Artificial Intelligence and the Impact on Business Curricula

Cynthia Busin Nicola
Carlow University

Dylan D'Alessio
Carlow University

ABSTRACT

The dawn of Artificial Intelligence is upon us. Within 10 years, it is predicted 375 million workers will need to change occupations as a result of widespread use of Artificial Intelligence. It is also predicted 70% or more of companies will use some type of Artificial Intelligence in their operations. AI builds efficiency and effectiveness. However, these impacts are not without ethical implications. So, how do we, in private, Catholic universities, provide the needed skills for a future workforce? How do we instill discussions of ethics into that development? This paper is in two parts. First, we will discuss the current uses and projected, future impacts of artificial intelligence on our workforce (and our lives). Second, a competitive analysis of 42 colleges and universities was conducted to determine our standing in programming that contains elements of Artificial Intelligence.

Introduction

We read about the constant growth of *Artificial Intelligence* [A.I.] and how countries, particularly the United States and China, are trying to become the dominant country in the *Artificial Intelligence* race. While we talk about *Artificial Intelligence*, there are many who do not quite understand exactly what *Artificial Intelligence* is, let alone the impact it will have on our educational system, particularly in higher education. This paper will first outline the impacts A.I. is already having in various functional areas of business then discuss a competitive analysis completed for colleges and universities in the western Pennsylvania region.

To answer the question, *Artificial Intelligence* is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction (What is AI, August 2018, p. 1).

Artificial Intelligence is already making waves in almost all aspects of our lives. However, we often confuse it for smart machines. Smart machines have more to do with machine learning, which is a subset of *Artificial Intelligence*. Machine learning is the study of algorithms that computer systems use with the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention (Machine Learning, 2019, p. 1). There are numbers of avenues to explore, and, in product development, Vincent (2019) states we have only seen the "tip of the algorithmic iceberg" (p. 1.).

Artificial Intelligence is becoming more and more of a growing presence in our society. For example, *Alexa, Siri, Cortana,* security surveillance, and online customer service are all examples of *Artificial Intelligence*. These are products and services that a large portion of the global population are using in their everyday lives, and the demand and popularity are growing.

In order to test the current world landscape of *Artificial Intelligence*, this paper consists of a news articles review of recently published news articles (within the last three years). These articles address a variety of topics from what *Artificial Intelligence* is, how it will impact functional areas of business, what *Artificial Intelligence* is currently being used for, and, job loss/growth from *Artificial Intelligence*. In addition, this paper considers the ethical side of *Artificial Intelligence*. As mentioned above, *Artificial Intelligence* use is continuing to grow, and while it can be a beneficial to our lives, its uses can also have negative/unethical consequences. The main purpose of the study was not only to investigate uses and issues in A.I., but to use the research to effect curricular changes at *Carlow University* in order to prepare students in the Department of Business for future careers.

News Articles Review

The research was purposely limited to news articles released within the last three years. The articles discuss *Artificial Intelligence* uses, potential uses, and benefits. The possible benefits experienced from *Artificial Intelligence* will be so significant that it will continue to expand in our work, home life, and business operations.

Artificial Intelligence and machine learning are predicted to reshape manufacturing, energy management, urban transportation, agricultural production, labor markets, and financial management (Araya, 2019). Considering these expected impacts, it is obvious that different countries want to lead the *Artificial Intelligence* revolution. The United States [U.S.] and China are two countries hosting the most companies working with *Artificial Intelligence* and who also have the most tools at their disposal. While the United States has been the most invested country at the research level of *Artificial Intelligence*, China is expected to dominate the industrialization of *Artificial Intelligence* due to their expertise in factory machinery, electronics, infrastructure, and renewable energy (Araya, 2019).

Moreover, China has a national strategy revolving around *Artificial Intelligence*. Between their advanced *Artificial Intelligence* capabilities and their national strategy to use *Artificial Intelligence* to influence their economy, they are becoming the biggest threat to topple the United States in becoming the leader of the *Artificial Intelligence* revolution. China has its sights set on incorporating system-wide *Artificial Intelligence*, including autonomous vehicles (AVs), advanced medical equipment, robotics, and financial technologies, widening its lead by leveraging massively abundant data and rapid prototyping (Araya, 2019).

The main problem facing the U.S. and other advanced economies is a market fundamentalism that devalues government-led moon-shots (Araya, 2019); this less government/free market approach is giving China a competitive advantage. However, President Trump is determined to keep the United States first in the *Artificial Intelligence* race. The President realizes the significance of *Artificial*

Intelligence usage and production, which is why the *American Artificial Intelligence Initiative Executive Order* was signed in February, 2019. The Order will accelerate America's pursuit of the sophisticated *Artificial Intelligence* capabilities necessary to maintain our military and economic dominance by instructing the federal government to prioritize research and development of America's own *Artificial Intelligence* capabilities (Velicovich, 2019).

While signing the Order, President Trump said, "Continued American leadership in *Artificial Intelligence* is of paramount importance to maintaining the economic and national security of the United States." (Velicovich, 2019, p. 1). This new initiative will also give *Artificial Intelligence* researchers more resources for innovation, encourage evolving applications of *Artificial Intelligence*, protect "critical *Artificial Intelligence* technology" from foreign entities, and will direct federal agencies to help U.S. workers develop *Artificial Intelligence*-related skills and promote educational programs in Science, Technology, Engineering and Mathematics (STEM) (Velicovich, 2019).

Education

Artificial Intelligence has the potential to revolutionize our learning experiences and is predicted to grow almost 48% in the education field between 2018 and 2022 (Meyer, 2019). In a 2012 interview, Daphne Koller, a computer science professor at S*tanford University,* said that "*Artificial Intelligence* has the potential to personalize the learning experience to fit the needs of each student." She elaborates on this statement by saying "*Artificial Intelligence* can help students by figuring out where students are making mistakes, how to help them when they're not paying attention and what they still need to learn" (Meyer, 2019, p. 1). This personalized education for students will be a monumental revolution in how future generations will learn, which, hopefully, will result in a higher average IQ rate among students.

Christopher Kuszmaul, a computer science teacher at *Polo Alto High School*, expanded on this thought by saying that using *Artificial Intelligence* for educational purposes will also create countless other benefits, such as making sure that the material being taught is actually worth learning, grading papers, and even being programmed to detect depression or other emotions in students. This ability that can raise red flags for teachers so students can be referred to support services (Meyer, 2019). The article concludes by saying that it is impossible to really determine how *Artificial Intelligence* will actually impact how students learn, but that the potential is very bright for the use of *Artificial Intelligence* in education.

Business

Artificial Intelligence will have a huge impact in business. One recent *Forbes* article discusses the four ways that *Artificial Intelligence* is changing the nature of work and the structure of business. The first way that *Artificial Intelligence* is altering the work environment is by augmenting the roles of knowledge workers. People in decision-making roles are going to greatly benefit from *Artificial Intelligence* due to its ability to do the repetitive task jobs at a highly-productive rate. Decision-making will be a higher-level task with repetitive information-gathering tasks diminished. The second way *Artificial Intelligence* is changing business is by altering organizational structures, or making their organizations cooperate more cross-functionally. The

third way is by making location a non-factor and allowing decision flows and data sharing to take place anytime, anywhere. The fourth, and final way, is by flattening corporate hierarchies to improve agility and speed decision making (Insights Team, 2019).

Another example is that companies are now starting to develop an *Artificial Intelligence* business strategy. Kelley's article states,

> Businesses that use *Artificial Intelligence* strategies in their business processes are seeing more and more gains, but enterprise *Artificial Intelligence* (incorporating *Artificial Intelligence* into organizational functions) is still learning. *Gartner's* 2019 CIO Survey of more than 3,000 executives found that *Artificial Intelligence* implementation grew 270% in the past four years, and 37% in the past year alone (Kelley, 2019, p. 1).

