Spring 2018

Artificial Intelligence in Modern Society

Michael Holt

Murray State University, TheMSUDude@gmail.com

Artificial Intelligence in Modern Society

Michael C. Holt

Murray State University

Abstract

Artificial intelligence is progressing rapidly into diverse areas in modern society. AI can be used in several areas such as research in the medical field or creating innovative technology, for instance, autonomous vehicles. Artificial intelligence is used in the medical field to improve the accuracy of programs used for detecting health conditions. AI technology is also used in programs such as Netflix or Spotify. This type of AI will monitor a user's habits and make recommendations based on their recent activity. Banks use AI systems to monitor activity on members' accounts to check for identity theft, approve loans and maintain online security. Systems like these can even be found in call centers. These programs analyze a caller's voice in real time to provide information to the call center which helps them build a faster rapport with the caller. The purpose of this research paper is to explain how artificial intelligence is creating advanced technologies in various fields of study which will create a more efficient society.

Artificial Intelligence in Modern Society

Even though some people believe intelligent machines could one day replace humans, having intelligent robots in the workplace would create safer and more efficient work environments which complement humans instead of completely replacing them. Currently people use artificial intelligence to make intelligent machines to help those in need. Manufacturers have been using AI in machines for many years with factories becoming more automated each day. Robots are taking over the world by infiltrating a multitude of job sectors and replacing the need for human input in various roles involving transportation, medical procedures, military applications, and even industrial and commercial fields. This paper will discuss how artificial intelligence will benefit our life and how robots can be used to complement human's work rather than replace them.

When people think about intelligent robots most people jump to the idea of robots becoming sentient and trying to compete with humans. It is important to understand these fears and why people believe this way. Intelligent robots will complement humans in our everyday lives. Smart cars are becoming more popular because they can drive completely automated. Self-driving cars will be safer than human drivers, so when there are more automated cars there will be less accidents because of this. Automated cars have sensors that detect anything we can perceive such as a stopped car in front of us or changing road conditions. Artificial intelligence can enhance things as simple as household appliances all the way to medical neural networks that can diagnose diseases or perform operations. As society changes and embraces a more automated lifestyle there will also be new jobs created to monitor, enhance and repair these automated machines.

Artificial intelligence is fundamentally intelligence behavior displayed by machines instead of humans. People who have studied computer science are needed in creating AI because they should observe how the machine reacts to certain variables. The computer scientist must be able to instruct the machine on what to do when it observers new situations. One example of a new situation would be if the programmer initially tested all the variables in a sunny environment and then when the weather conditions changed the program malfunctioned. This is one reason new AI technology will provide new jobs while also taking away some jobs. The jobs AI will replace first would be repetitious jobs such as working on an assembly line. New careers will include programming which would improve the efficiency of the automated systems. The jobs for which human workers are being replaced are called "the four D's of robotics": Dull, Dirty, Dangerous, and Difficult.

When speaking about the history of artificial intelligence some people believe it began in ancient times because AI, or a form of it, appeared in mythology. In Greek mythology, it appeared in the story about Hephaestus. Hephaestus was the Greek god of technology. In the story of Hephaestus, he had many projects that appeared to think and feel as if they were alive, but they were merely metal creations. Talos, one of Hephaestus's creations, was a giant bronze warrior programmed to protect the isle created by Hephaestus. He was like a cybernetic organism that combined neural network computing with living and nonliving components. Hephaestus had many creations besides Talos, but they all seemed to think and feel as if they were alive. The only way someone could tell they were not alive would be the fact they were made from metal.

This concept of artificial intelligence was known well before it was created, but they did not have the technology to produce it.

In the 17th century Descartes, a French philosopher, proposed that the bodies of animals were the same as complex organic machines. This is important because in Descartes idea it suggested artificial intelligence was possible if people could already create complex machines. Another important discovery happened in the 17th century, which established the creation of the first mechanical calculator. Blaise Pascal, a French mathematician and inventor, solved the issues with Wilhelm Schickard's failed attempt at the mechanical calculator.

In the 19th century Charles Babbage and Ada Byron, also known by her married name of Ada Lovelace, designed a programmable mechanical calculating machine. This analytical engine was proposed but was not competed by Babbage and Lovelace due to inadequate funding. Another important discovery in the 19th century would be the creation of Boolean algebra by George Boole. He created a modern symbolic logic which led to the creation of digital computer circuits.

In the early 20th century a Spanish civil engineer and mathematician named Leonardo Torres y Quevedo wanted to prove thought could be simulated by machines. He created a technology known as El Ajedrecista, (which is Spanish for *Chess player*), in 1912. Quevedo's device was an autonomous machine he used to prove that mathematics could replicate what people perceived as thought by having it play chess. The machine did not play using the complete set of chess pieces but rather just a king and rook vs a king. This system was created using a simple algorithm that would not always win the game in the minimum number of moves but would checkmate the

other player every time. The system also did not have a limit on fifty moves for the 50-move rule. If the player used an illegal move El Ajedrecista would signal the move as illegal and would not continue playing.

It was mentioned in these myths and in stories since then, but the birth of artificial intelligence began around 1950. In 1956 a group of scientists from different disciplines conversed about the construction of an artificial mind. In 1956 John McCarthy introduced the term Artificial Intelligence at the Dartmouth College AI conference. McCarthy was a math professor that introduced this term because he thought every aspect of learning and intelligence could be precisely calculated where a machine could simulate it. The Dartmouth conference of 1956 was when artificial intelligence emerged as a formal academic discipline ("A brief history of artificial intelligence," n.d.). Artificial intelligence is basically when a computer can comprehend data and make decisions based on what it detects.

Alan Turing was a mathematician that published "Computing Machinery and Intelligence" in 1950. He thought of this hypothetical machine in 1936. This was the beginning of artificial intelligence because he introduced something known as the Turing machine. A Turing machine accepts variables and has a response based on what values were entered.

> In speaking of 'the' Turing machine it should be made clear that there are infinitely many Turing machines, each corresponding to a different method or procedure, by virtue of having a different 'table of behaviour.' Nowadays it is almost impossible to avoid imagery which did not exist in 1936: that of the computer. In modern terms, the 'table of behaviour' of a Turing machine is equivalent to a computer program. (Hodges, 2002)

Artificial intelligence has come a long way since then and now helps us in our everyday lives. AI is growing every day and the people creating these computer programs are trying to create full AI automation in machines. One popular autonomous machine is the automated car that Uber, a popular peer-to-peer ridesharing service, uses to drive customers using artificial intelligence. Self-driving cars are not perfected yet, but they are being improved while innovative technologies develop.

While the true nature of artificial intelligence may not be a familiar concept to all individuals, it is a popular topic in movies. Some movies create suspense and horror based around self-aware machines. One thing people need to know about the researchers creating these machines is that they are simply trying to create machines to help people with tasks.

> It's about having a machine that can reach conclusions in a similar way to a human. That is, it can take examples and learn from them to improve the accuracy of its future conclusions. A good example of that is learning what a dog looks like from photographs of Labradors, poodles, and pit bulls and then later, when shown a picture of a Chihuahua, being able to identify that as being another breed of dog. The machine can reach a new, accurate, conclusion based on what it has learned in the past. ("Understanding Artificial Intelligence", Gupton)

An artificial intelligent self-driving vehicle must constantly be processing information from its surroundings and making decisions on those factors. An early definition of artificial intelligence was "the study of how to make computers do things at which, at the moment, people are better."

(Hofmann, Neukart, & Back, n.d.) Data is also required to help develop AI, but it also is used for the machines to learn, adapt, plan, interpret information and solve problems. There are diverse ways to teach a machine to learn. It is important to teach them through examples where they can use that knowledge in the future instead of only going off specific preprogrammed scenarios.

