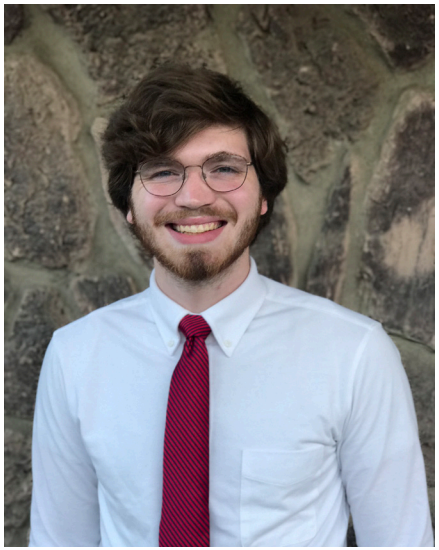

Bryce Fauble will be graduating this Spring with a degree in Liberal Arts and Engineering Studies. During his time at Cal Poly, Bryce has been concentrating in Engineering Leadership and Political Science, as well as pursuing a minor in German. Bryce's academic path was chosen due to his appreciation and curiosity for exploring both the analytical sides of engineering, and the more humanistic sides of political science. Ultimately, Bryce hopes to work as a policy analyst for a non-profit, think tank, or governmental organization. Pursuing this degree has allowed him to develop a specialized toolkit for facing challenging, 21st century issues. In fact, Bryce's desire to write this paper came from his own convictions to create lasting policy to assist working Americans. After graduating in June, Bryce will be attending Carnegie Mellon, where he will work towards achieving his Master's Degree in Public Policy and Management.

By Emily Spacek

THE RISE OF AI: WHY THE AMERICAN WORKFORCE MUST INEVITABLY CHANGE

Bryce Fauble

Abstract

This paper explains the potential impact of artificial intelligence on the American workforce with particular attention given to the manufacturing, service, and white-collar sectors. First, the conventional wisdom on this advancing technology is presented and analyzed. Then, using qualitative methodology in the form of case study research, this paper explores alternative solutions that demonstrate the rise of AI and the present and encroaching changes on the American workforce. According to this research, the American workforce will experience incredible transformations that must be met head on. The potential political and social consequences of this massive job loss are revealed, and suggestions of necessary social change and political regulation are presented. While the potential impacts of Artificial Intelligence have been discussed by mainstream media, this paper offers an in-depth, scholarly look into who exactly will be affected and how much they will be impacted.

Introduction

Artificial intelligences are becoming more and more advanced, and are continually making strides in ways that had not been theorized. On April 28th, 2017, The New York Times posted an article entitled, "Meet the People Who Train the Robots (to Do Their Own Jobs)", which discusses the potential implications of advancing technology on the American workforce.[1] In this article, five individuals discuss their opinions on artificial intelligence (AI) and how they train those AI to replicate the jobs each of the individuals perform. Rachel Neasham, for example, is a travel agent working for a startup who helps train the AI systems that could eventually take over for her. She discovered that while the AI is very good at analyzing the customers' preference for hotels and vacation destinations, humans are much better at continuing support when the customers are on their trip.[2] While AI are, thus far, good at simple analytical tasks such as data analysis, humans are still the best at maintaining a conversation. For example, humans can call the hotel about room service or recommend events for visitors to try. AI has yet to become sophisticated enough to perform these tasks. Another woman, Diane Kim, who trains AI assistants for office workers, has discussed the limits of training AI. Her main job is to discover the limitations of the AI software.[3] Sometimes clients ask the AI to do something it cannot do, and the AI then does not know how to recover. However, she has also said that some of her clients are surprised to learn that they are setting up meetings through an AI assistant, and are not at all interacting with a human. They send thank you notes or ask the assistant on dates, displaying the fact that AI are continually getting better at

[1] Daisuke Wakabayashi, "Meet the People Who Train the Robots (to Do Their Own Jobs)" *The New York Times,* April 28, 2017.

[2] *Ibid.*

[3] *Ibid.*

acting more "human".[4] This is also the case in the legal realm. Dan Rubins, a chief executive, spoke on how he used AI to replace lawyers during the process of contract writing. The AI he uses are programmed to find vague phrasing, fix typos, and minimize litigation time. While lawyers will assuredly still be needed in the future for basic contract writing, this shows the broad potential for new AI applications.

