental element
   a. Conduct
   b. Conduct + circumstances
   c. Conduct + results
   d. Conduct + circumstances + results (Halvei, 2014)

The structure of criminal liability has been designed for humans toward human

capabilities, not for other creatures' capabilities. The mental element requirement relies on the human spirit, soul, and mind (Halvei, 2014). So, the question becomes how can A.I. be held criminally responsible when it is soulless and spiritless?

The external element is reflected by the factual element requirement. Regarding A.I., the missing component to meet all the criteria would be conduct. When a court is looking to impose sentence on an offender, it is expected to assess and evaluate each case based on data about the in-rem and the in-personam (offender). A.I. is not a human, assessing and evaluating the A.I. itself would prove impossible.

Additionally, how would A.I. be punished? There are four general types of punishment

1. Retribution –
    a. Based on a feeling of revenge
    b. Makes the offender pay the price for their crime
    c. Considered to be the dominant purpose of punishment
2. Deterrance –
    a. Modern purpose of punishment
    b. Intended to prevent re-offending by intimidation
3. Rehabilitation –
    a. Assumes the offender committed the offense due to a certain reason
    b. Relates only to future events
    c. The offense committed serves only as the initial trigger, but not addressed directly by the process
4. Incapacitation
    a. Physical prevention of further offenses being committed

b. Long term incarceration, castration are examples

c. Relates only to future events (Halvei, 2014)

Regarding A.I., the two options best suited for punishment would be rehabilitation and have the developer/s re-program the A.I. or incapacitation and completely remove the A.I. from operation. Ultimately, if a crime is committed by A.I., the courts would impose punishment on those humans involved in causing the crime to happen in the first place based on the programming of the A.I. (Halvei, 2014)

Liability regarding A.I. can be scary for employees, especially if something goes wrong along the way with A.I. updates or data input sensors go out and a human employee loses a limb or worse, their life. They want to know it won't be in vain.

Limitations

A.I. machines are not truly intelligent, as has been discussed throughout this paper. Humans build A.I. that perform calculations, transform data, and resolve problems. It has been revolutionary for humankind. It is not without flaws, though, and it has six main limitations.

1. Limited data
2. Bias
3. Computing time
4. Cost
5. Adversarial attacks
6. No consensus on safety, ethics, and privacy

Often times data is inconsistent or of poor quality. Data has become one of the most sought-after commodities – surpassing oil. It has become the new currency.

Bias, as reviewed earlier, is often built in. It has the potential to creep into data-modeling processes. Current methods of designing A.I. algorithms are not meant to identify and retroactively remove biases. Most algorithms are tested only for performance. Predicted data or a lack of social context, can flow thru and easily missed.

There are still some hardware limitations such as limited computation resources for RAM and GPU cycles. Companies that are already established are in a much better position than those just starting up (Sabouret, 2021).

Mining, storing, and analyzing data will be very costly both in terms of energy and hardware use. Additionally, skilled engineers in these fields are currently rare and hiring them will definitely prove expensive.

Since A.I. is not human, it is not equipped to adapt to deviations in circumstances. This inability highlights a security flaw that has yet to be effectively addressed.

Current limitations highlight the importance of safety. Also, most critics argue along the lines of ethics of implementing it, not just in terms of privacy, but also philosophically.

Future

Many believe A.I. will transform rapidly and outpace human intelligence, transforming society. They believe it will be a consequence of hardware and/or software developments. Their belief lies in Mr. Gordon Moore and Moore's Law.

In 1965, Gordon Moore, the co-founder of Intel, observed transistors in an integrated circuit had doubled every two years. After this observation, he proposed Moore's Law. Moore's law states this doubling would continue into the future. This prediction ending up being accurate and between 1986 and 2007, the capacity of the world's computers doubled every 18 months (Eysenick & Eysenick 2022).

As time has progressed, hardware developments have increased A.I. processing speeds. This has only led to quantitative changes; however, software developments involving algorithms have produced qualitative changes, putting human intellect behind A.I.