Collecting data helps the programmer understand what the machine needs to decide on an action. The programmer might collect several samples but overlook something which will end up causing the machine to make an inaccurate decision during testing. One way this could happen would be to create a program which would drive an autonomous machine on a path with markers. For this example, we can say the road would be the path it's traveling on and the lines

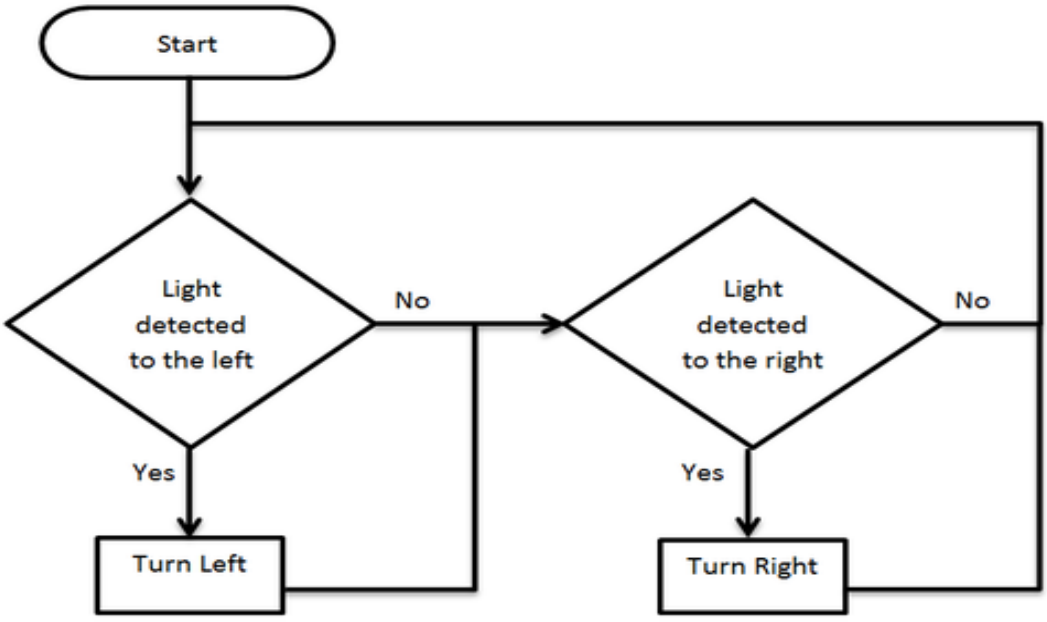

Figure 1: ("Light sensing robot", 2011)

in the middle of the road would be the path it was following. Well during initial testing if you always used it on double lined roads it would register following the lines instead of watching the road. If you then went on a different test run and took it to a road with broken lines or no lines at all it might have an error and not move at all or go off the road. This is just a very simple

application of how a range of factors can change how an artificial intelligent machine tries to compute the next process it needs to execute. With an actual autonomous machine there would be many different sensors and they would constantly be talking with the machine allowing it to use these factors in deciding what the next process it needs to perform.

Another example of this would be testing with a constant lighting. Some very simple robots can be created to use sensors to detect light patterns and plan based on what it is detecting. If you always program with a constant lighting and then run a trial test with no lights on at all then the machine will probably make inaccurate decisions. One very simple example of how this works would be a robot that uses light sensors to determine depth. It would be able to detect changes in shadows and light to follow whatever the programmer decided to tell it to do. In one example the person could tell it to move forward until it detected a change in shadows then make a turn and continue going. This would allow the robot to stay on whatever surface it was currently on and avoid falling off it or crashing into another surface. This figure to the right is a simple chart showing the logic behind this example. This example is also only created using a single light sensor. It could

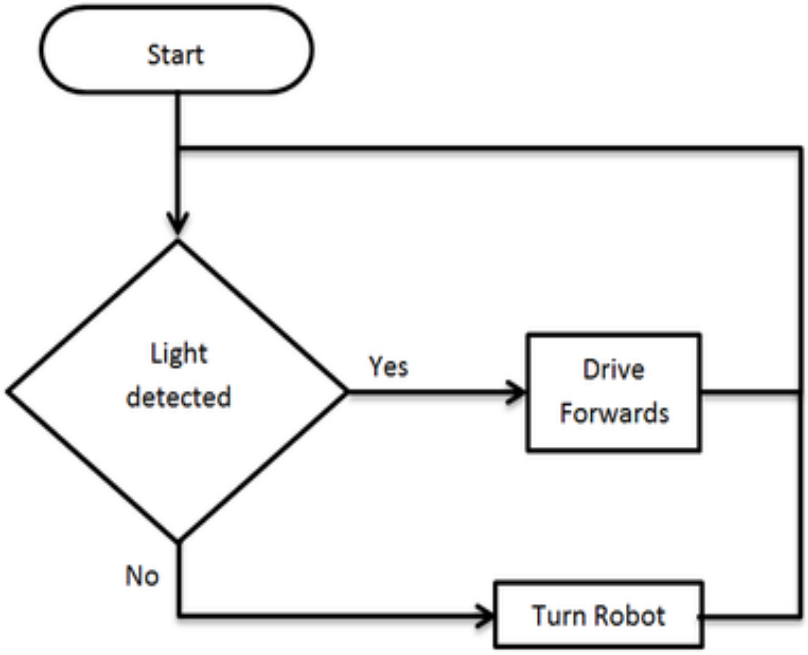

Figure 2: ("Light sensing robot," 2011)

become more complex if there were more sensors. The programmer would be able to code more commands based on what each sensor detects. In this next example it shows how someone would be able to instruct the robot to turn right or left based on where it detected light. For this to work the different sensors would need to be facing different directions.

Another feature people might not know is ran by artificial intelligence is the spam filter in your email. When moving spam to a specific folder it can't just filter out specific words because the people or companies who send these emails could quickly find ways around the spam filter this way. The spam filter is artificially intelligent because it is constantly learning what keywords, phrases and information on who is sending these emails. This is how companies such as Google and Yahoo filter spam out of your inbox.

Websites such as Turnitin and other anti-plagiarism programs use artificial intelligence to try and prevent people from stealing ideas and passing them off as their own. According to Mausumi Sahu in the article titled Plagiarism detection using artificial intelligence technique in multiple files talks about the kNN or k-Nearest Neighbor algorithm. This algorithm is a simple pattern recognition algorithm that is used for machine learning to detect plagiarism. (Sahu, 2016)

Some online programs are always learning from us to try and provide a more personalized experience. Vehicle global positioning systems often calculate the time it will take for someone to make a trip from their current location to their destination. When it calculates time, it must use factors such as weather, roads taken, traffic, road work and vehicle crashes that have been reported. These GPS systems also give warnings if there is road work ahead or if there have been

reported accidents. After it reports this information to the driver, they will be able to change the route if they want to and the GPS system will then calculate the new time of the trip.

AI is in our everyday lives. Programmers are constantly finding ways to teach machines how to cluster learning from examples, so the machine will be able to learn what the programmer is trying to teach. Another very simple example of this would be movie streaming services. They must go through your previous watched shows with your ratings and try to find new recommended shows for people to watch. There is also a new form of artificial intelligence one service named Netflix is using to help encode their video. According to Meghan Coyle in the 2017 article titled "Netflix Develops AI to Help Optimize Video for Mobile Devices" she talks about how they created a new video encoding system called Dynamic Optimizer to reduce the amount of data in a video file without losing image quality. This is what she had to say about the Netflix Dynamic Optimizer.

> The Dynamic Optimizer makes it easier for those customers to watch videos without rebuffering. At the mobile World Congress, Netflix demonstrated the new technology, showing that the image quality doesn't decrease drastically at different bandwidths. Netflix partnered with the University of Southern California and the University of Nantes to create the new technology. Participants rated the image quality of thousands of shots and the data helped train the AI. The AI optimizes each scene so that colorful, action-packed sequences get more bandwidth than the lingering shots. Dynamic Optimizer will not only improve the video quality for mobile viewers; it will also help free up capacity on carriers' networks, which could improve the mobile experience for everyone. (Coyle, 2017)

Some people talk about this process as using an algorithm and some say it's a form of artificial intelligence. In this article it talks about how this is an algorithm created by ideas about how teaching artificial intelligence to machines works.

When focusing more on the workplace and out in the world one version of artificial intelligence that is widespread would be smart cars. Smart cars use sensors to observe their entire surroundings and it then takes those observations and makes decisions from that information. The use of these sensors and quick thinking will complement a worker doing their job, but it is unlikely the autonomous system will be able to work completely independent. If an automated vehicle is traveling to a destination it would be after if there was someone in the vehicle watching everything that is going on and ready to take over if one of the systems failed for some reason. These systems have better reaction times than people, but there still needs to be someone there in case a sensor does not detect an issue. This just means it will be able to do many jobs and do them very precisely, but if something were to happen to the computer system then there would need to be someone to work on the machine.

There are many ways autonomous machines will help improve our lives as they continue to be refined over time. As mentioned before a few areas where AI will help us include smart cars, improved websites, making phone applications more personalized, enhancing positive outcomes in the medical field and doing many of the dull, dirty, dangerous and difficult jobs in factories and other industries. People also argue saying autonomous machines will replace human jobs, which might be true for simple repetitive tasks such as factory jobs. However, these new machines will also create jobs. These AI machine will eventually be able to replicate other jobs

too. There is a need for distinct types of sensors for different jobs and for every specific job the machine needs to be programmed with specific logic which is needed to be proficient at that job.