While job replacement by automation is not a new trend in the American workforce, the breadth of change that AI could bring is certainly unique. Automation has been especially prominent in the manufacturing industry, with the steel industry losing seventy-five percent of its workforce, or 450,000 people, to automation within the last forty-five years.[5] Towns like Youngstown, Ohio, Gary, Indiana, and Pittsburgh, Pennsylvania suffered massive hits to their economies during the 1970s and 1980s, and they are still recovering.[6] Major steel corporations such as Wheeling-Pittsburgh Steel Corporation and the LTV Corporation asked to borrow almost six billion dollars from the federal government, and a bailout, much like the auto bailout after the Great Recession, was given to attempt to preserve the industry.[7] However, job automation has not yet been seen across industries to the extent that The New York Times and the journalist Wakabayashi suggest. While there is a history of technology changing the American workplace in massive ways, due to current advancements in the technology, artificial intelligence now has the potential to affect jobs that have long been considered unreplicable.

The term AI, or artificial intelligence, was first used by

[4] *Ibid.*

[5] Claire Cain Miller, "The Long-Term Jobs Killer Is Not China. It's Automation," *The New York Times,* December 21, 2016.

[6] Bill Toland, "In desperate 1983, there was nowhere for Pittsburgh's economy to go but up," *Pittsburgh Post Gazette,* December 23, 2012.

[7] Robert Pear, "U.S. Mulls Aid in Steel Shutdowns," *The New York Times,* July 14, 1987..

computer scientist John McCarthy in a proposal for a conference at Dartmouth College on computer learning in 1955.[8] While often thought of as a new, emerging technology, AI has been in the scientific literature for over sixty years. In 1960, McCarthy wrote his seminal work on program learning, called "Programs with Common Sense." This book influenced AI thinking and philosophy for years, arguing that AI was the next step in human evolutionary thinking and could give humans a way to achieve higher thought.[9] As AI continued to develop, it was increasingly seen by software developers as a way to duplicate human thinking and, therefore, eventually replace humans entirely. This thought process became public conventional wisdom after the computer dubbed "Deep Blue" beat chess champion Garry Kasparov in 1997.[10] The startling realization that computers could best the brightest among us shocked the world. The next question asked was profound: What was to come for AI and automation? As AI and automation software continued to improve, Americans were pushed out of jobs that had been considered irreplaceable. Productivity went up, but workers in the steel and automotive industries shrank. This trend continues today.[11]

The issues that artificial intelligence pose will have significant impacts on not only the American economy, but the worldwide economy. Automation has already displaced a significant number of people from their workplace. According to a study done by Ball State University in Indiana, only 13 percent of total job loss in the manufacturing sector to date was due to trade, and 87 percent could be attributed to automation

[8] Andrew Myers, "Stanford's John McCarthy, seminal figure of artificial intelligence, dies at 84," *Stanford Report* (October 25, 2011).

[9] *Ibid.*

[10] Jennifer Latson, "Did Deep Blue Beat Kasparov Because of a System Glitch," *Time Magazine*, February 17, 2015.

[11] Michael J. Hicks and Srikant Devaraj, "The Myth and the Reality of Manufacturing in America," *Ball State University Center for Business and Economic Research* (June 2015): 1-7.

in the workplace.[12] However, as Daisuke Wakabayashi showed in her New York Times article, the impact on jobs from AI and automation will not only affect manufacturing. For example, contract litigators could be pushed out of a significant portion of contract writing.[13] AI applications have shown the ability to replace even doctors, with one particular program outperforming doctors at predicting heart attacks.[14] This possible impact on all socioeconomic classes and labor sectors in the United States leads me to ask the following research question: How will AI affect the American workforce?

Americans are technological optimists. According to a Pew Research Center poll published on February 8th, 2017, only thirty-seven percent of those polled believed that the use of algorithms (artificial intelligences) would have entirely negative impacts on society and individuals. The other individuals surveyed said that it would either be entirely positive or half and half (thirty-eight percent and twenty-five percent respectively).[15] This percentage represents an overwhelmingly supportive view of AI as an emerging technology. A separate poll conducted by Gallup found that twenty-six percent of American workers believed that their own job would be eliminated by technology within the next twenty years. Seventy-two percent of Americans said that it was not too likely or not at all likely that their job would be replaced by technology within the next twenty years (twenty-seven percent and forty-five percent respectively).[16] These percentages suggest, again, a highly optimistic view of technology and AI. The fact that both of these nonpartisan polls

[12] *Ibid.*

[13] *op. cit.,* fn. 1

[14] Matthew Hutson, "Self-taught artificial intelligence beats doctors at predicting heart attacks," *Science Mag*, April 14, 2017.