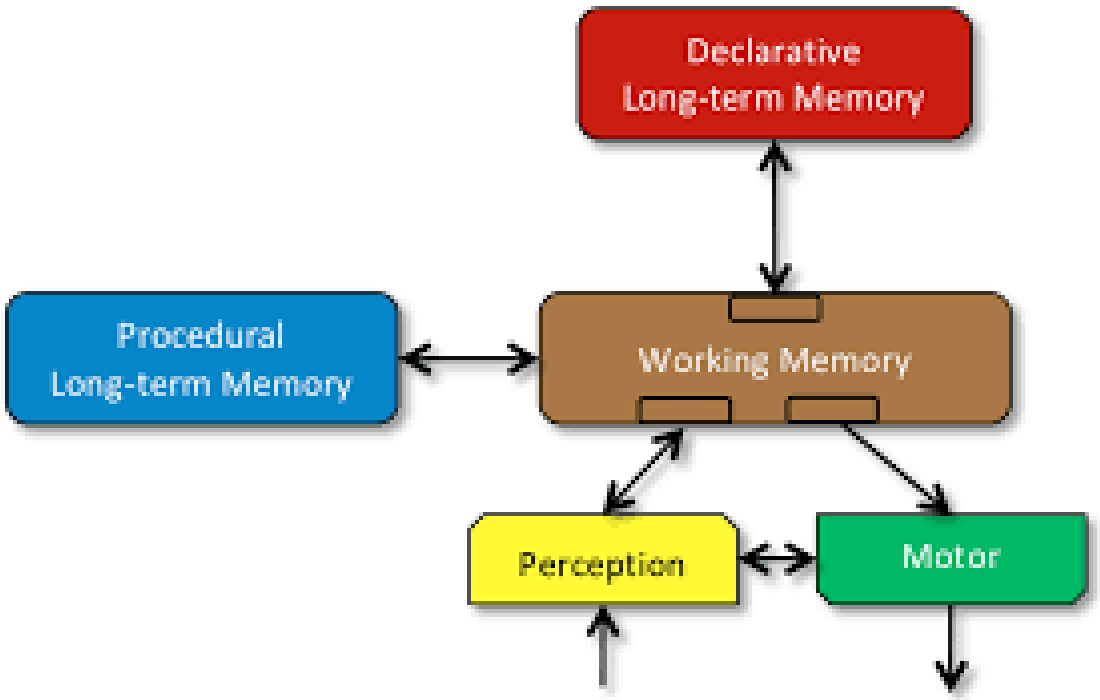
A promising approach to continue on this path into the future is to have A.I. imitate the human brain. This involves modelling the human brain's key cognitive processes and structures. This could be done by developing cognitive construction focusing on those aspects of human cognition of general importance over time and across different task domains.

Following is the standard model of the human cognitive construction. It has five major components.

1. Declaration long-term memory
    - Memory for information that can be consciously recalled.
2. Procedural memory
    - Memory for information such as motor skills that is not consciously acceptable.
3. Perception
    - Including all sense modalities such as vision and audition.
4. Motor
    - Involved in the control of action.
5. Working memory
    - Involves all four above components.

Figure 5

Standard Model of Cognitive Construction (Eyesnick & Eyesnick 2022)



As experts and developers focus on the above model working at making A.I. more and more intelligent, industries from financial services to healthcare to manufacturing are turning more and more to A.I. to replace human tasks. A.I. is only going to grow in the future and enter into more industries until A.I. is involved in every industry.

Societal Changes in Employment

Humans have experienced many changes in social life from the previous industrial revolutions. Each revolutionary breakthrough made in technology will have a huge shock to the existing labor market with traditional jobs replaced by new technology and/or new equipment.

A.I. is considered the third industrial revolution beginning in the mid-1970s. As time has progressed more and more product functions do not require operator intervention. They are autonomous. A.I. will lead to a major change in global production and living order. A.I. makes intelligent labor to replace manual labor. This frees the human from the heavy, dull, and repetitious manual labor.

As far as human life is concerned, A.I. exerts an obvious influence on family life and entertainment. Basically, A.I. is gradually changing the basic logic of human-kind's living order. Whether A.I. offers an opportunity or a challenge, it will deeply affect social production from enterprise reform to "reform carried out by all the people" and from mechanical innovation to "innovation campaign involving all the people." This will radically move social development.

During this third revolution there will be competition between machines and men as present jobs disappear and the related professions will either vanish or be transformed. This will result in increased polarization of the job market and the aggravation of social inequality (Jin, 2019).

There will be a dramatic decrease in low-end jobs and deteriorate mid to long-term employment. This will bring shock to the job market and traditional administration, then greatly reduce job opportunities.