A more automated society means our culture will become more efficient at manufacturing goods. While this is not the only benefit, it will also help lower costs of items for the public. A culture where automated vehicles take people to jobs where they help monitor automated machine making products is very possible in the future. There will also be other intelligent systems such as regulating household energy consumption. Systems will also be able to alert the owner if there is an issue within the home such as a fire. Increasing the whole efficiency of how people work, and live will be adopted and appreciated by most people, but some will still want to be in control of the things they are doing. Helping automate our lives is not the only thing AI will introduce. These systems will be able to improve our research in different fields.

Certain programs have started trying to improve artificial intelligence in the medical field. Using software to study the heart and create automatic reports for the medical staff. In the Cedars-Sinai online article it talks about the artificial intelligence in medicine (AIM) program.

> "The Artificial Intelligence in Medicine (AIM) program is a research program of the Department of Medicine at Cedars-Sinai Medical Center. The AIM program seeks to develop software to allow computers to process and analyze three-dimensional images of the heart in much the same way an experienced human operator would. The program applies artificial intelligence techniques to the measurement of parameters critical to understanding the state and behavior of the human heart. This automated approach allows information to be obtained very quickly that is quantitatively accurate and does not suffer

from intra-observer or inter-observer variability." ("Artificial intelligence in medicine (AIM), n.d.)

This article talks in detail about how the program will be able to use camera sensors and automatically detect where the heart is and reconstruct it in AIM's own system. The Program will then scan the heart and try to detect any anomalies and the strength or certain parts of the heart. According to this article, the AIM program is licensed and distributed by most nuclear medicine camera manufacturer. This image shows an example of how the AIM system processes information.

Programs in the AIM program use many pictures of whatever they are testing to help determine what is good and what is not. With the AIM program it will learn from many images of healthy hearts. When it detects an anomaly, it will report it to the user. The program should be able to spot specific issues even if the programmer has not used that issue when programming AIM. The program will be able to detect other errors because it will know what a healthy heart consists of and if anything does not fit in this description it will alert the medical staff to that area. This system will create

Figure 3: ("Artificial intelligence in medicine (AIM), n.d.)

three dimensional images of the heart by recording the measurements of the heart cavity. It creates this image by recording the different sections of the heart and how they move during the cardiac cycle.

> AIM is certainly not the first use of computers in medicine. Many of the administrative and financial records keeping needs of the hospital, health center, and even small group medical practice have been turned over to computer systems. Such use of computers differs little from similar applications in a wide range of businesses, and a few technical developments have been motivated specifically by medical use of what could be called "business computing." Obviously, such use will continue to benefit from the increasing performance of general business-oriented systems; just as computer suppliers now aim for the small retail store as a possible market, they also envision the computerization of even individual doctors' offices, providing billing, scheduling, forms preparation, word processing, and other services." (Szolovits, 1999)

The medical field has made numerous advances because of artificial intelligence. In modern society patients and their doctors can contact each other via email, online chats or phone calls. Using the internet to stay in contact with your doctor is useful because you can get useful information about an illness quickly instead of scheduling a doctor visit and then having to wait until your appointment. All patient's data is also stored in a database where the doctor or patient can access information from it online when they need information. Since all this information is stored in a digital system, artificial intelligence can be used to check for risks of certain diseases. The use of connecting a patient's family medical history to their current health information,

helps the computer system understand the types of comorbidities a patient might have to identify issues listed in the record.

According to Kim Krisberg (2017) in the article titled “Artificial Intelligence Transforms the Future of Medicine” in the Association of American Medical Colleges News there has been a study named “Deep Patient” that uses artificial intelligence to scan through health data stored about patients to help predict disease risks. The goal of this system would be a new system that would replace the traditional electronic health records. Kim talks about how doctors are unable to know everything they are supposed to know, so we are at an age where technology will be able to help doctors. They believe machines will be a help to all doctors because the intelligent machine will be able to store information and diagnose patients when a doctor might overlook an issue. In Miotto’s research he finds that Deep Patient is a representation of aggregated EHRs of around 700,000 patients. They used this information and used 76,214 test patients comprising 78 diseases from a wide range of clinical domains (Miotto, Li, Kidd, & Dudley, 2016). This information is challenging to create a model out of because there are several factors such as errors, sparseness of information, incompleteness of records and biases.

The Human Diagnosis Project, also known as Human Dx, is a project led by the global medical community to instruct a patient on the best path to get help. According to the Human Dx website they are pioneering an approach to collective superintelligence, by combining the collective intelligence of humans with machine learning.” (The human diagnosis project, n.d.) This system is used to help those uninsured people try to find the best steps to get treated without seeing unnecessary doctors. The project is a worldwide joint effort that includes more than 8,000

doctors from over 80 countries and 500 medical institutions. As you can see in the image from (Human Dx: Visualizing Progress, 2016) it has many blue circles and each circle represents a medical condition. When you click on the circle it gives the user detailed information about the illness and shows people who have contributed to the information about that condition to the system. Once you click on the condition it gives you a menu as shown in the related diagnoses image that shows related conditions that might be linked to the one you are researching. As you can see in this picture the Human Dx interface also shows the top contributors.

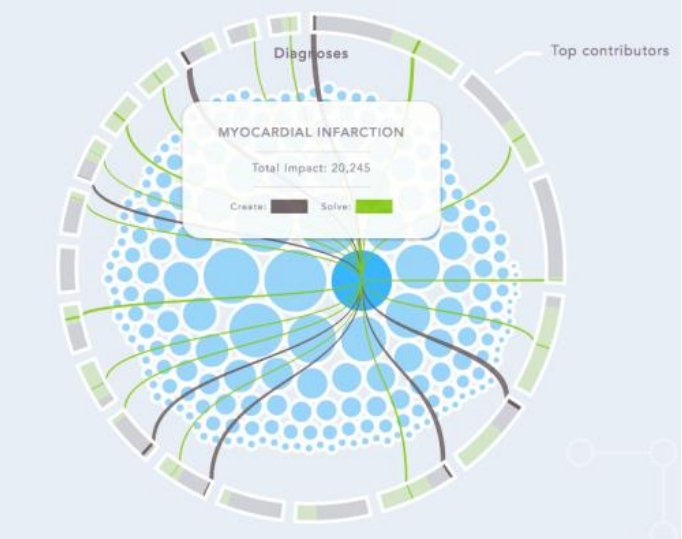

Figure 4: (Human Dx: Visualizing progress, 2016)

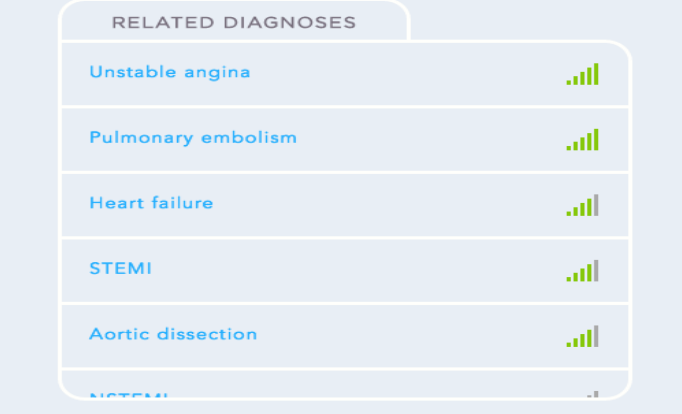

Figure 5: (Human Dx: Visualizing progress, 2016)

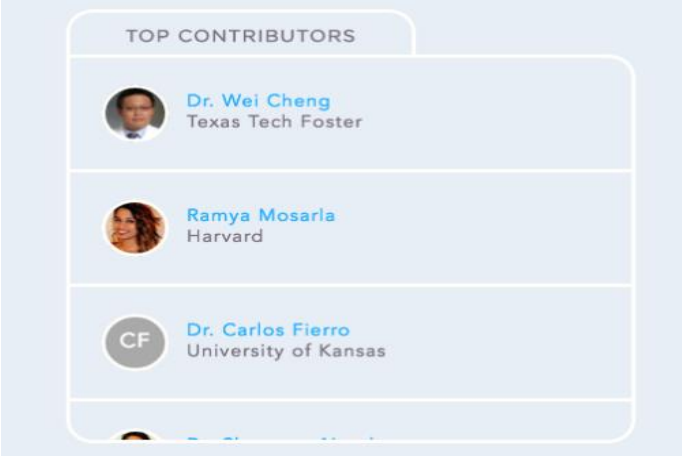

Figure 6: (Human Dx: Visualizing progress, 2016)

Systems like these use AI patterns to help predict diseases. In the following statement Miotto talks about the future of disease prediction results from using artificial intelligent programs to predict diseases.