[15] Lee Rainie and Janna Anderson, "Code-Dependent: Pros and Cons of the Algorithm Age," *Pew Research Center* (February 8, 2017).

[16] Frank Newport, "One in Four US Workers Say Technology Will Eliminate Job," *Gallup* (May 17, 2017).

point to Americans believing that they will not be replaced points to a trend in American thinking toward technological optimism.

The views surrounding technology and artificial intelligence are incomplete. My research question will challenge this conventional wisdom, as traditional ways of thinking about technology do not take into full account the possible economic impacts of emerging technologies. The average American does not thus far possess the knowledge required to form an educated opinion on the matter.[17] Former President Barack Obama, a well-informed man with access to leading experts, has expressed his concern with the "economic implications" of artificial intelligence.[18] He said in an interview with WIRED that, "...historically we've absorbed new technologies, and people find that new jobs are created, they migrate, and our standards of living generally go up. I do think we may be in a slightly different period now, simply because of the pervasive applicability of AI and other technologies."[19] Were conventional wisdom complete, it may exhibit a view similar to former President Obama's: rationed caution.

In my research, I utilize a qualitative methodology in the form of case study research. In order to do this, I use three case studies to explain how AI will affect different sectors of the American economy. The first case study is the economic sector of manufacturing, such as the auto industry or steel industry. The second case study is the service sector, including basic restaurant jobs, cashiers, or cooks. The last case study is on the "white-collar" sector. This industry includes jobs such as lawyers, doctors, or those who are often considered office workers. The findings of this research are based upon primary

[17] Camille L. Ryan and Kurt Bauman, "Educational Attainment in the United States," *U.S. Census Bureau* (March 2016).
[18] Scott Dadich "Barack Obama, Neural Nets, Self-Driving Cars, and the Future of the World," *WIRED* (November 2017).
[19] *Ibid.*

sources such as Bureau of Labor Statistics data, official White House policy stance documents, Congressional Research Service reports, and Senate Subcommittee documents. This primary source research is supplemented with numerous secondary sources including The New York Times, Washington Post, CNNMoney, and a variety of peer-reviewed scholarly articles.

The Manufacturing Sector

Americans still believe that manufacturing is the backbone of the American economy. In a poll conducted by Gallup, nineteen percent of those asked felt that manufacturing was the best way to create jobs in the United States more than any other category.[20] Manufacturing has even been embedded into the American consciousness through sport, with teams such as the Pittsburgh Steelers and San Francisco 49er's adopting mascots that instill a sense of pride in the blue collar worker. Unfortunately, manufacturing has been stricken by automation. The study conducted by Ball State University showed this plainly, revealing that eighty-seven percent of job loss in the last forty years has been due to advancements in automation technologies.[21] However, with AI continuing to make serious strides and advancements, this job loss is only going to increase.

For example, at some UPS plants, 3D printers have begun to be used to quickly create any conceivable product.[22] These 3D printers can be used to print almost anything, and do not need for a human worker to input code, specs, or even unload the machine. At these factories, one worker watches around 100 machines and is only needed to fix the machines as they break or malfunction.[23] These factories, though convenient

[20] Frank Newport and Andrew Dugan, "Americans Still See Manufacturing as Key to Job Creation," *Gallup* (May 24, 2017).
[21] *op. cit.,* fn. 6
[22] "UPS To Launch On-Demand 3D Printing Manufacturing Network," *UPS Pressroom* (May 18, 2016).
[23] *Ibid.*

for customers and manufacturers of custom products, continue to displace workers. A single machine can replace the workers required for coding, the workers involved in shipping, and the workers needed for building the products themselves. In fact, even the workers that are needed for fixing the machines could soon be replaced. General Electric has outlined a plan for what it calls a "Brilliant Factory" that includes replacing workers whom would have manufactured prototypes contracted by different companies to GE.[24] In fact, Proctor and Gamble, another manufacturing giant, has said that introducing artificial intelligence onto their factory floors has decreased unexpected downtime by ten to twenty percent.[25] These two examples show a continuing trend of large manufacturing companies moving towards replacing their menial labor workforce.