Kelley also says that even though *Artificial Intelligence* continues to grow and is becoming more vital, more than 50% of businesses are not applying *Artificial Intelligence* technology, which is essentially setting them up for future failure. They will be unable to remain competitive (2019).

According to "Infographic: The AI Economy" (Smith, 2019), by 2030: 250-280 million new jobs will be created in AI, 375 million workers may need to change occupations as a result of AI, AI could bring in $13 trillion globally, and, it is predicted roughly 70% of companies will use some type of A.I. (pp.1-5).

ZoomInfo (2018, pp. 1-4) has many thought-provoking statistics as well. So far, only 23% of businesses have incorporated A.I. into producing products or services. Companies with 100,000 employees or more are most likely to incorporate A.I. into their firm's strategic plans, with 83% saying it is a "strategic priority". 63% state A.I. will help to reduce costs and 54% state A.I. has already increased productivity, often freeing up workers for more meaningful tasks. 27% of executives state their organizations plan to invest (by 2019) in cybersecurity safeguards using A.I. and machine learning. *PricewaterhouseCoopers* predicts up to 38% of US jobs could be at risk of high automation by 2030; and, *Forrester* predicts robots, A.I., machine learning and automation will create 9% of new jobs by 2025. 84% of businesses claim A.I. will allow them to sustain - or obtain - a competitive position in their industries.

Whit Andrews, an analyst at *Gartner* in Massachusetts, lays out the steps to successfully implement an *Artificial Intelligence* business strategy. He suggests starting with an area that has maximum potential for growth and implementing transparent *Artificial Intelligence* that employees can interact with. He then says that, "An *Artificial Intelligence* business strategy that proves constantly successful is integrating your automated workforce programs with manual human workers. Transparently explaining *Artificial Intelligence* to your workers helps alleviate fear about job security, limitless *Artificial Intelligence* and other workforce concerns." (Andrews, as cited in Kelley, 2019, p. 1). Andrews also recommends having employees see *Artificial Intelligence* at work, having employees agree on what is worth trying, and associating employee work outcomes with *Artificial Intelligence*.

Artificial Intelligence is predicted to impact many areas of business, such as: human resources, information technology, marketing, and finance. One source expands on this by discussing how

Artificial Intelligence will provide less human error and more time for creativity due to the elimination of mundane tasks and endless virtual assistance (Abramovich, 2019).

Simon Morris, Senior Director, Campaign Marketing, Consumer and SMB, *Adobe,* says that he is most excited about personalization and aligning data with business. Tod Loofbourrow, CEO, *ViralGains,* says, "*Artificial Intelligence* has an unprecedented impact on every digital leader's ability to drive measurable results in moving consumers on the journey from brand discovery, to interest, to emotional connection, to action" (Loofbourrow, as cited in Abramovich, 2019, p. 1). Moreover, Matt Lieberman, Director, *PwC*, says,

> Per our recent study on *Artificial Intelligence*, 72% of executives believe it will be the business advantage of the future, with huge potential to optimize business efficiency and labor productivity (67%), automate proactive communications (70%), and improve big data analytics (59%). In the immediate future, executives are looking for *Artificial Intelligence* to alleviate repetitive, menial tasks, such as paperwork (82%), scheduling (79%), and timesheets (78%). It is critical that top executives shape their company's *Artificial Intelligence* experience, identifying the appropriate data, guiding the training process, and refining the outputs to ultimately make life easier for employees while increasing productivity and competitive edge (Lieberman, as cited in Abramovich, 2017, p. 1).

Mark Asher, Head of Market Intelligence and Strategy, *Adobe,* talks about how far we have come already with products such as *Cortana* and *Siri* and that he cannot wait to see where the innovation of *Artificial Intelligence* takes us. Lastly, Alastair Cole, CIO, *Partners Andrew Aldridge* says that *Artificial Intelligence* is making businesses faster, stronger, and better, and that these benefits can't be realized unless customers are prepared to relinquish control over some of their actions (Cole, as cited in Abramovich, 2017).

Human Resources

One particular area of business that may be heavily impacted in the near future is human resources. According to Ginny Rometty, CEO, *IBM,* an improved technology stack led to a 30 percent reduction in the headcount of its global human resources department (Kolakowski, 2019). *Artificial Intelligence* is already being used by people working in human resources to eliminate repetitive tasks, speeding up processes that used to take quite some time. A. I. can provide employees with job recommendations (based on inputs such as the employee's skills and previous projects), automate interview scheduling, and perform initial applicant screenings (Kolakowski, 2019). As a result, *Artificial Intelligence* is also turning out to be a huge cost saver. This is expected to negatively impacts availability of jobs in the field.

Artificial Intelligence is also used to assist in hiring decisions. Algorithms are being developed in a way to "spot" any significant characteristics, education, skills or experience that can be determinants in whether a candidate should or should not move on in the hiring process. So, while *Artificial Intelligence* is not doing any actual hiring, it is assisting with the screening process. These same algorithms are also being used to monitor and help employees by overseeing them during

their workday just as a manager would. Managers will now be able to take time to focus on other, bigger aspects of their job (Kowalowski, 2019)

Sales

Sales is likewise feeling the effects of *Artificial Intelligence*. "*Artificial Intelligence* is becoming more than just a mainstream in sales, it's becoming a way of life" (Levine, 2019, p. 1). To further emphasize this, Gabe Larsen, VP of Marketing and report co-author says, "most people in the industry understand that *Artificial Intelligence* truly enhances a sales rep's role and makes it more efficient." Results of a survey conducted clearly show that *Artificial Intelligence* is having a positive impact on sales by automating and augmenting sales processes:

> Nearly 71 percent of the 633 U.S.-based sales professionals who responded to the survey indicated they are using some form of *Artificial Intelligence* at work, twice the 38 percent in *InsideSales*' previous 2017 report (free, registration required). And nearly 12 percent now say they are using *Artificial Intelligence* "all the time at work," compared to only 6.8 percent in the earlier study. About 39 percent said, "definitely yes" to the question of whether *Artificial Intelligence* could improve their organization's sales performance, while another 52 percent answered, "probably yes." In other words, about 90 percent expect *Artificial Intelligence* to improve sales performance (Levine, 2019, p. 1).

It appears the only thing keeping percentages from being higher may be the perceived lack of trust among employees towards *Artificial Intelligence*. Sales personnel are afraid *Artificial Intelligence* may replace them completely.

Banking

Artificial Intelligence is currently being used in mortgage decisions. A new *Fannie Mae* survey of mortgage lenders found that 40% of mortgage banks have deployed *Artificial Intelligence*, using it to automate the document-heavy application process, detect fraud, and predict a borrower's likelihood of default (Wieczner, 2019). Analyzing applicant details more effectively and accurately, results in better decisions.

Artificial Intelligence is likewise being used in investing. Alternative data analysts are being brought in who use *Artificial Intelligence* to make smarter investment decisions. Some firms already using *Artificial Intelligence* for investment research include: *BlackRock, Fidelity, Invesco, Schroders,* and *T. Rowe Price* (DeCarlo, 2019).

In banking, *Juniper* forecasts the success rate of robot interactions to reach over 90% by 2022. And, in marketing and sales, Chabot software will be used increasingly in customer service. The benefits of these include 24-hour service, instant responses to inquiries and answers to simple, frequently-asked questions. *Gartner* predicts also that, within two years, 30% of all B2B companies will employ AI to facilitate sales processes. Because of this coming trend, *Forrester* predicts one million U.S.A. sales personnel will lose their jobs to this self-service efficiency (ZoomInfo., 2018, pp. 5-6).

Accounting/Finance

Other financial sectors that *Artificial Intelligence* will soon impact are accounting and finance. Many bookkeeping tasks, like accounts receivable and accounts payable, are already being performed by *Artificial Intelligence,* as well as automated data entry and data categorization (Gass, 2019). In addition to these tasks, many experts believe that *Artificial Intelligence* will also take over performing payroll, auditing, and tax remittance tasks sooner than later (Gass, 2019).