> To predict the probability that patients might develop a certain disease given their current clinical status, we implemented random forest classifiers trained over each disease using a dataset of 200,000 patients. We used random forests because they often demonstrate better performances than other standard classifiers, are easy to tune, and are robust to overfitting. By preliminary experiments on the validation dataset we tuned every disease classifier to have 100 trees. For each patient in the test set we computed the probability to develop every disease in the vocabulary. (Miotto, Li, Kidd, & Dudley, 2016)

So, from Miotto's predictions, we will have a system in the future that can predict the probability of a person having a certain disease based on current health factors and clinical status. Programs such as these will help future doctors and healthcare staff in their efforts in trying to keep all patients healthy. They will have a better understanding of what could possibly be wrong with a patient and try to cure that illness. This is one type of AI in the medical field, but there are other distinct types of AI which can complement these systems. Systems that scan through databases of pictures, videos and voice recordings will pair very well with a system such Human Dx. If the other system detected a condition through its analyzing it could refer you to something such as Human Dx, so that patient could see how this condition might affect them and what types of treatment they should try to seek.

Finding patterns in illnesses based on a patient's history is a key point in trying to improve healthcare in the future. In an article by Karen Angelo, she talks about how currently doctors only see patients on an average of 7 minutes each visit. With this very limited time with each patient it is very important to try and streamline this process. In this article DiSanzo said, "With

Watson, there's an opportunity to use artificial intelligence and signal processing to improve knowledge that increases the consistency of care." (Angelo, 2016)

With computers' processing power always increasing, some people have turned to using computers to analyze biomarkers to give warnings about certain diseases. Something as simple as an audio biomarker, like a voice recording, is enough information for some AI programs to detect certain conditions. These artificial intelligent programs can also scan photos a person uploads to social media websites for example and distinguish hereditary conditions.

> The RightEye GeoPref Autism Test [tm] helps doctors identify early stages of autism spectrum disorder (ASD, a group of developmental disorders with a wide range of symptoms and levels of disability) in children 12 to 40 months old by using eye-tracking technology. The tests use infrared sensors to test the child's eye movement as he or she watches split-screen video (one side with people and faces and the other with moving geometric shapes). At this age, children with healthy brains focus more on faces than shapes. The amount of time they spend looking at each screen can help predict where the child might fall on spectrum. Early tests have shown an 86% success rate in correctly predicating ASD. (Artificial intelligence in health care – audio/video biomarkers aid in diagnosis, 2017)

There are many other applications such as these. Many more artificial intelligent programs will develop in the future to help fight against certain illnesses at a much earlier age. "FDNA Inc. announced the launch of a set of apps, called Face2Gene, to aid in the identification and evaluation of rare genetic disorders." (Artificial intelligence in health care – audio/visual

biomarkers aid in diagnosis, 2017) Programs such as these will take data points from a photo and compare them with the data sets that are programmed into the system from patients with these diseases or disorders. These programs could be created into phone applications someone could download and use instead of visiting a doctor. It would still be advised to see a doctor, but the app could give a good insight if you have any condition it can detect.

> In addition, thanks to its enormous database of tagged images and the associated data found in user profiles and posts, Facebook would present a tremendous research opportunity. By correlating additional data points derived from posts about diet and exercise, location of residence and recent trips, family history (pulled from listed family members profiles) or any number of other data points, researchers may be able to learn more about causes, symptoms, and treatments. Although it is not likely to happen on a social media site like Facebook, a group called Beyond Verbal, through the beyond mHealth Research Platform, is working to collaborate with researchers, hospitals and universities, and businesses to collect voice samples and discover new biomarkers. Beyond Verbal already has well over 2.5 million voice samples in more than 40 languages and is continuing to grow. With virtual assistants like Siri and Alexa, smart cars, and smart phones, the opportunities are endless. (Artificial intelligence in health care – audio/visual biomarkers aid in diagnosis, 2017)

Applications such as these will be a great utility in the future. Currently these artificial intelligent programs are just starting their journey, but over the years more diseases will be linked to certain biomarkers. There is already a great database for biomarkers to be compared. If it was linked

into a system, such as Facebook or had access to the Siri or Alexa databases there would be a higher level of precision when determining conditions from audio or visual biomarkers.

Two types of AI for the medical field are AI to help discover patterns in diseases and to learn the best practices for patient care. Additionally, AI systems can automatically detect problems or threats and alert staff. In this article by Daniel B. Neill from Carnegie Mellon University, Neill talks about the diverse types of AI in the medical field and the steps needed to advance our AI. In this article he talks about how systems will be able to detect substantial variations in care between groups with significant impacts on how the differences can be negative or positive patterns in patients. If the patterns are negative they will try to understand why they are getting worse, but if the results are positive it shows potential for new practices in the medical field.

> We believe recent advances in fast and scalable detection methods are an important first step toward identifying and optimizing patterns of patient care. For example, the recently proposed fast generalized subset scan (FGSS) can identify self-similar subsets of data records for which some subset of attributes is anomalous; the multidimensional subset scan (MD-Scan) and disjunctive anomaly detector (DAD) identify combinations of attribute values for which the corresponding number of data records is significantly higher or lower than expected. (Neill, 2013)

Designing applications that can determine certain conditions of a person based solely on images or audio biomarkers shows artificial intelligence has a place in our society for the future. With more intelligent applications to help doctors, it will improve the rate at which patients are correctly diagnosed with specific diseases. These improved systems will also drastically cut

down in the amount of time a patient has to wait in a doctor's office because these systems use data you can send to the doctor's office without physically being there. This will not eliminate the need to visit your doctor, but it will provide you and the doctor with better results when you do have a visit.

> Approximately 98,000 patients die per year from in-hospital preventable harm, and in 2008-2011, more than 400,000 patients died of preventable harm in the United States. These numbers are alarming, especially when these patients are lost mostly due to iatrogenic harm such as nosocomial infections, diagnostic errors, surgical complications, decubitus ulcers and even falls. Disturbingly, it is even stated that "the average U.S. patient is expected to be harmed by diagnostic errors at some point in [his or her] treatment." (Sakr, 2016)

When there are systems in place such as AIM the number of these issues would drastically decrease because these systems will be able to compare details about the patient, the patient's history and other factors with previous patients that have been stored in the database. The AIM system would then know what types of medicines and procedures have worked in the past which would help a doctor in their decision-making process on the patient they are currently taking care of. These statistics are troubling, but with the help of new computerized systems hopefully these numbers will decrease.

> "That technology will create a new niche for doctors with a new kind of training. Medical professionals will still fulfill their calling to help heal patients, but it will be in a different way. It is my belief that new technologies will make doctors more efficient in their jobs. In the future, greater reliance on computer-based diagnostics may relieve physicians of

> considerable time and stress, leaving them with more, rather than fewer, opportunities to express their care and empathy for their patients." (Sakr, 2016)

Creating new jobs dealing with computer systems while improving the accuracy of medical tests will be beneficial for our future. Artificial intelligence in the medical field will be great at detecting patterns based on many factors such as images and audio recordings. These patterns might be completely overlooked by doctors, but the AI system will only be able to alert the medical staff of a possible condition. Therefore, people should not be worried about intelligent machines stealing everyone's jobs. These systems might end up replacing some simple repetitive jobs such as certain jobs in factories, but this will also create more jobs in the factories because there will need to be people to work on the computers if they have any errors and start doing a defective job.

> Medical diagnosis is a problem solving and decision making. Feature Subset Selection (FSS) selects a good subset of features for improving accuracy performance. Machine learning has nothing to do with differential medical diagnosis. Physicians must start their investigations to determine the directions of suspicions or to continue in one direction. Applying FSS in medical field may help not only in improving the accuracy performance of classification but also in saving time, cost, and the pain accompanying tests. Much effort has been done in applying neural networks and ML algorithms. Most of this work was concerned with improving the accuracy of the classification, but none of them studied the economic feasibility of applying FSS. Our experiments can be applied in any field that deals with a huge number of features especially in decision making under risk. (Elmahdy, n.d.)

In Elmahdy's research about artificial intelligence in the medical field he talks about machine learning (ML) algorithms and neural networks. These neural networks are directly based of off how our biological neural network works. These artificial neural networks are characterized by containing adaptive weights which relay information and then the neural network learns from the patterns they create. These are known as learning algorithms. Learning algorithms learn from the observed data and try to improve the model. There are two types of artificial intelligence. The two types include general AI and narrow AI. General AI is when a system has all the capacities of human intelligence. Narrow AI is when the intelligence is good for one thing such as comparing different fruits to see which ones are good or bad. Narrow AI is good for a specific job, but nothing else.