Quality assurance is another aspect of manufacturing that could eventually phase out human workers. Quality assurance entails making sure that parts coming off of an assembly line are all up to specifications, and then if they are out of line, fixing the machine that is causing the issue. This job is tedious and intensive, requiring focus for the entirety of the workday. If a mistake is missed, it could mean an entire day's product has to be thrown out. Naturally, this process would be improved upon by automation. Numerous companies are already selling quality assurance software, which removes humans from the process.[26] These programs can have all of the specs for every part in the factory directly uploaded to them, can analyze better statistical methods to predict failures more quickly, and can do the job much faster than their human counterparts. As AI continues to improve, GE plants such as the "Brilliant

[24] Paul McDougall "From robots to AI: Manufacturing is getting a lot smarter," *The Washington Post*, May 3, 2016.

[25] *Ibid.*

[26] Adam Auerbach, "Part of the Pipeline: Why Continuous Testing Is Essential," *Techwell,* August 3, 2015.

Factory" will be able to connect these quality assurance programs with the machines themselves, and fix the machines that are out of line without a human ever being involved.

Leading experts in the field of artificial intelligence have spoken on the potential job loss that would directly impact the manufacturing sector. When testifying before the Senate Subcommittee on Space, Science, and Competitiveness on the potential impact of artificial intelligence, Dr. Eric Horvitz testified that "There is an urgent need for training and retraining of the U.S. workforce so as to be ready for expected shifts in workforce needs and in the shifts in distributions of jobs that are fulfilling and rewarding to workers."[27] The White House Office of Science and Technology had taken this stance as well, recommending in its report, Preparing for the Future of Artificial Intelligence, that, "The Executive Office of the President should publish a follow-up report by the end of this year, to further investigate the effects of AI and automation on the U.S. job market, and outline recommended policy responses."[28] This recommendation paid particular attention to those people in low and medium skill jobs, knowing that they would be the most impacted by further automation in the workforce.

The Service Sector

Artificial intelligence and automation of jobs is not something that will be confined to the manufacturing sector. This technology can replace workers everywhere, including at the grocery store and fast food restaurants. In November of 2016, McDonald's announced that they were going to replace cashiers with automatic machines, similar to ATMs or modern

[27] U.S. Congress. Senate. Subcommittee on Space, Science, and Competitiveness. 2016. *The Dawn of Artificial Intelligence*, (114th Congress, 2nd Session, November 30, 2016).

[28] The White House, "Preparing for the Future of Artificial Intelligence," *White House Office of Science and Technology* (October 12, 2016).

vending machines.[29] This introduction of automation, many have theorized, was in response to the strikes put on by fast food workers asking for a higher rate of pay.[30] This theory, if correct, goes to show that large companies can and will utilize artificial intelligences in order to improve the bottom line.

Many Americans have begun to see this automation in grocery stores as well. Self-checkout lanes have become a staple in most American grocery stores. The concept of these cashier lanes is that the customer does the work of a cashier, including scanning and bagging groceries. This reduces the need for on-hand cashiers in grocery stores; rather than a whole host of cashiers, grocery stores need only one or two employees to watch for possible malfunctions.[31] However, the future looks grim even for those cashiers that remain in the industry. Amazon recently purchased Whole Foods in an enormous $13.4 billion deal and is looking to continue to revolutionize the grocery business.[32] If Amazon is going to make their new stores anything like the Amazon Go store they already run, cashiers may very well be pushed out of the picture. In this revolutionary store, there are no checkout lines; you simply go in, grab your items, and leave.[33] The store has finally opened to the Seattle public, and while the store does not offer any sort of produce or weight-based items, ready made meals and drinks are available to those who download the new Amazon app and walk in.[34] With a lack of cashiers, the store only needs

[29] "Building a better Mcdonald's, Just for You," *McDonald's* (November 17, 2016).
[30] Ed Rensi, "Thanks To 'Fight For $15' Minimum Wage, McDonald's Unveils Job-Replacing Self-Service Kiosks Nationwide," *Forbes,* November 29, 2016.
[31] Nick Fountain, "Self-Checkout Could Soon Be Checking Out," *NPR* (October 20, 2016).
[32] Nick Wingfield, "Amazon to Buy Whole Foods for $13.4 Billion," *The New York Times,* June 16, 2017.
[33] Kif Leswing, "Amazon is buying Whole Foods- here's Amazon's vision for the grocery store of the future," *Business Insider,* June 16, 2017.
[34] Elizabeth Weise, "Amazon opens its grocery store without a checkout line to the public," *USATODAY,* January 21, 2018.

workers to restock food that is purchased by eager Seattleites. Clearly, this could be a revolution in the grocery business, and it's all thanks to the AI running the shop behind the scenes.