Gass advises firms begin to innovate now with *Artificial Intelligence* to avoid falling behind competitively. To accomplish this, he suggests company workshops for employees, learning new skills and ways of thinking to adjust accordingly with *Artificial Intelligence,* and leaving old accounting traditions behind (Gass, 2019).

Simon Wright, Managing Director at *CareersinAudit.com*, adds to Gass's statements by saying that *Artificial Intelligence* taking over number crunching tasks is going to free up so much time to focus on higher-thinking tasks, such as advising, strategy, and developing (Wright, 2019). He says in the beginning of his article, "Concerns about the increased automation of accountancy tasks and transactional business should not instill fear into accountants despite the impact of *Artificial Intelligence*" (Wright, 2019, p. 1). He continues to state that while many within the industry mistrust *Artificial Intelligence* (due to a lack of understanding), they have no need to worry because *Artificial Intelligence* is only supplementing accounting tasks; humans still will be heavily relied upon to perform the more humanized tasks, like communicating with clientele and decision making (Wright, 2019).

Wright suggests that both employees and employers educate themselves on *Artificial Intelligence* so they can: stay ahead of the game, give yourself a competitive advantage, and decide how to properly and effectively implement *Artificial Intelligence* into your firm's operations (Wright, 2019). *Artificial Intelligence* in accounting holds great promise.

In the last accounting article, Thomas Zipperle, CFO of *SAP South East Asia*, details the seven different ways that *Artificial Intelligence* will impact accounting and finance. These include: clearing invoice payments, auditing expense claims, determining bonus accruals, mapping risk assessments, calculating detailed analytics, automating approval workflows, and transforming the finance role (Zipperle, 2017).

While the majority of these tasks are the aforementioned number-crunching tasks, there are also decision-making tasks involved (determining bonus accruals and mapping risk assessments) as well as overall transformation of the finance role. Skill requirements will change from completing repetitive tasks to one involving humanized characteristics a machine cannot as effectively perform, such as business partnering, and using cross-functional knowledge (Zipperle, 2019). Zipperle suggests a similar approach as the previous authors – education to know what is being developed, how to utilize it, and how remain competitive as *Artificial Intelligence* impacts accounting (Zipperle, 2019).

Management

Artificial Intelligence will impact middle-management in particular. Artificially- intelligent software and machinery will be able to perform repetitive tasks, such as overseeing staff and developing reports for higher-level management. This in turn will eliminate some of the middle-management layer.

A recommended job-security strategy for current managers is to be proactive in learning *Artificial Intelligence* applications. Invest in staying competitive in your job category and industry, make sure your personal brand demonstrates this, and take the initiative to learn possible impacts on your job category (Theus, 2018). In short, take initiative to learn about *Artificial Intelligence* and do what you can to keep yourself in a position to stay employed.

Manufacturing

No industry can escape the growing presence of *Artificial Intelligence*. *Artificial Intelligence* is changing the way we build things so that they are designed more efficiently. A new program from software developer, *Autodesk*, recently commercialized from an R&D project called "Dreamcatcher" uses *Artificial Intelligence* techniques to assist human designers as they go about their creative tasks. The designer inputs requirements, limitations, and other qualities into the program—even the total cost of materials. The software then produces hundreds (or even thousands) of options. As the human designer considers all choices, the software displays preferences and helps iterate even better options (Pressman, 2019).

Other manufacturing examples include the creation of machines to perform human tasks on the assembly lines, creating what the designers call "collaborative robots". In addition, artificially-intelligent wind turbines produce electricity and systems to safeguard and monitor employees performing dangerous jobs (Pressman, 2019). *Artificial Intelligence* in manufacturing will only grow, enabling a more significant move towards efficiency and productivity.

Healthcare

Artificial Intelligence will quickly be making its way full force into the healthcare industry. Deep-learning *Artificial Intelligence* (a subset of machine learning, and its neural networks) will impact every type of clinician, from helping to accurately read scans, slides, skin lesions, eyegrounds, and more. Health systems will, as a result, be affected. Increased use of remote monitoring will ultimately obviate the need for regular hospital rooms and even provide virtual medical coaches to better manage patient care or even help prevent diseases (Topol, 2019). In addition, there are three significant roles Artificial *Intelligence* will soon play in the healthcare industry.

The first is that *Artificial Intelligence* will actually be able to outperform doctors, doing things physicians are less effectively able to do, such as reading radiology scans (like *Imagen*); identifying tumors and tracking the spread of cancer (*Arterys*); detecting eye conditions using retinal imaging (*Google's DeepMind*); flagging dangerously abnormal potassium

levels via a "bloodless blood test" *(Mayo Clinic Ventures and AliveCor)*; and otherwise assisting with diagnosing, or even predicting, disease (Fry, 2019).

The second way is by revolutionizing drug research and development. In fact, *BERG*, a manufacturing company, has partnered with major drug makers like *AstraZeneca* and *Sanofi Pasteur* to use clinical data fed through an algorithm to identify promising biological targets for drugs and molecules that may be able to treat diseases like Parkinson's. *Sanofi Pasteur* is also analyzing huge amounts of data to gain a deeper understanding of why certain flu vaccines are effective for some people but not for others (a critical public health question considering last year's devastating flu season) (Mukherjee, 2019).

The third (and perhaps most significant and groundbreaking) is that *Artificial Intelligence* will be able to reverse disease. *Artificial Intelligence* will be used to measure patients' vitals and take the information to make personal recommendations on diet and other factors. It will be able to prevent patients at risk for diabetes from developing the full-blown disease and, in early trials, even reverse Type 2 diabetes through its purely digital platform (Mukherjee, 2019). These huge developments with *Artificial Intelligence* can arguably be the most beneficial of services that *Artificial Intelligence* can offer us, and it looks promising that it will be able to help improve the health of millions around the world and make groundbreaking developments with disease and medicine for years to come.

Communications

Artificial Intelligence is changing the structure of our workforce and skills needed. One of the many examples involves communication. *AI* can teach us all to speak the same language. This is already happening; *Google* is beginning to update its translator feature to translate all languages into your home language (Vanian, 2018). So, we can literally converse with anyone using *Artificial Intelligence* innovations in language translations.

Another example of *Artificial Intelligence* reshaping the workforce is through its ability to read our minds! *The Massachusetts Institute of Technology* (*MIT*) has created a noninvasive, wearable device called *AlterEgo*, which knows what you will say before you even say it. The device can answer many queries within seconds, send private messages, and internally record streams of information to access at a later time—all without any observable external actions. It also effortlessly facilitates private human-to-machine communication by interpreting electrical impulses in the jaw that are triggered when words or phrases are internally vocalized (Vanian, 2018). This will mean communication at an advanced, sophisticated new level.

Sports

Artificial intelligence is already impacting the sports industry. Just this year, *Callaway* has used *Artificial Intelligence* to create the *Epic Flash Driver*. "Its *Flash Face* aims to help golfers get more ball speed for more distance. *Callaway* engineers bought a five-million-dollar computer to help them design the inside of the clubface, feeding the machine information on what exactly they wanted with respect to ball flight" (Kramer, 2019, p. 1). The new driver details state,

The size, height and configuration of the ridges work in concert -- that topography results in a significant ball speed boost for a noticeable distance increase when you make solid contact. The face is forged from a special titanium and heat-treated. The driver also incorporates proprietary Jailbreak technology behind the face -- vertical bars stiffen and stabilize the lightweight triaxial carbon crown with the sole, placing more impact load on the face to promote faster ball speed (Kramer, 2019, p. 1).