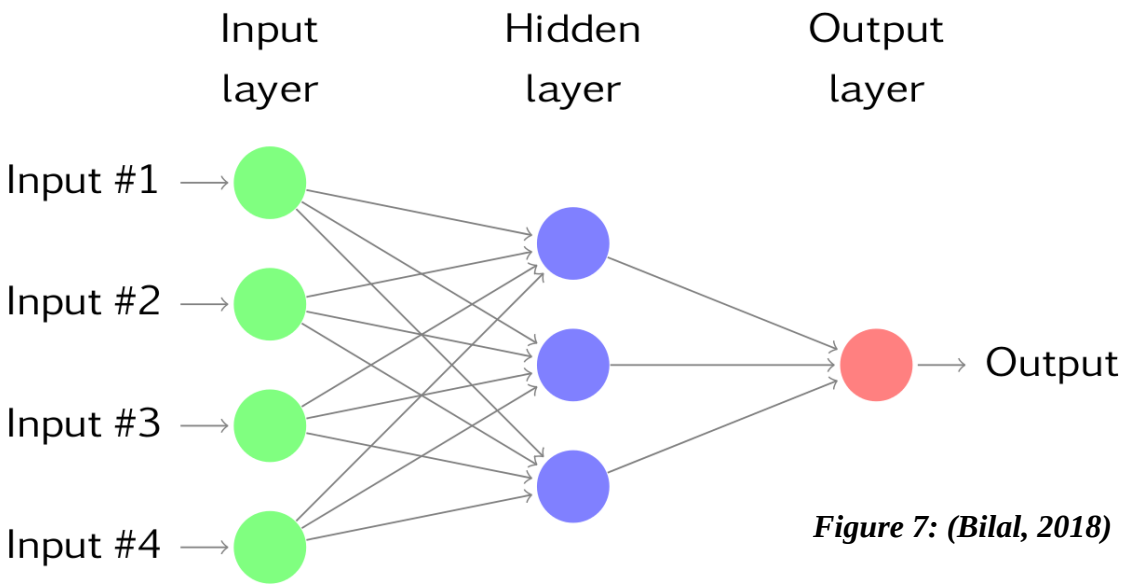

Figure 7: (Bilal, 2018)

"In the image above, the green circles represent the neurons on the input layer, the blues ones – the hidden layer, and the red one – the output layer. The arrows represent the connection between the different neurons." (Bilal, 2018) With each of the connections they carry a value called the

connection weight. A neuron has a number called a threshold value and a formula called the activation function. These values are called the parameters of the neural network. The neural networks learn by taking the values being sent to the output and compare them. Then people correct the formulas based on how the output needs to be changed. Usually these values are calculated by taking the derivative of the cost function and adjusting it in a gradient-related direction. This system will then learn to adjust the weights and threshold values, so it will produce a correct output.

Those were how neural networks learn, but machine learning is different. Machine learning is created by using algorithms to parse data, learn from that information and then use that information to make a prediction about whatever data it is currently analyzing. Machine learning is a more basic practice of using information to learn patterns and then pose a solution. Using data to make the computer learn without programming it to do that task is how machine learning is defined. This type of learning can be supervised or unsupervised learning. Supervised learning consists of semi-supervised learning, active learning and reinforced learning. The distinct types of supervised learning use types of maps or direction to help the machine learn, but unsupervised machine learning is leaving the machine alone and letting it find structure for its inputs.

Machine learning is everywhere when using the internet. When you use Amazon and it has online recommendations already based on other things you have been searching for online, that is an example of machine learning. With this Amazon example, it learns from previous purchases or recent online activity. When Amazon has these types of recommended items they are created by using your online patterns. For an example, let's say someone was searching Google trying to learn how to wire a home audio system. The person might search for different things such as amplifiers, equalizers, subwoofers, wires and other items. Then if that person went from the search engine they were using and went to Amazon it would probably have a recommended list of highly rated audio equipment. It learns this based on your recent online activity.

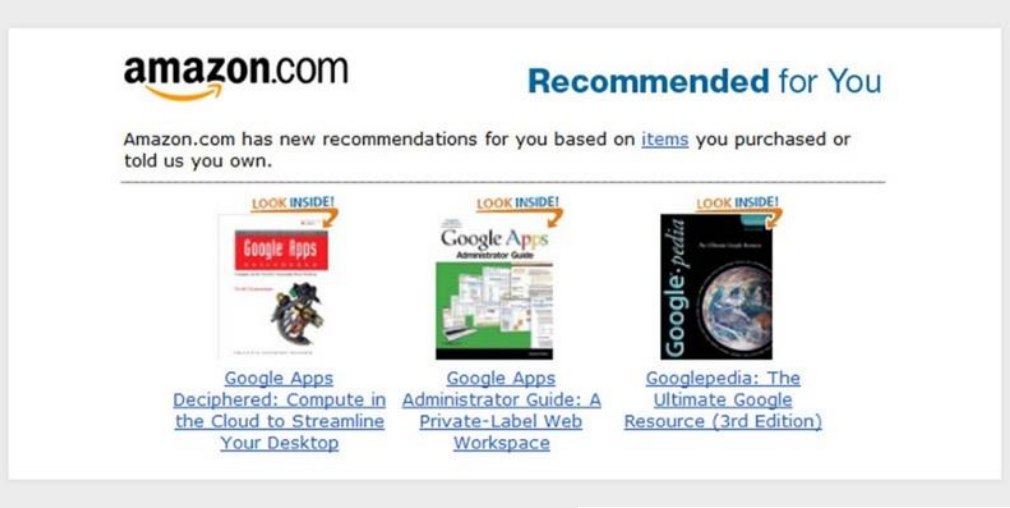

Figure 8: (Feldman, 2018)

One very impressive example of modern machine learning is the use of Siri or Cortana. These voice recognition systems use machine learning and deep neural networks to replicate human interactions. Voice recognition software has drastically improved over the recent years because of how well it is able to adapt to distinctive dialects of the same language. For an example when these programs try to understand someone speaking English from Southern U.S. it will not sound

the same as someone in England speaking English. This is the same language, but it sounds very different at the same time.

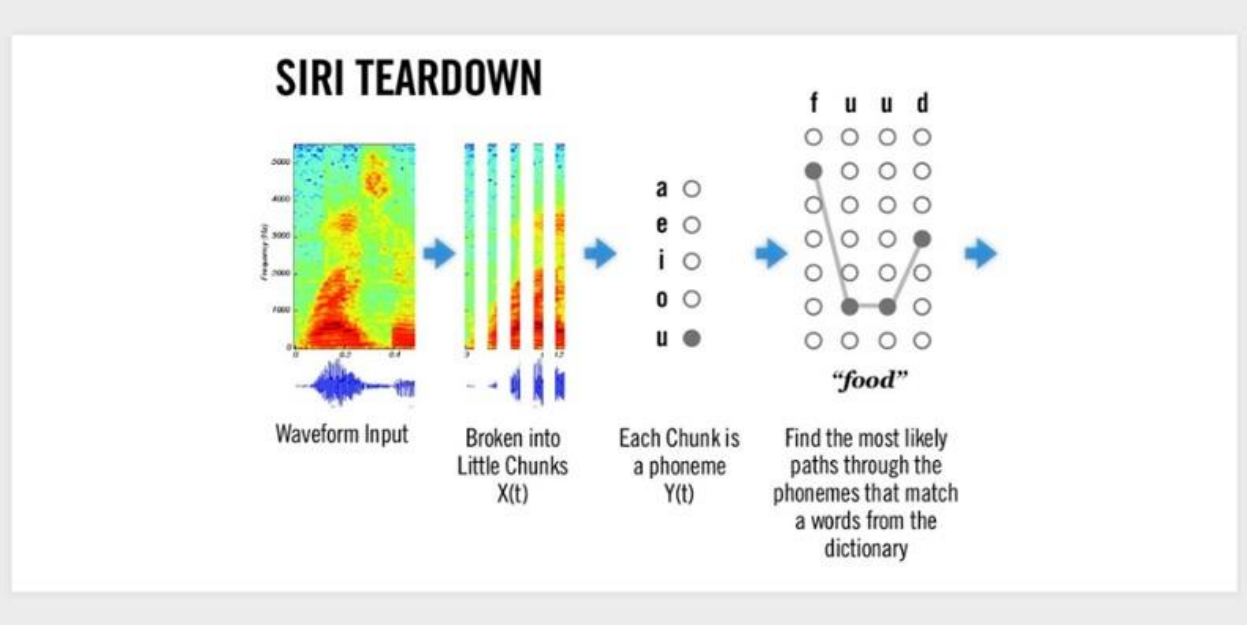

Figure 9: (Feldman, 2018)

Another company that utilizes machine learning to improve the user experience is Facebook. It uses technologies to scan your images and look through your friends list, so you can quickly tag your friend. This software is known as DeepFace and is known to detect the differences in the human face with a 97% accuracy. The facial recognition software Facebook uses combined with looking through a user's friends list is very impressive.