Waiters and waitresses are beginning to feel the push of automation as well. Within the last two years, restaurants like Olive Garden have started to put tablets on the tables where customers sit, allowing them to purchase and pay for food through the tablet.[35] The only times they interact with a server is when the host takes them to the table, and when the server brings them the food that they've ordered. According to Olive Garden, these tablets are not meant to replace the servers, but instead are a means to assist them.[36] However, with less need for a server to take orders or take payment, they could soon be propelled out of the dining room entirely.

Along with the waiters and waitresses, chefs may start to feel the heat from AI. While the technology is still not as advanced as some of the artificial intelligence powering self-driving cars or machining lines at Ford, some companies have begun to develop 3D printers for food. These 3D printers can learn any recipe within a fraction of a second, can print food of any variety, and can take out the difficulty of preparation that keeps some people from cooking. While this printer can only print raw food and not prepared food, future advancements could mean that users could press a button and have fresh, 3D printed, ready to eat food right in front of them. This advancement is the proof in the pudding that artificial intelligence and advancements in technology can genuinely replace any job.

The service sector will also be impacted in ways that have yet to be seen, with major impacts on those who are most vulnerable. In Elon Musk's official "Master Plan, Part Deux," he

[35] Tracey Lien, "Olive Garden rolls out tabletop tablets for ordering and payment," *Los Angeles Times,* April 14, 2015.
[36] *Ibid.*

outlined a plan to create a "Tesla Fleet," where owners could allow their cars to join a fleet of self-driving taxis, generating revenue while their owners were not using them[37] This opportunity for Tesla owners could potentially put taxi drivers, as well as Uber and Lyft drivers, out of work. According to the Bureau of Labor Statistics data published in May of 2016, over 185,000 people were employed as Taxi Drivers or Chauffeurs.[38] Were owners of self-driving cars to send them out on the road when they weren't in use, all of these jobs could be lost. Meanwhile, those who can afford to buy Tesla cars would continue to generate income.

Taxi drivers will not be the only drivers impacted by automation. Truck driving, one of the most common jobs in almost every state in the United States, could also feel significant impact.[39] The Bureau of Labor Statistics reported in May of 2016 that over 1.7 million Americans were employed as truck drivers.[40] This figure includes freight truckers, warehouse truckers, and petroleum and gas truckers. As automation in driving becomes readily available, truckers will be forced out of the labor force due to self-driving delivery trucks. These self-driving trucks could run through the night, expediting delivery and reducing danger from drivers who do not take enough time to rest.[41]

In addition to the more than 2 million jobs at stake just in driving, those who work in customer relations are also at risk of replacement. Rachel Neasham, who was discussed earlier, is training AI to replace her job as a travel agent.[42] As such, she helps to book customers into hotels, helps them to buy flight tickets

[37] Matthew DeBord, "Elon Musk is on the verge of making a huge change for Tesla's owners," *Business Insider,* July 23, 2016.
[38] Occupational Employment Statistics, "Taxi Drivers and Chauffeurs," *Bureau of Labor Statistics*, May 2016.
[39] Occupational Employment Statistics, "Heavy and Tractor Trailer-Truck Drivers," *Bureau of Labor Statistics*, May 2016.
[40] *Ibid*.
[41] "Rules to curb sleepy truck drivers are breaking down," *Associated Press,* December 8, 2016.
[42] *op. cit.,* fn. 1

and other various necessities for taking a trip. This is tedious work and requires a lot of comparing and research. However, an AI that was programmed to compare all of this data could do so in a fraction of the time that it would take Rachel. And if an AI could be trained to do a task like that, it could almost definitely be trained to do any tedious task. Were every travel agent replaced by AI, the United States would lose around 68,000 jobs.[43]

The "White-Collar" Sector

The "white collar" sector of the economy refers to those workers who are required to be highly educated, skilled or knowledgeable to do their jobs. People who work in this sector includes lawyers, engineers, professors, and doctors. For years, these jobs have been considered the apex of work, as they pay very well, and with the high educational requirement, there has been little pressure from competition. However, the threat of AI is becoming increasingly menacing for those at the top.