Baseball is another sport experiencing *Artificial Intelligence's* presence. The *Atlantic League*, an independent baseball league with eight teams along the east coast, has been experimenting with the use of "robots" to help call balls and strikes during games. These robots, however, are not tangible robots, but are an advanced software called *TrackMan*. The software is used via umpires wearing a *Bluetooth*-connected earpiece, connected to an *iPhone,* connected to a software program in the press box (Bogage, 2019).

The experiment has run fairly smooth, with the exception of occasionally calling higher and lower strikes than the umpires would. That is where the umpire can step in and overrule; so, the umpire's call is what stands, not the software's. Many umpires are not surprised this is happening, with *Atlantic League* umpire, Derek Moccia, saying, "I have seen this coming, it's inevitable. The game is changing. Baseball needs to speed up to keep up with the world. And if you want to be on board with this, you have to keep up. The game is bigger than you, bigger than any player." (Bogage, 2019, p. 1). With the new software running well and seeming to be generally accepted by those within the league, it may only be a matter of time before it gets the greenlight to help call balls and strikes in major league games.

Creative Arts

CNN Style recently put out a story on six modern-day artists who are using *Artificial Intelligence* in their work. The first of the six artists is Robbie Barrat, who is using his *Artificial Intelligence* and computer knowledge to create *Artificial Intelligence* nudes. The second artist is James Bridle, who is analyzing and exposing the political world through his *Artificial Intelligence* art. The third artist is Jenna Sutela, who works with artificial life to "teach them to channel spirits to help carry us to parallel worlds" (Manatakis, 2019, p. 1). The fourth artist is a duo of Holly Hurndon and Mat Dryhurst. They are using *Artificial Intelligence* by training it to make music. The fifth artist is Hito Steyerl; she takes on film projects to learn about how *Artificial Intelligence* affects society through carrying and passing along false information, which negatively effects humanity through the false and misguided perceptions of reality. The sixth and final artist, Ash Koosha, is a songwriter who has created the artificially-intelligent singer/songwriter, "Yona", which was designed to replicate human emotions in its songs (Manatakis, 2019). The growing presence and effects *Artificial Intelligence* has in the arts will be provocative. It may even redefine the terms used for *creation, creativity, intellectual property and art*.

Workforce Skills

All levels of management will eventually be impacted by *Artificial Intelligence,* but there are four kind of jobs that will not be affected because they are jobs that only humans can successfully. These jobs involve creativity, strategy setting, and social/empathetic skills; the new jobs that will

be created due to the emergence of *Artificial Intelligence* (Lee, 2019). Martin Ford, author of the book, <u>Architects of Intelligence</u>, elaborated on this trend by saying that it is the more repetitive jobs that are in the most danger, and that the three industries that will remain untouched by *Artificial Intelligence* for the time being are creative work, human-centered work, and skilled-trade work (2019).

At least one set of experts believes jobs will be shredded, but not eliminated. Instead of worrying about job losses, executives should be helping to reduce jobs in which *Artificial Intelligence* and machine learning take over boring tasks, while humans spend more time with higher-level tasks (McKendrick, 2018, p. 1).

According to Erik Brynjolfsson, the jobs most likely to be eliminated by *Artificial Intelligence* are: concierges, mechanical drafters, morticians, undertakers, and funeral directors, credit authorizers, and brokerage clerks. The jobs least likely to be affected adversely by *Artificial Intelligence/machine learning* are: massage therapists, animal scientists, archaeologists, public address system and other announcers, and plasterers and stucco masons (McKendrick 2018).

So, it would behoove us to retrain the workforce to do these four types of jobs, plus add more of the aforementioned jobs so we can keep as many workers unaffected by *Artificial Intelligence* as possible. The age of "artificial general intelligence"— or when *Artificial Intelligence* will be able to perform intellectual tasks better than humans—is 30+ years away. General *Artificial Intelligence* requires advanced capabilities, such as reasoning, conceptual learning, common sense, planning, creativity and even self-awareness and emotions, all of which remain currently beyond scientific reach. There are no known engineering paths to evolve toward these general capabilities (Lee, 2019).

Meghan Biro gives four ways to prepare for the *Artificial Intelligence* hiring wave. The first is to come to terms with the fact that *Artificial Intelligence* workers will eventually be needed in all industries. The second is to educate yourself now in preparation. The third is that new jobs in *Artificial Intelligence* will be all kinds, such as: *Artificial Intelligence* ethicist, *Artificial Intelligence* project manager, *Artificial Intelligence* research scientist, business intelligence developer, robotics scientist, machine learning engineer, data scientist, and software learning developer (Biro, 2019). The fourth, and final way, is to train recruiters for *Artificial Intelligence*-related hiring so they will understand what skills are necessary to fill future positions.

Duena Blomstrom's article adds more regarding hard and soft skills. To keep employed, it is imperative to consider different hard and soft skills. We must find a way to redefine what they are, what is intensely human and what will remain our competitive advantage with the advent of *Artificial Intelligence* (Blomstrom, 2019). According to the article, hard skills (e.g. math, writing, programming) and soft skills (e.g. teamwork, leadership, communication) are going to be vital. Possessing these will be a big determinant in whether we will be able to remain employed or not. Some companies have even started veering away from the conventional path in terms of what type of diploma they require for some of their most skilled jobs and even may arrive at shunning formal education in favor of much more relevant selection criteria (Blomstrom, 2019).

For example, famous for being conservative institutions, banks have started hiring fewer finance graduates and have moved towards technologists, international relations graduates or psychology majors who tend to have strong soft skills (Blomstrom, 2019). They are focusing more on skills like empathy, mission focus, perseverance, and other qualities and attributes that cannot be easily done by machines.

Writer, Tom Merritt, discussed the top five ways that *Artificial Intelligence* will change businesses. According to the author, the five main impacts are: cheaper analytics, hiring in new positions, customization for customers, anticipation of your customers' next move, and information security (2018).

In a recent *Fortune* article, A.I. products and services will include self-driving cars, devices to assist with scheduling and planning travel, providing needed assistance with customer service ordeals and shopping, helping coaches scout new talent, helping athletes improve performance, improving marketing tactics, and improving farming and agriculture (*7 ways AI Is changing how you shop, eat, and live*, 2019).

Ethical Implications

The ethical implications surrounding *Artificial Intelligence* are many. Inequality, bias, weaponization, programming errors, are deep ethical concerns. Several articles reviewed discuss some of these issues. These are written by different authors, scientists, and religious heads.

According to a *YouGov* survey of 2,000 Americans, just 41 percent "somewhat support" or "strongly support" the advancement of *Artificial Intelligence*. And experts fear that lack of consensus — combined with a lack of faith in *Artificial Intelligence* developers — could prevent the technology from reaching its potential (Houser, 2019). This has become worrisome for those developing *Artificial Intelligence* because this split opens up the possibility of negative reactions.

Security Risks

An important issue is the security associated with A.I. development. The increased improvement of machine-learning algorithms is allowing machines to have some of the same intelligence features as humans. Writer Jayshree Pandya's article says that, "These rapidly evolving neuromorphic chips are being designed to process human sensory data such as images, smell and sound and to respond to changes in that data in ways not specifically programmed, a lot is expected to change for machine intelligence and *Artificial Intelligence* evolution." (Pandya, 2019a, p. 1). This is becoming a key component of the development of *Artificial Intelligence*. This mega development in turn has raised the question: *By doing this, are we creating a new species that may not consider humanity's best interests*? The author is proposing the question because of the probability of merging human and machine intelligence to create superhuman intelligence, or cyborgs. Pandya goes on to say that before we let *Artificial Intelligence* loose, there needs to be further research conducted on superhuman intelligence and other alternatives to ensure humanity can keep ahead of all ethical dilemmas. "While evaluating superhuman intelligence, the ability of alternate DNA to analyze, calculate, and deduce at incalculable speeds is not the focus of this article, the possibility of human brain and intelligence evolution needs to be researched further to

keep up with artificial super intelligence." (Pandya, 2019a, p. 1). Proper deliberation, multi-disciplinary discussion, strategic planning, and wise, grounded decision-making are essential.