When using Google Maps, the global positioning system (GPS) can find traffic conditions and reroute the driver if there is a wreck up ahead or anything else that might slow their travel time. Google Maps also looks at traffic speeds if that data is available and if there are traffic jams ahead it will alert the driver and give them other route choices if they decide to go on a faster alternate route. Another helpful feature GPS systems can give a user is traffic details such as the current speed limit and other road conditions.

Netflix is another notable example of machine learning. “More than 80 percent of TV shows on Netflix are found through its recommended engine. Machine learning is integral to this process, as the platform caters to more than 100 million subscribers.” (Feldman, 2018) Netflix keeps the full machine learning algorithm secret, but they have stated two factors in the neural network are show content and user behavior.

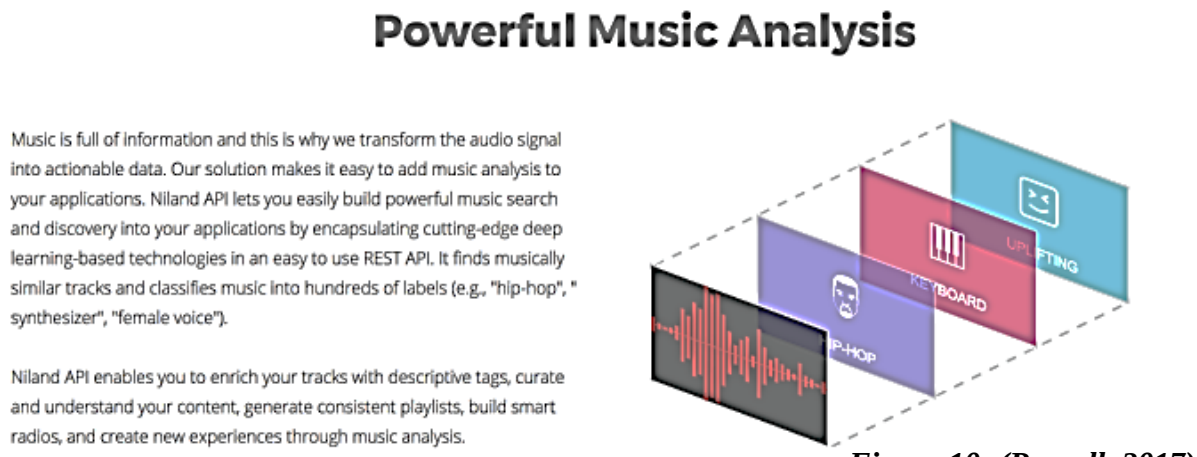

Figure 10: (Russell, 2017)

Spotify purchased Niland team which is a team of people that focuses on artificial intelligence. In a Spotify press release they announced:

> We are pleased to welcome Paris-based machine learning startup Niland to the Spotify family. Niland has changed the game for how AI technology can optimize music search and recommendation capabilities and shares Spotify’s passion for surfacing the right content to the right use at the right time. The team from Niland will join our New York office and help Spotify continue innovating and improving our recommendation and personalization technologies resulting in more music discovery which benefits both fans and artists. Their innovative approach to AI and machine learning based recommendation systems is a perfect fit for the Spotify team. (Niland team joins Spotify, 2017)

Niland keeps their exact methods of recommendations a secret, however they do tell people they are constantly working on improving their system. According to Niland they are always looking for ways to improve the listening experience on Spotify and the discovery method in which users find new artists based on their music listening patterns.

AI technology that analyzes a user's listening or viewing habits will lead to a more satisfied customer. If someone really enjoys a product they are going to tell other people about how they really enjoy it. They will eventually recommend it to other people and that means more customers, so using this AI system to learn about people is worthwhile. These systems also introduce customers to new artists or products based on their activity through the software. This could be an effective way for new artists to advertise. If they were able to put their music on a platform that recognized them being similar to a popular artist, it could promote their music if enough people listened to them through a recommended playlist and received a high amount of positive reviews.

These advertisements would only be targeted at customers which had interests in similar areas. Since these ads are going to be like things users have already liked before, it will be a more productive advertising method than listing unwanted advertisements to everyone that uses the application. However, not all commercials are wanted. When people get spammed with unwanted ads they are not going to be as interested in the product being presented.

Google spam filters for googles email service, or Gmail, uses a type of artificial intelligence to filter about 99.9% of all the spam out of your inbox and into a spam folder. Spam is an unwanted electronic message that is possibly sent to thousands of recipients. These spam filters adapt to new types of spam emails constantly because if spam filters only blocked certain words then companies would be able to understand how to bypass these filters. With an artificial intelligent spam filter, it is very hard for spam to reach someone's inbox because the Gmail spam filter scans databases full of unwanted emails to understand the structure of spam email messages. One group of researchers tested several types of spam filtering and found the ones that use static rule sets that block a certain list of words or content do not effectively block spam. They proposed a solution to this problem:

> This research looked into junk e-emails of several academics within a department and generated three lists of three, four and five-character words. These lists had two categories of words, bad and good, extracted from the junk mails. To produce these lists, the message content has been processed- preprocessing phase- in three steps. In the first step the stop-word removal, a list of stop words such as articles (e.g. "a", "an" and "the"), prepositions (e.g. "with" or "beside") and conjunctions (e.g. "and", "or" or "for") have been generated and compared against the message content to get rid of words that are mapped to the list. In the second step, the stop-word removal, the work has generated another list of noise. Noises such as misspelling, misplaced space or embedding special characters are extracted. For an instance, the word Viagra could be written as "V1agra", "V|iagra" or Free into "fr33". The message content has been compared against the list in order to remove the message noise. (Nosseir, Nagati & Taj-Eddin, 2013)

Uber Technologies is a peer to peer transportation network company. This system is more convenient than calling a taxi service. Someone who needs transportation in a city would have to call a taxi dispatch and wait for one of their drivers to respond to your location. With Uber you can simply tap a button on the app once you have an account created and it uses its system to find the nearest driver to you. Uber trips are usually cheaper than taxi fares. Uber also usually arrives sooner than a taxi would. It is estimated that in a dense urban area the driver arrive time is less than a minute. In the image shown here you can see how the app takes a customer's information and shows a map of where the driver is and other information about the driver. The service is also overall better than you would have with a taxi because after you get out of the vehicle you have an option to rate your driver. An option for Uber is to also share your ride with someone else in the area if there is room in the vehicle to save money by carpooling. Another convenience of this service is that the person using the Uber pays everything through the app, so there is no need to worry about cash. Uber uses AI systems through their application. When someone requests a ride it automatically looks in that area using the Uber drivers GPS system to find a suitable driver for the occasion. The customer is required to list how many

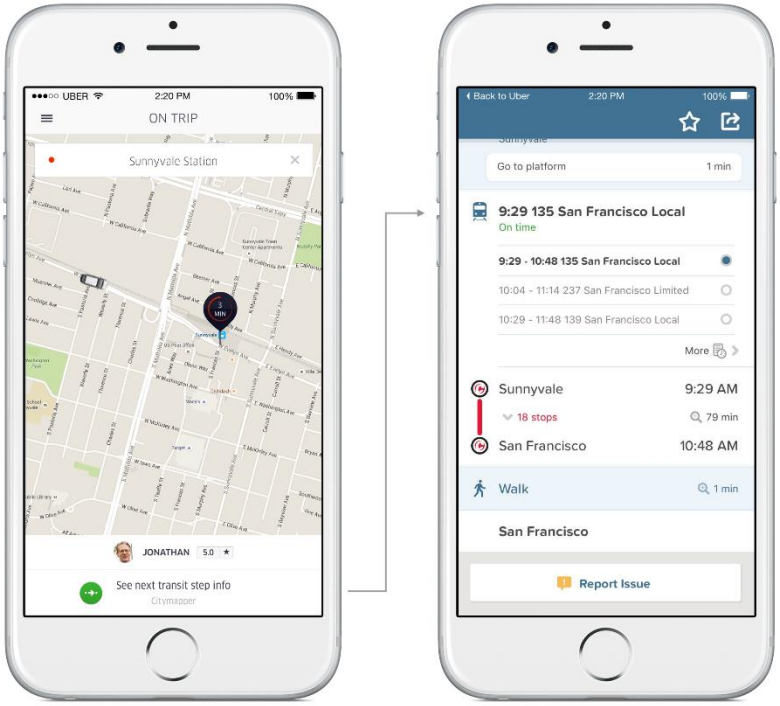

Figure 11: (Quinn, 2016)

occupants will be in the Uber trip, this is so the system is able to find the nearest vehicle with enough available seats for everyone that will be traveling. There are other options too such as finding a luxury car or just food delivery. So, the Uber app must sort through quite a bit of data to find the best suitable driver for the situation.