One of the last areas of work many Americans would think to see job replacement by AI would be in the software engineering world. Obviously, if AI are programs, there must be those people who develop and code these programs. However, software engineers could soon be programming AI to handle jobs that have been staples in the field since software was invented. Debugging code is incredibly important, but often tedious work that involves reading through code and finding mistakes that break it. This process can potentially take hours when thousands of lines of code are involved. However, some programs are beginning to debug themselves. Researchers at MIT developed a program that senses its own faulty code, then imports code from other working programs and integrates it into itself.[44] With this reduction in possible workload to software engineers, engineers can focus more on developing code itself,

[43] Occupational Employment Statistics, "Travel Agents," *Bureau of Labor Statistics*, May 2016
[44] Larry Hardesty, "Automatic Bug Repair," *MIT News,* June 29, 2015.

and less on fixing the code that they have already worked on. With this reduction in downtime, fewer software engineers are needed to do the same amount of work, and because of this, not even coders themselves are safe from the software they create.

Doctors are some of the most respected men and women in the workforce, but they could also be replaced by advancing technology. In his testimony to the Subcommittee on Space, Science, and Competitiveness, Dr. Eric Horvitz called artificial intelligence a "sleeping giant" when referring to its impact on the healthcare industry.[45] He also referred to a study conducted by Mohsen Bayati and his colleagues, which states that AI was used to evaluate patients and how likely they were to be readmitted to the hospital within thirty days. When the AI was used instead of standard doctor evaluation, readmittance went down by thirty-five percent, and those who needed more care received it instead of leaving the hospital.[46] Given this, doctors could be replaced in symptom analysis. According to a recent Science Mag article, four separate AI programs that were developed through a "self-learning" technique performed significantly better than doctors when attempting to predict heart attacks.[47] These AI were about seventy-three percent accurate, which, when applied to the 83,000 patient records used to train the AI, would have been 355 more patients saved.[48]

This algorithm is just one example of the power of AI to replace doctors. Those doctors whose main job is to examine images, such as x-rays or MRIs, could soon be replaced with pattern recognizing AI. In an article published by Nature magazine, an AI program taught to look for signs of different

[45] *op. cit.,* fn. 23

[46] Mohsen Bayati et. al, "Data-Driven Decision for Reducing Readmissions for Heart Failure: General Methodology and Case Study," *PLoS ONE* (October 8, 2014).

[47] *op. cit.*, fn. 14

[48] *Ibid.*

skin cancers performed as well as twenty-one dermatologists.[49] The increase of these programs could lead to a massive overhaul of the medical system, with patients no longer going to see a doctor, but going to see a computer that could perform just as well as a doctor. The same could be said of patients who are going to get their heart checked. An algorithm from a company called Arterysis takes MRI images from patients and calculates the amount of blood that is flowing through a patient's heart.[50] This process, which usually takes trained doctors about forty-five minutes to an hour, can be performed by the AI in about fifteen seconds.[51] Fewer doctors are then needed for diagnosis and can spend more time talking with patients about the implications of their disease, as well as treatments.

Finance is another industry that could experience a push by AI. Stockbrokers and investment bankers do jobs that may soon be automated. In fact, Charles Schwab recently revealed a program entitled Schwab Intelligent Portfolios, which automatically checks and adjusts investors portfolios.[52] Customers pay next to no fee to use this program, instead of the usual one percent they would pay to the investment banker. Customers simply fill out a questionnaire and the program manages an investment portfolio for them. These programs are quite literally handling millions of dollars worth of investments with no human involvement in money movement. And programs do more than help retirees and families manage retirement funds; they now run most of Wall Street.[53] Almost all trades go through a computer, with AI programs making trades in milliseconds

[49] Andre Esteva et. al., "Dermatologist-level classification of skin cancer with deep neural networks", *Nature* (February 2, 2017): 115-118.

[50] Arterys, "Arterys Partners With GE Healthcare to Launch Transformative Cardiac Medical Imaging Platform" *PR Newswire,* December 7, 2015.