Programming and Bias

One source mentions designing *Artificial Intelligence* for humanity's best, long-term, interests. When it comes to design, there are nine companies that are leading the various development and creation stages of *Artificial Intelligence*. There are six in the U.S. - *Google, Microsoft, Amazon, Facebook, IBM and Apple,* with the other three being in China - *Baidu, Alibaba and Tencent* (Baram &Webb, 2019). Since they are the main catalysts of *Artificial Intelligence*, the author talks about the immense pressure on their shoulders to properly program and develop *Artificial Intelligence* while constantly considering humanity's best interests at all times.

These corporations need to first be on the same page about what is collectively in our best interests. They also need to be careful with staffing programmers. Potential bias in programming must be eliminated.

> The Big Nine should take concrete steps on how it sources, trains, and uses our data, how it hires staff, and how it communicates ethical behavior within the workplace. At every step of the process, the Big Nine should analyze its actions and determine whether or not they're causing future harm—and then they should be able to verify that their choices are correct. This begins with clear standards on bias and transparency (Baram & Webb, 2019, p. 1).

The article closes by discussing how these nine corporations should work to earn our trust in a world where *Artificial Intelligence* is a key player. Some trust-earning steps include conducting meaningful research, instilling ethical considerations into workflow processes, and constructing a strict and strong code of conduct for employees (Baram & Webb, 2019).

Pandya (2019b) in Forbes also talks about bias in the development of Artificial Intelligence. She says that bias can result from a machine's algorithmic programming. A programmer can program them with bias; the machines will not know better because they cannot detect bias within themselves. Ensuring integrity, transparency and trust in algorithmic decision-making are becoming some of the complex challenges for the creators of algorithms with huge implications for the future of society (Pandya, 2019b). The author goes on to question if we even need these decision-making algorithms; maybe we do not want to let machines take over something we could easily do on our own. She says, "It is difficult to know whether decision-making algorithms will be able to make effective decisions with the current computing and data analytics infrastructure and processing capability." (Pandya, 2019b, p. 1).

Decision-making Capabilities

Another potential risk with *Artificial Intelligence* decision-making is allowing it to become so powerful that it actually *tells us* how to live or what to do next. Products like *Siri, Alexa,* fitness and dieting apps are examples of intelligence machinery that provide guidance on routine, but essential, activities. People find such products attractive since they provide stability and

convenience. "The reality is, as biological organisms, our bodies and minds perform best when maintaining an equilibrium. We feel best when our environment is familiar, and our lives possess consistency." (Iscovich, as cited in Ashley, 2019, p. 1).

Iscovich continues by stating, "With the emergence of technology, in particular *Artificial Intelligence*, we needn't depend on our own brains to develop the best routine; instead we can outsource such decision-making to thinking machines" (Ashley, 2019, p. 1). In fact, Iscovich is developing an app that uses *Artificial Intelligence* for daily routines and to even make suggestions on what we <u>ought</u> to do throughout our day. He says, "Our app would function similarly to a smartwatch, learning about a person all day long. It would take in biometric data, such as heart rate, blood pressure, and breathing rate to learn what's working in a person's life and what might be improved." (Iscovich, as cited in Ashley, 2019, p. 1).

CEO Responsibilities

Burkhardt, Horn and Wigley (2019) call on CEOs to carry the responsibility of ensuring that *Artificial Intelligence* is used responsibly and ethically; and, even lay out steps to do so.

> While *Artificial Intelligence* is quickly becoming a new tool in the CEO tool belt to drive revenues and profitability, it has also become clear that deploying *Artificial Intelligence* requires careful management to prevent unintentional but significant damage, not only to brand reputation but, more important, to workers, individuals, and society as a whole (p. 1).

They recommend that CEOs take the necessary steps to make sure that *Artificial Intelligence* is being used in an ethical manner by consistent reliance on company values. The three ways to do this are to: clarify how values translate into the selection of *Artificial Intelligence* applications, provide guidance on definitions and metrics used to evaluate *Artificial Intelligence* for bias and fairness, and advise on the order of the hierarchy of company values (Burkhardt, Horn, and Wigley, 2019).

Furthermore, the authors provide five different areas that require CEO oversight: appropriate data acquisition, data-set suitability, fairness of *Artificial Intelligence* outputs, regulatory compliance and engagement, and explain-ability of *Artificial Intelligence* outputs (Burkhardt, Horn, and Wigley, 2019). *Artificial Intelligence* will continue to have a larger, more significant role in companies. So, it makes sense that CEOs lay down moral ground rules for uses of *Artificial Intelligence*.

Humanity's Future

Perhaps the most frightening ethical issue is the implication that humanity will end. "[Humans] are going to become robots," said *Behavox* CEO, Erkin Adylov,. "Essentially artificial intelligence is going to bring a lot of enhanced capabilities to us." (Limitone, 2019, p. 1). Adylov expands on his statement by saying that *Behavox* customers, who use their new software, can process large volumes of data and do market-making in ways that humans are unable, essentially creating *cyborgs*. Adylov additionally discussed the *World Economic Forum's* "Future of Jobs Report",

which says that 75 million jobs will be cut by 2022, but that 133 million new jobs will be created from the increase of automation. That report also found 42 percent of task hours will be performed by machines versus 58 percent by people (Limitone, 2019).

In the future, there is an ever-growing possibility of humans and machines morphing into one entity. *Artificial Intelligence* will be embedded into our brains. Greg Kieser, founder of *Supersystemic,* predicts that we will have connections from our brains directly to the internet within the next two decades. He says, "We will ask a question in our minds, and the answer will be there instantly." (Staff, 2019, p. 1). This raises more ethical concerns on uses of *Artificial Intelligence*, concerns that Kieser is fully aware. "Humans weaponize everything, and he fears that *Artificial Intelligence* may be used to "manifest the antichrist on earth." (Staff, 2019, p. 1).

Military Use

Kieser raises perhaps the biggest ethical concern - the weaponization of *Artificial Intelligence*. While discussing *Artificial Intelligence* in the military, Pandya says, "When nations individually and collectively accelerate their efforts to gain a competitive advantage in science and technology, the further weaponization of *Artificial Intelligence* is inevitable." (2019c, p. 1). This raises the question: how close are we to this reality, and will it be humans - or other machines - as the intended targets?

> The rapid development of *Artificial Intelligence* weaponization is evident across the board: navigating and utilizing unmanned naval, aerial, and terrain vehicles, producing collateral-damage estimations, deploying "fire-and-forget" missile systems and using stationary systems to automate everything from personnel systems and equipment maintenance to the deployment of surveillance drones, robots and more are all examples (Pandya, 2019c, p. 1).

Pandya (2019c) suggests requiring programmers to program *Artificial Intelligence* to not have harmful intentions towards humans. However, we cannot guarantee other countries' intentions, especially since there is no international agreement involving the use of *Artificial Intelligence* in warfare.

Security Concerns

The final ethical concern involves security. There are three risk management principles that can be used to avoid risk. One article listed potential security issues as: **data difficulties (inadvertently exposing sensitive information), technology troubles (software issues), security snags (weak security),** *models misbehaving (problems with the algorithms), and* **interaction issues (how *Artificial Intelligence* is used by people) (Cheatham, Javanmardin, and Samandari, 2019). For these, the authors have provided three risk management principles. These are:** Clarity: Use a structured identification approach to pinpoint the most critical risks, Breadth: Institute robust enterprise-wide controls, and Nuance: Reinforce specific controls depending on the nature of the risk (**Cheatham, Javanmardin, and Samandari, 2019**).