When talking about the future of transportation apps we should also talk about the overall future of transportation. There have been many instances of artificial intelligent technologies being implemented into road systems and vehicles themselves. Companies are trying to create smart cars which can drive themselves. When people are trying to teach these vehicles essential information about knowledge of driving they also must program certain things into the vehicle such as knowing when the vehicle needs maintenance, when it needs to stop for refueling, voice recognition and adjusting routes based on the quickest trip possible. These vehicles will need voice recognition to know where a person wants to travel to. These cars will eventually be used for taxi rides such as the Uber rides mentioned before.

> Autonomous cars will also be used for ride sharing. Ride sharing in cities is sure to grow more popular as the price decreases because there is no human driver. This represents a new and rapidly growing market based on self-driving cars with artificial intelligence. Any chance that personal cars and light truck vehicles will be replaced by Uber-type ride sharing seems highly unlikely, however. People like their personal vehicles, the performance, the convenience, and the privacy. As Tesla has shown, the autonomous performance vehicle is very appealing to people. (Eustis, 2017)

Figure 12: (Korosec, 2017)

This is a picture from the inside of the hands-free Tesla vehicle. (Korosec, 2017) When speaking of Tesla's autonomous vehicle, they have described the possibilities of what their smart vehicles are capable of. You will be able to tell the vehicle where to drive and it will, but with their AI system the vehicle will know where you are wanting to go most of the time. These vehicles are also marketed with artificial intelligent driving which is substantially safer than a human driver. Other features of these smart cars are self-parking, full self-driving and enhanced auto pilot which can navigate very sharp turns and complex freeway traffic. There are sensors all around these smart vehicles because they are constantly scanning the environment and need to have information from every direction. The new sensors in these vehicles can see through heavy rain and dense fog, where a human might have trouble seeing. These new types of self-driving systems will be able to automatically brake safely when it detects things such as bad road

conditions ahead or something in the road. Insurance companies will also look at these owners and possibly lower the driver's insurance cost.

Using these intelligent vehicles is overall a safer alternative to driving in a standard vehicle, they still do have some issues. On May 7, 2016 there was a driver by the name Joshua Brown that died in a self-driving car in Ohio. Brown set his autopilot on his Tesla Model S and it was driving down the highway. A tractor-trailer came onto an intersecting road and the Tesla cameras failed to detect the object, so it never applied the brake. When trusting machines with this much responsibility, people need to make sure all equipment is working properly. People should also know exactly what the equipment is programmed to do. Losing a life to an incident involving an automatic vehicle is disturbing, but it is also not as likely as incidents involving people driving their own vehicles. Here is a statement from Tesla about the incident.

> According to one of Tesla's public statements, the camera on Brown's car failed to recognize the tractor-trailer crossing the highway against the bright sky. As a result, the car did not brake, nor did it issue any warning to Brown. The car crashed into the trailer, killing Brown. The automobile's self-driving system was not at fault, according to an investigation conducted by the National Highway Traffic Safety Administration. The agency found that Autopilot was designed to prevent Tesla cars from rear-ending other vehicles but was not intended to handle situations when vehicles crossed the road from intersecting roadways. Thus, there were no 'defects in the design or performance' of the system, the NHTSA concluded. (Seidenberg, 2017)

This was a very tragic incident, but also shows how these self-driving vehicles can still fail to detect something a human driver would be able to see and prepare to stop or slow down. This incident brought up the topic of who is to blame, the driver or the car company. When they went to the law books to find out what it said about self-driving vehicles, there wasn't anything there specifically. This meant the driver was responsible because the highly automated vehicle (HAV) could not be blamed. New laws will have to be created for these self-driving cars. Some experts are wanting to put more of the blame on the car manufacturers.

> Other experts worry that a strict liability regime would put an unfair burden on manufacturers of HAVs. There will be far fewer accidents with HAVs, but when they occur the vehicle's manufacturer will be sued. So, carmakers will have more liability than they do now for making a safer product," Marchant says. (Seidenberg, 2017)

We are living in a time in which certain laws will be rewritten because of artificial intelligence. The car accident mentioned above, was not specifically listed in any law book about who would be responsible. Smart-cars will not be the only area that will need laws to protect people from these instances. Another example would be if a road system caused different lanes of traffic to both operate at the same time for some unexplained reason. This would be highly unlikely in an AI traffic control system; however, laws will need to be made in case something like this ever occurred. Some congested cities will most likely adopt some type of artificial intelligence system to manage their traffic. These systems will be beneficial to daily drivers because it will make down time in traffic intersections less frequent, but they will need someone to monitor this system for errors. Errors in these systems might be highly unlikely, but still possible.

In March of 2018 there was another incident that caught the media news involving a self-driving vehicle. This vehicle was used as an Uber. Uber has self-driving vehicles in select cities, but after this incident they halted their tests. This incident was most likely the persons fault for stepping in front of the Uber too quickly, but the Uber still did not have time to detect the person and stop the vehicle. With incidents such as these "peoples' trust in the technology behind autonomous vehicles may also have taken a hit." (Careaga, 2018) This article from Andrew Careaga at the Missouri University of Science and Technology talks about the recent accidents involving self-driving vehicles and trying to convince the public that artificial intelligence can be trusted. In this article Siau says about the recent incidents with Uber and self-driving cars, "Incidents point to the need to rethink the way AI applications such as autonomous driving systems are developed, and for designers and manufacturers of these systems to take certain steps to build greater trust in their products." (Careaga, 2018)

As previously mentioned, artificial intelligence is used in traffic control. When driving on the road there are systems in place to operate traffic lights to keep congestion to a minimum. Efforts in artificial intelligence research with driving patterns help these traffic systems learn. These systems are trying to have a deep learning on how to minimize downtime when a vehicle comes to a stop light in an intersection. Using artificial intelligence to make these control devices understand what they need to do instead of relaying the information to a control center which applies generic algorithms will be an improvement because the systems will then take in more information and understand what it needs to do in that situation.

> Control devices include traffic signals at intersections, traffic signals at on-ramps, variable message signs (VMS) that can present different messages to drivers (e.g., warning about an existing congestion or alternative path recommendation), radio advisory systems to broadcast messages to drivers, and reversible lanes (i.e., freeway lanes whose direction can be selected according to the current and expected traffic demand). In the control center, operators interpret sensor data and detect the presence of problems and their possible causes. Problems are congested areas at certain location caused by lack of capacity due to accidents, excess of demand (like rush hours), etc. In addition, operators determine control actions to solve or reduce the severity of existing problems. For instance, they can increase the duration of a phase (e.g., green time) at a signal, or they may decide to show certain messages on some VMSs to divert traffic. (Molina, Robledo, & Fernandez, 2000)

When cities are operated by artificial intelligence that has used deep learning about its own traffic patterns then traffic situations will be greatly improved from current algorithm operated traffic systems. For the most part everybody approves these advancements because the safer cars combined with smarter traffic controls will speed up travel and make things safer. However, when talking about AI some people get really worried about losing their jobs.

Artificial intelligence is being used for emergency management as well. There are companies that are using AI to save lives during natural disasters. The way these systems help during disasters is through drone technology and other sensors on robots. These sensors can detect damaged buildings and give accurate information about them or the landscapes it is monitoring.

Artificial Intelligence for Disaster Response (AIDR) is a free online tool developed by the Qatar Computing Research Institute. AIDR uses machine learning to monitor texts and tweets about crises to increase the efficiency of agencies and volunteers during a disaster.

> Artificial Management for Disaster Response has proven effective in many natural disasters around the world. Technology allows people to quickly and efficiently respond to such cases and save many lives in the process. However, these systems are not only reactive but also proactive. By predicting earthquakes and quickly warning potential victims about impending disasters, these intelligence systems have proven to be quite useful. (The benefits & challenges of using artificial intelligence for emergency management, n.d.)

These systems have been used in many disasters, but two notable ones are the 2015 earthquake in Nepal and the 2015 earthquake in Chili. In the Nepal incident AIDR was able to use AI to scan images that were sent over text or Twitter and categorize needs based on how urgent help was needed for each situation. It organized the order in which the workers and volunteers needed to respond to by categorizing the damages it detected and knowing the resources they currently had available. In the Nepal earthquake these systems were able to alert people of the incoming dangers which allowed the emergency responders to safely evacuate thousands of people who were in danger zones.

One item people probably don't think about when talking about AI would be thermostats. There is a thermostat called Nest that learns from a user and customizes their home temperature based on how you initially set it. During the first week of use the thermostat learns and adapts to the

temperate the person sets throughout the day. This thermostat automatically adjusts throughout the day and throughout the different seasons. This style of thermostat can keep the house cool through the night, warm in the early hours of the morning and then go into an energy saver mode when you leave the house. It uses sensors in your phone to know when you leave the house, so it can save energy if you have programmed it to do so.

Figure 13: (Nest support, n.d.)