The ten occupations least likely to be replaced by A.I. is as follows:

1. Psychologist
2. Personnel of Public Relations
3. Architect
4. Therapist
5. Lawyer

6. Musician
7. Scientist
8. Gymnasium Coach (Jin, 2019)

The biggest challenge with A.I. is unemployment. If an employee fails to keep up with technical innovation, they will be eliminated from the job market. Too many unemployed people will bring a threat to social stability. Therefore, there must be a good re-employment program to assist the human worker for a lifetime of education and learning. Constant innovations and adjustments are required for occupational training in the future (Jin, 2019).

In the future, A.I. may cause three kinds of social inequality. From contact to application and then to mastery of the technology.

1. Inequality caused by uneven opportunities for contact A.I. – people in developed countries will be more adept to dealing with relevant issues. Whereas people of underdeveloped countries will not know what to do.
2. Inequality caused by whether one can afford A.I. products – A.I. products are expensive. Moderately rich people create more value with A.I. products they purchase.
3. Inequality caused by different proficiency of "mastery of technique" in A.I. – A.I is considered a high-tech industry, calling for extreme knowledge and skills. Again, the user does not need to master the A.I. technology, but he/she does have to be able to afford it.

Low-end laborers may be faced with the threat of unemployment and poverty in a short period of time. In the long run, however, A.I. may offer people the opportunities to flow to a higher position (Jin, 2019).

Competition

A.I. has been designed and predicted to eventually take on human tasks that demand logical thinking. Research has shown that after people fail a task, they may or may not reorient their behavior. It depends on what they attribute that failure to. With regard to people competing with A.I. to complete a task successfully, there is ongoing research to understand how people will respond.

Casual attribution is the first way people respond to failed tasks. It is the consideration as to why a consequence occurred. People interpret the relationship between an individual's action and the environment. Casual attribution was slowly incorporated into research for education and now being used with research in the competition between man and machine.

Casual attribution affects feelings, future behaviors, and expectations of success. When people fail at a task and attribute it to stable factors, they have a low expectation of future successes.

When people are more likely to attribute positive results to internal causes and negative results to external factors, it is called self-serving attribution. It is considered to protect self-esteem and decrease self-threat. It tends to emerge when a task is important to a person.

Many studies on attributions have been conducted in the area of human/A.I. interaction. These have focused on how people make attributions of responsibility for A.I. failures and who they blame for such failures.

One such research created two competition tasks that required people to display logical thinking in experiments. The behavioral responses were mixed, however, in general the people made self-effacing attributions for their failures. They attributed the outcome to internal and

stable factors. They rarely blamed unstable factors, such as their own effort and luck. The same pattern of casual attribution was shown in both experiments.

These experiments indicated that people blame their failure against A.I. on themselves. There are two explanations for these findings. First, the study used tasks demanding participants to make logical decisions and see several moves ahead. Based on this, participants may have thought the outcome depended on their own and their opponent's logical thinking ability. High attribution to self-ability and low attribution to luck may have been brought about by the experiment itself.

The second explanation could be that participants responded to their interaction with A.I. as they would a human opponent. Thereby, demonstrating casual attribution between A.I., as well as humans. Responses were mixed when it came down to whether participants wanted a re-challenge after they were defeated by A.I. It was found the majority did not want to re-challenge A.I. and were more averse to it than re-challenging another human (Yokoi & Nakaychi, 2022).

This is believed to be because of one of two reasons. First, the difficulty of the experiment may have influenced the participants' decisions. Or, second, it was because people are more sensitive to failure than they are success. Based on these experiments and the fact that A.I. is being designed to think logically eventually in the future, it makes sense that people are concerned for their jobs, their livelihoods, being lost forever to A.I (Yokoi & Nakaychi, 2022).

User Perception

A.I. applications are associated with work viability, high-valued work, and firms' decision-making dynamics, promoting better performance. Today, A.I is used to assist human specialists in making decisions under high-stakes situations. Despite its advantages, as discussed

throughout this paper, A.I. decision-making is often not desirable due to concerns over our privacy, fairness, knowledge, trust in technology, and perceived values.

A.I. research suggests personal decisions making characteristics influence perceptions about outcomes and a person's value of a specific result. Sometimes lack of understanding about the decision support system makes people unwilling to take risks with insight that they gain from A.I. Like business intelligence gained by transforming raw data to provide decision support, data analytics affects the user perception, transforming further into satisfaction and user retention.