As a counter argument, *Artificial Intelligence* is can actually help keep us safe. In fact, there are three main ways that it enhances safety. The first way is by programming weapons that specifically pick targets. Weapons can be programmed to spot and take out real threats, such as terrorist groups. While an argument can be made that using *Artificial Intelligence* in any form of weaponry is a violation of ethics, it can be used to defend us against potential attacks.

Artificial Intelligence in cybersecurity protects personal information and important data. *Artificial Intelligence* is being programmed to pinpoint potential phishing scams and other hacking attempts and is even being used in security cameras to "see" and try to stop threats (Vanian, 2019).

In a different field, *Artificial Intelligence* is being used in finance to spot and stop internal and external financial criminals from scamming, laundering, and committing fraud. This is an optional means of protection that most companies should be incorporating into their organization (Vanian, 2019).

Case Study: A Competitive Analysis

We can begin to ascertain the necessity for preparing students to have a background in *Artificial Intelligence* for their careers. As a result of the discovered impact/statistics, Business programs need to ascertain how to incorporate *Artificial Intelligence* and *Machine Learning* into curricula. A competitive analysis was completed to determine how many institutions in our landscape are already offering some type of education in those areas. This included a search for undergraduate majors and minors, concentrations, coursework, and certificates. Several recommendations will follow the findings of this analysis.

Cross-institutional Competitive Study

A total of 42 local and competitive higher-education institutions were examined in this study for curricular offerings. The list of colleges and universities were obtained from Dean of the *College of Leadership and Social Change* and the Business Department Chair (DiMola & Wilsey, personal communications, April 23, 2019). These are colleges *Carlow University* has used in the past as comparative schools for faculty compensation and benefits. In addition, included are local, competitive institutions with offerings in *Artificial Intelligence*, both within and outside the Business major. This study included evaluating whether the institution had any of the following: undergraduate/graduate major in *Artificial Intelligence*, undergraduate minor in *Artificial Intelligence*, graduate certificate in *Artificial Intelligence*, graduate concentration in *Artificial Intelligence*, undergraduate/graduate courses in *Artificial Intelligence*.

Allegheny College, Meadville, PA
Alvernia University, Reading, PA
Cabrini University, Radnor, PA
California University of PA, California, PA
Carnegie Mellon University, Pittsburgh, PA
Chatham University, Pittsburgh, PA
Dominican University, River Forest, IL

Duquesne University, Pittsburgh, PA
Edinboro University, Edinboro, PA
Franciscan University, Steubenville, OH
Gannon University, Erie, PA
Grove City College, Grove City, PA
Gwynedd Mercy University, Gwynedd, PA
Holy Family University, Philadelphia, PA
Indiana University of PA, Indiana, PA
LaRoche University, Pittsburgh, PA
Mercyhurst University, Erie, PA
Misericordia University, Dallas, PA
Mt. Aloysius College, Cresson, PA
Notre Dame of Maryland University, Baltimore, MD
Ohio Dominican University, Columbus, OH
Penn State University, State College, PA
Point Park University, Pittsburgh, PA
Regis University, Denver, CO
St. Bonaventure University, Allegany, NY
St. Francis University, Loretto, PA
St. Leo University, St. Leo, FL
St. Vincent College, Latrobe, PA
Seton Hill University, Greensburg, PA
Slippery Rock University, Slippery Rock, PA
University of Pittsburgh, Pittsburgh, PA
Utica College, Utica, NY
Washington & Jefferson College, Washington, PA
Waynesburg University, Waynesburg, PA
Westminster College, New Wilmington, PA
Wheeling Jesuit University, Wheeling, WV

_____ = 36 total

In addition, simple *Google* searches ("undergraduate majors in *Artificial Intelligence*", "undergraduate minors in *Artificial Intelligence*") were performed to locate undergraduate and graduate degrees specifically in *Artificial Intelligence* in the United States. Seven total institutions were examined from this search:

Carnegie Mellon University (**already included in list above**)
Harvard University Institute for Applied Computational Sciences
Massachusetts Institute of Technology, Cambridge MA
Southern New Hampshire University
Stanford University
University of Advancing Technologies (private and family owned, accredited)
University of California, Berkeley

_____ +6 = 42 universities

Summary of Findings

Of the aforementioned 36 universities, only one institution (*Carnegie Mellon University*) has an undergraduate major specifically in *Artificial Intelligence*. Two institutions, *Carnegie Mellon University* and *Holy Family University,* have an undergraduate minor or concentration in *Artificial Intelligence. Carnegie Mellon* also has a graduate major in *Artificial Intelligence (*Carnegie Mellon, 2019; Holy Family, 2019).

Thirteen (13) of the 36 institutions have undergraduate coursework either in *Machine Learning* or *Artificial Intelligence,* or both. And, these four institutions have graduate coursework in *Machine Learning* and/or *Artificial Intelligence: Regis University*, *Utica College*, *Duquesne University, and Cabrini University* (Regis University2019-20; Utica College 2019; Duquesne University, 2019; Cabrini University, 2018-19). Moreover, some institutions (such as *St. Bonaventure University* and *Seton Hill University*) have coursework specifically in *Management Information Systems* (St. Bonaventure University 2018-19; Seton Hill University, 2019). These courses may - or may not - include specific material in *Artificial Intelligence*. It is hard to determine content from the course descriptions given.

The additional six institutions (besides *Carnegie Mellon University*, already mentioned) that were obtained in the *Google* searches have a variety of offerings related to *Artificial Intelligence*. *Southern New Hampshire University* offers a B.S. in Information Technologies with a concentration in Robotics and Artificial Intelligence (Southern New Hampshire, 2019). The *University of Advancing Technologies* in Tempe, Arizona, is a privately, family-owned university accredited by the *Council for Higher Education Accreditation* (CHEA), and the *US Department of Education, Higher Learning Commission*. They offer a B.S. in Artificial Intelligence (University of Advancing Technologies, 2019). *Massachusetts Institute of Technology* (2019) has the following: graduate program, undergraduate program, post-baccalaureate, post-doctoral and research programs – all in *Artificial Intelligence*. Moreover, *Stanford University* (2019) offers a Master in *Artificial Intelligence* as well as a graduate certificate program in this area. *University of California*, Berkeley (2019), houses the *Berkeley Artificial Intelligence Lab* for students. And, finally, *Harvard University* has an *Institute for Applied Computational Science* (2019). These institutions, while important to note, are not considered appropriate contenders in our competitive analysis.

Slippery Rock University has a "Concentration in Cognitive Sciences" that includes a selection of cross-disciplinary courses. This speaks to a liberal arts foundation, which is consistent with *Carlow's* mission as well as the future skills emphasized in the review of news articles.

From this analysis, it is important to note one observation which could be a competitive disadvantage. First, while other institutions are offering coursework in *machine learning* or *artificial intelligence,* these courses are rarely housed within a Business Management, Accounting, or Human Resources major. The clear, overwhelming majority are found within Computer Science, Information Technology or Data Analytics majors. The competitive disadvantage here is that *Carlow University* has no Computer Science or Information Technology major. And, the Data Analytics major is in the early process of development.

Curricular Recommendations

Considering the *Mercy* mission of *Carlow University*, to offer transformative experiences for our students, and to encourage them to be *ethical leaders* of tomorrow, our competitive advantage would be to integrate concepts of *Artificial Intelligence* into our offerings. This can be done within the Departments of Management and/or within the overall general education requirements.

The following list of alternatives is based on these current available resources/research and the competitive position of *Carlow University*:

1. Construct an undergraduate minor in *Artificial Intelligence*
2. Construct an undergraduate/graduate major in *Artificial Intelligence*
3. Consider a graduate degree in *Ethics*
4. Develop a course in *Management Information Systems, Artificial Intelligence,* and/or *Machine Learning* for the Departments of Management
5. Partner with *Carnegie Mellon University* for graduate offerings
6. Enrich current undergraduate and graduate courses with content in *Artificial Intelligence*
7. Consider a cross-disciplinary requirement in *Artificial Intelligence*
8. Combine any of the above

Additionally, the *Carlow University* undergraduate and graduate catalogs (2018-19) were reviewed for current interdisciplinary courses that may be used to construct a minor in *Artificial Intelligence*. It is recommended as well that the Department of Management develop a *Management Information Systems* course as well as introductory courses in *Machine Learning* and *Artificial Intelligence*. Adjunct faculty may also be a resource for this effort.