[51] *Ibid.*

[52] Michelle Fleury, "How artificial intelligence is transforming the financial industry," *BBC News,* September 16, 2015.

[53] *Ibid.*

– faster than any human ever could. This is favorable and unfavorable: while computers can make investment choices faster than humans can, they can also malfunction. In 2012 Knight Capital lost over 400 million dollars in half an hour after a computer malfunctioned.[54] So, while computers may replace most stockbrokers and investment bankers, some may have to remain in order to remedy these problems.

Another "white-collar" sector that could be heavily impacted by AI programs is the litigation sector. Lawyers have incredibly complicated jobs, often including interpretation of wording, creating and finding patterns, and critically thinking about complex ideas. However, artificial intelligence programs could be easily taught to look out for those patterns, interpret words and phrases, and break down complex ideas into easily computable data. According to a study done led by a professor at University of North Carolina School of Law, artificial intelligence programs could help reduce workload for lawyers by thirteen percent.[55]

Hours spent on document review, for example, could be reduced by eighty-five percent.[56] While it is not realistic to assume that this would happen automatically, as the paper implies, these programs have the potential to overhaul how hours, and therefore money is spent on certain aspects of the job. These AI are already being exploited in the world of contract writing. According to those who use a program developed by Kira Systems, contract writing time is reduced by twenty to sixty percent.[57] Once again, AI has shown its potential to completely overhaul the job market in new and unexpected ways.

[54] *op. cit.,* fn. 44

[55] Dana Remus and Frank Levy, "Can Robots Be Lawyers? Computers, Lawyers, and the Practice of Law," *SSRN* (December 11, 2015).

[56] *Ibid.*

[57] Steve Lohr, "A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet." *The New York Times,* March 19, 2017.

Implications and Recommendations

The potential for job replacement has always been an issue for the working class in the United States. A new technology may come along in the steel industry, as it did in the 1970s, or in the automotive industry, as it did in the 1980s, with the potential to completely revolutionize manufacturing sector. Some jobs have come and gone in the American workforce, but most of the fluctuation has stayed firmly in the lower classes. However, with the advancement of artificial intelligence, job replacement has the potential to impact the job market like never before. While the low and medium-skilled jobs will be affected hardest, those at the top will feel the impact as well. If all of the jobs discussed in these case studies were to experience a fifty percent job loss rate due to AI, the American economy would lose over four million jobs.[58] This estimate is over dramatic of course, but shows the potential for just how much the American economy could suffer from a lack of foresight when it comes to artificial intelligence. This number also does not include a number of other industries and jobs that could potentially be affected by AI programs. The estimate likewise fails to account for the jobs internationally that would be lost from potential American developed programs. How would this situation impact American relations with countries that experience job loss and are not prepared to deal with it? How will Americans handle being out of work after being replaced by a computer program? How will the economy suffer from this job loss? All of these questions must be considered if we are to appropriately handle the impacts of artificial intelligence. Artificial intelligence programs will only continue to advance as we move into the future. More and more people will feel the impact of potential job loss. The United States must develop a

[58] Occupational Outlook Handbook, *Bureau of Labor Statistics* (2014).

plan to analyze this potential job loss, develop a plan to combat job loss such as retraining those who are impacted, and prepare for a future where work is no longer a requirement. Americans may not be ready to accept this reality, but it will come for them nonetheless. It is possible, but may mean accepting a program that includes heavy government involvement and powerful labor union forces.[59] Unless Americans want to ask themselves where the strong financial sector, service sector, and litigation jobs went off to, as they do now with manufacturing, they need to plan. A safety net must be created for those who will no longer have decent paying jobs after they are replaced. A standard living wage must be created for those who can longer advance through the workforce. More emphasis must be placed on educating children on science and technology so that they can be armed with the proper knowledge to enter into an ever-changing workforce. Society as a whole must rethink its focus on how people produce and instead to an emphasis on what people produce. Human creativity, such as our ability to create art, music, and develop new ways of thinking about the world around us – things not able to be replaced by a computer – must be established as our true worth. Men and women must no longer be valued by the wealth that they create for others, but the wealth they create for themselves through thorough self-fulfillment. These are radical ideas, but must be sought after if humanity is to survive the coming AI revolution.

[59] Peter Goodman, "The Robots Are Coming, and Sweden Is Fine," *The New York Times,* December 27, 2017.