Studies show 61% of knowledge workers believe the data in A.I. is bias. A.I. is not only a socially structured enterprise but is socially structured in the sense that when implemented in a social environment, an A.I. system can assume social roles and enact social practices and form social relations. Based on this information, the perception of end users such as employees and applicants, is not positive (Kushwaha et al, 2022)

Conclusion

A.I. is no longer the technology of the future, but a reality that shapes our present daily lives. From voice assistants to data processing to financial services to manufacturing, people are surrounded by A.I. It has been around since the 18th century Industrial Revolution and throughout time, has grown and progressed and proven it is only going to continue developing into the future.

In a world where technology is advancing at an unprecedented pace, the development of A.I. brings both excitement and concern. With the ability to process vast amounts of data and make decisions without human interference, A.I. has the potential to pose significant risks to people's personal and collective well-being. A.I. is changing how companies work. Many believe the work will change and that organizations will begin to replace human employees with

intelligent machines. This is already happening; A.I. systems are displacing humans in manufacturing, service, delivery, recruitment, and the financial industries, consequently moving human workers towards lower-paid jobs or making them unemployed.

The history of work is the history of people outsourcing their labor to machines. While that began with repetitive tasks like weaving, machines have evolved to the point where they can now do what people might think of as complex cognitive work, such as math equations, recognizing speech and language, and writing. In the 21st century, A.I. is evolving to be superior to humans in many tasks, and this makes it seem people are ready to outsource intelligence to technology, as well. With this latest trend, it seems like there is nothing that can't soon be automated…meaning that no job is safe from being offloaded to machines.

The question of whether A.I. will replace human workers assumes that A.I. and humans have the same qualities and abilities, but they do not. A.I. machines are fast, more accurate, and consistently rational, but they are not intuitive, emotional, or culturally sensitive. Businesses need to anticipate what A.I. means in relationship to how humans think and act, and work to integrate the new technologies. Employees need to look at A.I. as bringing greater productivity and automation for work and as a benefit and not a threat.

A.I. is exceptional at learning patterns and automating tasks. Humans are creative and have general and emotional intelligence; both of which are skills that no A.I. can own. That is why A.I. will enable us to reach newer heights. We already have self-driving cars and robotic manufacturing. A.I. augments the capacity at which humans can operate. This allows for bigger and faster innovations. Through A.I., humanity will become more efficient and help sustain us.

The reality is, as a race, we have progressed so much that we now need A.I. to extend our intelligence and inspire creativity. It enables a spectrum of digital opportunities for tailored

products. The advantages of A.I. seem to allow for the natural evolution of not just our global economy, but, also, our quality of life, including assisting in creating safer workplaces by monitoring worker fatigue and detecting potential hazards.

From potential data breaches and cyber-attacks to the ethical implications of A.I. decision making, developers, experts, and politicians need to work together to understand and mitigate all the risks associated with A.I., while reaping the benefits. As we continue this journey called life, everyone must remember that the future of A.I. is in all our hands. It is up to all people to shape it in a way that serves the greater good.

References

Autonomy, artificial intelligence, and robotics: Technical aspects of human control", August 2019 - Executive Summary. (2021). *International Review of the Red Cross* (2005), 102(913), 504–507.

Bankins. (2021). The ethical use of artificial intelligence in human resource management: a decision-making framework. *Ethics and Information Technology*, *23*(4), 841–854

Bartlett. (2021). Beyond privacy: Protecting data interests in the age of artificial intelligence. Law, Technology and Humans, 3(1), 96–108

Bean. (2012). Are you protecting your employee's data? *The Journal of Corporate Accounting & Finance*, *23*(5), 13–19

Besold, & Robere, R. (2016). When Thinking Never Comes to a Halt: Using Formal Methods in Making Sure Your AI Gets the Job Done Good Enough. In *Fundamental Issues of Artificial Intelligence* (pp. 43–62)

Bhargava, & Sharma, P. K. (2021). Artificial Intelligence: Fundamentals and Applications (Bhargava & P. K. Sharma, Eds.; First edition.). CRC Press 2021

Boddington. (2017). *Towards a code of ethics for artificial intelligence*

Castelfranchi. (2013). Alan Turing's "Computing Machinery and Intelligence." *Topoi*, 32(2), 293–299

Eysenck, & Eysenck, C. (2022). *AI vs. humans*. Routledge

Frauenheim. (2006). Data accuracy, privacy key at IHRIM Gathering (International Association for Human Resource Information Management). *Workforce Management*, 85(9),

Gobet. (2017). Allen Newell's Program of Research: The Video-Game Test. *Topics in Cognitive Science*, 9(2), 522–532