To further consider development of an *Artificial Intelligence* minor, we recommend the Provost form a cross-disciplinary team to investigate all alternatives since this study has shown the important links between *Artificial Intelligence* and education, ethics, psychology, philosophy, theology, biology, mathematics, data analytics, and information technology.

As an initial contribution, Management students can now be introduced to the impact *Artificial Intelligence* will have on their fields. To assist our faculty, we have constructed a "course shell" on *Artificial Intelligence* on *Schoology* that will allow the faculty in the Departments of Management and Accounting to access articles, scholarly reports, books, and videos. A.I. Reusable Learning Objects (RLO's) can be inserted into existing Management and Accounting courses. These objects cut across all functional areas of business knowledge and can be used at both the undergraduate and graduate levels: marketing, operations, human resource management, management, accounting, finance, communications, ethics.

Finally, we also encourage exploration into a graduate program in *Ethics*, which would include the impact of *Artificial Intelligence* on our world as we know it. This graduate degree could be geared to professionals already at mid-to-upper-level management in a variety of organizations. *Carlow,* with its rich history and Mercy heritage and values, could be known for graduating ethicists who will ask the difficult questions that need asked in our race to combat the challenges facing us in the 21st century and beyond.

Artificial Intelligence will provide many benefits as well as consequences. Some benefits include: assistance in decision-making processes, in human resources functions, and assistance in making everyday lives simpler. The pros of *Artificial Intelligence* were most evident through the discussed effects it will have in functional areas of business. Human resources will be the most affected, with elimination of repetitive tasks, screening of potential candidates, scheduling employees, and in developing reports. Sales representatives are already using *Artificial Intelligence* to perform more efficiently. *Artificial Intelligence* is also giving out mortgages and helping with investment decisions in the area of finance. It assists in medicine, assembly lines, organizational structure, creates new jobs, makes analytics cheaper, heighten security, and aid in sports.

Some of the ethical issues have included weaponization of *Artificial Intelligence*, programmer bias and mal intent, and potentially allowing *Artificial Intelligence* to get so powerful that it can overtake humanity.

Artificial Intelligence is already present in daily life through the use *Alexa, Siri,* self-driving cars, online customer service, and fitness and dieting apps. As *Artificial Intelligence* makes its way into all the functional areas of business, and, starts to play a more predominant role in our society, we will be able to judge whether it is a positive force of change. Regardless of how you feel about *Artificial Intelligence*, one thing is for certain: it is our reality and will continue to play a much bigger role in our lives for years to come. We need to make curricular changes now, in order to prepare business students for *Artificial Intelligence* in their careers.

References

7 ways AI Is changing how you shop, eat, and live. (2018, October 22). *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-lifestyle/

Abramovich, G.(n.d.). Is artificial intelligence on the brink of changing business forever? *Adobe.* Retrieved May 25, 2019, from https://www.adobe.com/insights/how-will-artificial-intelligence-impact-business.html

Araya, D. (2019, January 02). Who will lead in the age of artificial intelligence? *Forbes*. Retrieved May 26, 2019, from https://www.forbes.com/sites/danielaraya/2019/01/01/who-will-lead-in-the-age-of-artificial-intelligence/#3062b7856f95

Ashley, M. (2019, March 25). Will artificial intelligence soon tell us how to live? *Forbes*. Retrieved May 19, 2019, from https://www.forbes.com/sites/cognitiveworld/2019/01/27/will-artificial-intelligence-soon-tell-us-how-to-live/#54333beb2938

Baram, M., & Webb, A. (2019, March 01). How can we design AI for the best long-term interests of humanity? *Fast Company.* Retrieved May 19, 2019, from https://www.fastcompany.com/90312306/how-can-we-design-ai-for-the-best-long-term-interests-of-humanity

Biro, M. M. (2019, January 25). Recruiting AI talent: 4 ways to get ahead of the next hiring wave. *Forbes.* Retrieved May 26, 2019, from

https://www.forbes.com/sites/meghanbiro/2019/01/24/recruiting-ai-talent-4-ways-to-get-ahead-of-the-next-hiring-wave/#42e25c7f59b0

Blomstrom, D. (2019, January 15). It's not about what you know. Soft skills are hard. *Forbes.* Retrieved May 25, 2019, from https://www.forbes.com/sites/duenablomstrom1/2019/01/14/its-not-about-what-you-know-soft-skills-are-hard/#ac5e11eff95c

Bogage, J. (2019, July 10). Baseball's robot umpires are here. And you might not even notice the difference. *Washington Post.* Retrieved July 19, 2019, from https://www.washingtonpost.com/sports/2019/07/10/baseballs-robot-umpires-are-here-you-might-not-even-notice-difference/?utm_term=.5a947730d227

Burkhardt, R., Hohn, N., & Wigley, C. (n.d.) Leading your organization to responsible AI. *McKinsey and Company.* Retrieved May 25, 2019, from https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/leading-your-organization-to-responsible-ai

Cabrini University. (2018-2019). Undergraduate Course Catalog. Retrieved from: https://www.cabrini.edu/graduate-degrees/programs/data-science

Carlow University. (2018-19). Undergraduate Course Catalog. Retrieved from: https://www.carlow.edu/Course_Catalogs_and_Descriptions.aspx

Carnegie Mellon University. (2019). School of Computer Science. Retrieved from: https://www.cs.cmu.edu/bs-in-artificial-intelligence and https://www.cs.cmu.edu/masters-programs#headline20

Cheatham, B., Javanmardin, M., & Samandari, H. (2019, April), Confronting the risks of artificial intelligence. *McKinsey and Company.* Retrieved May 19, 2019, from https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/confronting-the-risks-of-artificial-intelligence

DeCarlo, S. (2018, October 22). How AI is shaking up banking and Wall Street. *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-business-finance/

Duquesne University. (2019). Palumbo-Donahue School of Business. Retrieved from: https://www.duq.edu/academics/schools/business/graduate/specialized-masters/ms-aim/curriculum-and-course-descriptions

Fry, E. (2018, October 22). Outsmarting your doctor. *Fortune.* Retrieved May 19, 2019 from https://fortune.com/2018/10/22/artificial-intelligence-ai-healthcare/

Gass, J. (2018, September 10). AI's impact on accounting and finance. *YEC.* Retrieved August 18, 2019, from https://www.forbes.com/sites/theyec/2018/09/10/ais-impact-on-accounting-and-finance/#4906009fe855

Harvard University Institute for Applied Computational Science. (2019). Harvard Computer Science. John A. Paulson School of Engineering. Retrieved from: http://harvardcs.info/concentration/courses/

Holy Family University. (2019). School of Business Administration. Retrieved from: https://www.holyfamily.edu/choosing-holy-family-u/academics/schools-of-study/school-of-business-administration/undergraduate-programs/business-intelligence

Houser, K. (2019, January 11). Just 41 percent of Americans support advancing AI. *Futurism: The Byte*. Retrieved May 25, 2019, from https://futurism.com/the-byte/ai-development-americans-support

Insights Team. (2019, February 05). 4 ways AI and associated technologies are changing the nature of work -- and the structure of business. *Forbes*. Retrieved May 26, 2019, from https://www.forbes.com/sites/insights-microsoftai/2019/02/04/4-ways-ai-and-associated-technologies-are-changing-the-nature-of-work-and-the-structure-of-business/#53f36a46110e