Harvey. (2013). SmartData: privacy meets evolutionary robotics

Hodges, A. (2009). Alan Turing and the Turing Test. In: Epstein, R., Roberts, G., Beber, G. (eds) Parsing the Turing Test. Springer, Dordrecht

Haenlein M. & Kaplan A. A Brief History of Artificial Intelligence: On the Past, Present, and

Haleṿi. (2014). *Liability for crimes involving artificial intelligence systems*

Issues of Artificial Intelligence. Synthese Library, vol 376. Springer, *Cham Future of Artificial Intelligence*. California Management Review. 2019;61(4):5-14

Jennings. (2010). Developing Creativity: Artificial Barriers in Artificial Intelligence. *Minds and Machines (Dordrecht), 20*(4), 489–501

Jin. (2019). *Reconstructing Our Orders: Artificial Intelligence and Human Society*. Springer Singapore Pte. Limited

Kaliraj, & Thirupathi, D. (2022). Artificial intelligence theory, models, and applications (Kaliraj & D. Thirupathi, Eds.). CRC Press.

Kushwaha, Pharswan, R., Kumar, P., & Kar, A. K. (2022). How Do Users Feel When They Use Artificial Intelligence for Decision Making? A Framework for Assessing Users' Perception. *Information Systems Frontiers*

Lewis. (2019). McKinsey Global Institute Reports. In *The Power of Productivity* (pp. 321–322). University of Chicago Press

Müller. (2016). Fundamental issues of artificial intelligence (Müller, Ed.). Springer.

2023

Kate Dudzik & Robert L. West & Jeremy T. Young, Developing a macro cognitive common model test bed for real world expertise, Procedia Computer Science, Volume 145, 2018, Pages 691-698

Kushwaha, Pharswan, R., Kumar, P., & Kar, A. K. (2022). How Do Users Feel When They Use Artificial Intelligence for Decision Making? A Framework for Assessing Users' Perception

Pachot, & Patissier, C. (2022). Towards Sustainable Artificial Intelligence: An Overview of Environmental Protection Uses and Issues

Palos-Sánchez, Baena-Luna, P., Badicu, A., & Infante-Moro, J. C. (2022). Artificial Intelligence and Human Resources Management: A Bibliometric Analysis. *Applied Artificial Intelligence*, 36(1)

Regulation of artificial intelligence in selected jurisdictions. (2019). The Law Library of Congress, Global Legal Research Directorate

Russell, S. (2016). Rationality and Intelligence: A Brief Update. In: Müller, V.C. (eds) Fundamental Issues of Artificial Intelligence. Synthese Library, vol 376. Springer, Cham.

Ryan. (2020). In AI We Trust: Ethics, Artificial Intelligence, and Reliability. Science and *Engineering Ethics*, *26*(5), 2749–2767

Sample, Ian (2018). Google DeepMind's AI program learns human navigation skills. The Guardian (London)

Silberg, Jake & Manyika, James (2019). Notes From the AI Frontier: Tackling Bias in AI (and in humans)

Schroeder, Stephen (2017). Employee GPS Tracking: Challenges & Best Practices

Sabouret. (2021). *Understanding artificial intelligence* (First edition.). Chapman & Hall/CRC

Tambe, Cappelli, P., & Yakubovich, V. (2019). Artificial Intelligence in Human Resources Management: Challenges and a Path Forward

Tizhoosh, & Pantanowitz, L. (2018). Artificial Intelligence and Digital Pathology: Challenges

and Opportunities. *Journal of Pathology Informatics*, *9*(1), 38–38

Torra. (2017). Data Privacy: foundations, new developments and the big data challenge. Springer International Publishing

Vasudevan, Pulari, S. R., & Vasudevan, S. (2022). Deep learning : a comprehensive guide (First edition.). CRC Press

Warwick, K. (2015). The Disappearing Human-Machine Divide. In: Romportl, J., Zackova, E., Kelemen, J. (eds) Beyond Artificial Intelligence. Topics in Intelligent Engineering and Informatics, 9. Springer, Cham

Wall Street Journal (2008-), Eastern Edition; New York [New York]. 24 Feb 2020: A2.

Walker, G. (2018). The captain of my soul: The misplaced fear of artificial intelligence. *Harvard International Review, 39*(4), 8+.

West, & Allen, J. R. (2020). Turning point: policymaking in the era of artificial intelligence. Brookings Institution Press.

Yokoi, & Nakayachi, K. (2022). When people are defeated by artificial intelligence in a competition task requiring logical thinking, how do they make causal attribution? *Current Psychology*, 1–16