Kelley, K. (2019, April 30). An animated guide to creating an AI business strategy. *Tech Target*. Retrieved May 25, 2019, from https://searchenterpriseai.techtarget.com/video/An-animated-guide-to-creating-an-AI-business-strategy?track=NL-1816&ad=927267&src=927267&asrc=EM_NLN_112316905&utm_medium=EM&utm_source=NLN&utm_campaign=20190502_How automation affects data scientists' roles; SAS Viya gets AI updates

Kolakowski, N. (2019, April 12). How A.I. could delete HR and recruiting jobs for good. *Dice*. Retrieved May 26, 2019, from https://insights.dice.com/2019/04/09/ai-delete-hr-recruiting-jobs/

Kramer, S. (2019, January 11). Callaway taps A.I. to make new epic Flash Driver. *Forbes*. Retrieved May 25, 2019, from https://www.forbes.com/sites/scottkramer/2019/01/11/callaway-taps-a-i-to-make-new-epic-flash-driver/#3d6e29c16610

Lee, K. (2019, January 11). Artificial intelligence is powerful. How to protect workers. *Time*. Retrieved May 25, 2019, from http://time.com/5501056/artificial-intelligence-protect-workers/

Levine, B. (2019, January 29). InsideSales' new study: AI is 'becoming a way of life' for sales. *Marketing Land*. Retrieved May 25, 2019, from https://marketingland.com/insidesales-new-study-ai-is-becoming-a-way-of-life-for-sales-256141

Limitone, J. (2019, May 02). AI is transforming humans into robots, right now. *FOX Business*. Retrieved May 25, 2019, from https://www.foxbusiness.com/technology/ai-transforming-humans-robots

Machine Learning: What it is and why it matters. (n.d.). *SAS*. Retrieved July 14, 2019, from https://www.sas.com/en_us/insights/analytics/machine-learning.html

Manatakis, L. (2019, January 28). Six artists who are shaping the future of AI. *CNN Style*. Retrieved May 28, 2019, from https://www.cnn.com/style/article/artificial-intelligence-

Massachusetts Institute of Technology. (2019). Undergraduate Programs. Retrieved from: http://eecs.mit.edu/academics-admission/undergraduate-programs artists-dazed-digital/index.html

McKendrick, J. (2018, August 20). Artificial intelligence will replace tasks, not jobs. *Forbes*. Retrieved May 19, 2019, from https://www.forbes.com/sites/joemckendrick/2018/08/14/artificial-intelligence-will-replace-tasks-not-jobs/#b070719a7fa4

Merritt, T. (n.d.). Top 5: Ways AI will change business. *Tech Republic*. Retrieved May 25, 2019, from https://www.techrepublic.com/article/top-5-ways-ai-will-change-business/

Meyer, A. (2019, April 18). Artificial intelligence technology enhances educational experience. *The Campanile.* Retrieved May 25, 2019, from https://thecampanile.org/2019/05/04/artificial-intelligence-technology-enhances-educational-experience/

Mukherjee, S. (2019, October 22). Reinventing drug R & D. *Fortune.* Retrieved May 19, 2019 from https://fortune.com/2018/10/22/artificial-intelligence-ai-healthcare/

Pandya, J. (2019a, March 13). Can artificial intelligence be biased? *Forbes.* Retrieved May 19, 2019, from https://www.forbes.com/sites/cognitiveworld/2019/01/20/can-artificial-intelligence-be-biased/#6c5538467e7c

Pandya, J. (2019b, March 13). The weaponization of artificial intelligence. *Forbes*. Retrieved May 19, 2019, from https://www.forbes.com/sites/cognitiveworld/2019/01/14/the-weaponization-of-artificial-intelligence/#578733c93686

Pandya, J. (2019c, April 12). The troubling trajectory of technological singularity. *Forbes.* Retrieved May 19, 2019, from https://www.forbes.com/sites/cognitiveworld/2019/02/10/the-troubling-trajectory-of-technological-singularity/#67f2b9e56711

Pressman, A. (2018, October 22). How AI is changing how we build things. *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-manufacturing/

Regis University. (2019-2020). Regis University Catalog. Retrieved from: https://www.regis.edu/Academics/Course-Catalog.aspx

St. Bonaventure University. (2018-2019). Undergraduate Course Catalog. Retrieved from: https://www.sbu.edu/web-editors/courses/cs-csl-341 https://www.sbu.edu/docs/default-source/default-document-library/current-undergraduate-course-catalog.pdf

Seton Hill University. (2019). Data Analytics, B.S. Retrieved from: http://catalog.setonhill.edu/preview_program.php?catoid=2&poid=259&returnto=41

Slippery Rock University. (2019). Interdisciplinary Programs (BS)- Concentration in Cognitive Science. Retrieved from: http://catalog.sru.edu/preview_program.php?catoid=28&poid=5320&returnto=531

Smith, G. (2019). Infographic: The AI economy. Retrieved August 16, 2019, from: http://anewdomain.net/infographic-the-ai-economy/

Southern New Hampshire University. (2019). B.S. in Information Technologies. Retrieved from: https://www.snhu.edu/online-degrees/bachelors/bs-in-information-technologies

Staff, C. T. (2019, April 19). The challenge of A.I. / Open Lines - Shows. *Coast to Coast.* Retrieved May 26, 2019, from https://www.coasttocoastam.com/show/2019/04/19

Stanford University. (2019). Stanford Computer Science. Retrieved from: http://cs.stanford.edu/degrees/mscs/specializations

Theas, D. (2018, April 25). Middle management job security in the age of automation. *Ladders.* Retrieved May 25, 2019, from https://www.theladders.com/career-advice/middle-management-job-security-in-the-age-of-automation

Topol, E. (2018, October 22). 3 ways AI is changing healthcare. *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-healthcare/

University of Advancing Technologies. (2019). Artificial Intelligence (BS). Retrieved from: http://uat.edu/artificial-intelligence-degree#university-core-curriculum

University of California, Berkeley. (2019). BAIR: Berkeley Artificial Intelligence Research. Retrieved from: http://bair.berkeley.edu

Utica College. (2019). Online Master of Science in Data Science Curriculum. Retrieved from: http://programs.online.utica.edu/programs/masters-data-science/curriculum

Vanian, J. (2018, October 22). How AI is changing the way you work. *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-work/

Velicovich, B. (2019, February 17). Trump's artificial intelligence executive order will ensure America doesn't lose the AI race to China. *FOX News.* Retrieved May 26, 2019, from https://www.foxnews.com/opinion/trumps-artificial-intelligence-executive-order-will-ensure-america-doesnt-lose-the-ai-race-to-china

Vincent, J. (2019, January 28). The state of AI in 2019. *The Verge*. Retrieved May 25, 2019, from https://www.theverge.com/2019/1/28/18197520/ai-artificial-intelligence-machine-learning-computational-science

What is AI (artificial intelligence)? - Definition from WhatIs.com. (n.d.). Retrieved May 18, 2019, from https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence

Wieczner, J. (2018, October 22). 3 ways AI is making you safer. *Fortune.* Retrieved May 28, 2019, from http://fortune.com/2018/10/22/artificial-intelligence-ai-defense-weapons/

Wright, S. (2019, May 10). Artificial intelligence, robots and accountants. *Accountancy Daily.* Retrieved August 18, 2019, from https://www.accountancydaily.co/artificial-intelligence-robots-and-accountants

Zipperle, T. (2017, June 07). 7 ways artificial intelligence and machine learning will impact the finance office. *Accounting Today.* Retrieved August 18, 2019, from https://www.accountingtoday.com/list/7-ways-artificial-intelligence-and-machine-learning-will-impact-the-finance-office

Zoominfo. (2018, August 13). RE: 65+ statistics about artificial intelligence. Retrieved from: https://blog.zoominfo.com/statistics-about-artificial-intelligence/