> During the learning period, it's up to you to teach your Nest thermostat good habits to help save energy. Turn it down before you go to bed, before you leave for work, or any time you would turn down a regular thermostat to save energy. Your thermostat will learn what temperatures you like and when you want them and create temperature schedule to help save energy and keep you comfortable. (Nest support, n.d.)

The Nest thermostat never stops learning and adapting, but after a couple of weeks it knows your basic schedule. The first day someone has the Nest installed it learns the temperature they like and by the second day it has a rough idea of when to raise or lower the temperature. After a few days it will know their basic schedule, but if they have any issues they can adjust the settings from the phone application to help it get a better understanding of how it should adjust the temperature. Using the application to fine tune the system in the beginning might make it understand in more detail about what settings are desired.

Systems such as the nest thermostat will save electricity by knowing when to automatically change temperatures and go into energy saver mode. Systems such as these will eventually make their way into offices too to keep everything automated. Other systems could be added to the workplace such as full office automation including greeting customers through AI systems and arranging data for the workers if needed.

Automated thermostats will not be the only household AI. Household electronics for instance television recording devices, DVR or similar system, could eventually be able to record shows that the user might be interested in watching based off previous activity. Other systems could be put into place that act like the Nest. The Nest goes into energy saver mode when it detects the user has left their house. If more appliances did this, then that person would save additional on their other household utility bills. These systems could work off shared data and understand the person better.

Call centers are also able to take advantage of AI systems. There is a system called Cogito which helps agents in call centers in real time. These systems can analyze voice signals during a conversation and tell the person taking the call information about the caller. This helps the person at the call center build a better and faster rapport with the caller. This increases call efficiency and improves ratings provided by customers. This system was started in 1999 by MIT researchers at the Human Dynamics Lab. Cogito was founded in 2007 to bring their findings from 1999 to 2007 to the public. From 2007 to 2011 they received funding from investors to help develop the artificial intelligence platform for interpreting human communications and

psychological states automatically. In 2012 this software was deployed within some healthcare programs. This allowed the system to have thousands of interactions and create millions of data points that the platform can use to improve. In 2015 Cogito's AI solutions became the leader in augmented intelligence solutions for enterprise call centers. Cogito can do this by determining the customer perception in real time on every phone call. The next quote is from the Cogito website about their customer service.

> Great service is better business. Cogito's emotional intelligence software improves every customer interaction with real-time agent guidance. Streaming behavioral recommendations empower agents to build better customer relationships on every call. Live dashboards provide management with the ability to intervene and assist on challenging calls and gain insight into agent performance and trends across the entire customer base. (Cogito's leading solutions, n.d.)

Cogito is an example of how well artificial intelligence can complement current employees. This system is not completely replacing people, so they do not need to worry about losing their jobs. Some other systems might become automated, but there will also need to be people at call centers to reassure people when they are having issues. This will benefit the company by keeping high customer review ratings and it will also keep people happy if they are able to solve the issues they are reporting to the call center.

Some hotels have already created welcoming concierge robots to greet guests. These robots can do everything a normal worker would be able to do. Since this is more of a customer service job, it shows that AI can be used in many fields. As stated in one IBM press release "Connie, named for Hilton's founder Conrad Hilton, marks the first time IBM has developed a Watson-enabled robot for the hospitality market. Connie will work side-by-side with Hilton's Team Members to assist with visitor requests, personalize the guest experience and empower travelers with more information to help them plan their trip." (Meet Connie: Pilot of the first cognitive-powered robot, 2016)

Figure 14: (Clapaud, 2016)

Connie's physical support is Nao, a French-made 58cm-tall android that has become the go-to platform for educational and customer care tasks, thanks to its relative affordability (about $9,000) But the concierge's brain is based on IBM's flagship AI program Watson – the jeopardy winning system engineered to understand peoples questions and answer them in the best way possible. (Volpicelli, 2016)

Since “Connie” is so inexpensive it will not be surprising if these robots are more common in the future. Robots such as these would work great in hotels, welcome centers, stores, vehicle repair shops any so many other places. Robots such as this one learns from their conversations and try to keep the customers informed on the situations they are enquiring about. Having something like this in an electronics store might also bring attention to the store while relieving the workers because they will not have to answer as many questions. This will allow the workers to work on faulty electronics if a customer needed help with a defective product.

Artificial intelligence is spreading to most fields and if a computer system can do a job faster and more efficiently than a human, employers will start using the machine instead of people. These theories may come true, but they will also create new jobs when eliminating others. It is a scary situation to think about when workers might lose employment over intelligent machines. Nobody knows for sure, but there have been studies about this topic.

> To be successful, AI innovations will need to overcome understandable human fears of being marginalized. AI will likely replace tasks rather than jobs in the near term, and will also create new kinds of jobs. But the new jobs that will emerge are harder to imagine in advance than the existing jobs that will likely be lost. Changes in employment usually happen gradually, often without a sharp transition, a trend likely to continue as AI slowly moves into the workplace. A spectrum of effects will emerge, ranging from small amounts of replacement or augmentation to complete replacement. For example, although most of a lawyer’s job is not yet automated, AI applied to legal information extraction and topic modeling has automated parts of first-year lawyers’ jobs. In the not too distant

> future, a diverse array of job-holders, from radiologists to truck drivers to gardeners, may be affected. (Artificial intelligence and life in 2030, 2016)

Some factory workers have already been replaced with machines that are able to do their repetitive job more efficiently. Repetitive jobs such as factory work are easier for a machine to complete. Jobs like these in factories might replace people with machines soon, but that will also create new jobs. There might not be as many jobs, but there will need to be new jobs such as maintaining the machines if there is a problem they are unable to fix. Even though factory professions might be easier for an intelligent machine to learn, artificial intelligence could improve almost any job. People who work in customer service can greatly benefit from AI as well. These systems will be able to greet people and understand any concerns they might have. These robots will also be able to work nonstop unlike human workers. Also, robots can work in many different conditions which people are unable to do such as being in hazardous areas.

When talking about robots in hazardous areas people should think about three-dimensional headsets to pair with these robots. Augmented reality is when someone can change how you view reality with cameras and computing. AR is either direct or indirect viewing of the world but has augmented parts of the image with computer perceptual information. Augmented can be something as simple as Pokémon Go or other phone games which use the camera from a phone to make it feel like you are playing the game in the real world instead of it just being a phone game. Augmented reality can also come from viewing reality from a three-dimensional technology from a different location. This could be something like a camera on a drone.

> People can mount displays on their heads or stand in a digital lab where images are projected onto the wall. Using handheld devices or sensors, they can move through buildings simulate battle conditions, role play disaster responses, or immerse themselves in virtual reality. Some of the most advanced applications have come from the military. Its planners use augmented reality to train recruits for street patrols and battle conditions. Supervisors can alter virtual conditions and see how the soldiers respond. This allows them to "experience" a wide range of circumstances from the safety of the lab. That helps them navigate actual battlefields once they are sent abroad. (West, 2015)

Augmented reality is a very interested type of technology but might not be as widespread in the workplace as intelligent machine that are able to manufacturer products. These machines will be mass produced for certain companies and replace hundreds of workers. These companies, such as engine manufactures or other jobs that involve routine skills, will eventually have a full automated process that will eliminate most of its workers. There will still need to be people to monitor the machines and assist when there is an issue, but most of the repetitive work will be able to be completed with robots.

Banks use artificial intelligence in many ways. They use AI systems to approve people for loans, maintain online security or monitor some credit cards transactions if it suspects identity theft. In a BAI Banking Strategies article, they talk about how AI is entering the banking industry and how it is remaking risk management. Rich Baich, the bank's chief information security officer at Wells Fargo talks about the AI services.

> "AI is quickly moving from research and development labs and [proof of concept] to important production services focused on improving customer experiences and underpinning the fundamental safety and trust of the financial services ecosystem," Baich adds. "as banking has changed, so has the security protocols used to keep our customers money safe." (Dahlgren, 2018)

People get nervous when you talk about artificial intelligence in the workplace because it is uncharted territory. It has the potential to revolutionize every type of work, but in studies it has shown these changes will mainly be in low income countries first.

> A lot of attention has been given to the upheaval of employment markets that AI will cause in high-income countries. However, the World Bank Development Report (2016) estimates that the share of occupations that could experience significant automation is actually higher in lower income countries than in higher ones, where many of the jobs susceptible to automation have already disappeared, and this concerns about two thirds of all jobs. The impart on low and middle-income countries could indeed be profound but is likely to vary significantly in different countries depending on their demographics and the makeup of their economies. (Artificial intelligence the road ahead in low and middle-income countries, 2017)

All the examples previously mentioned will create a safer and more efficient society. It is important to understand these technologies will not completely replace people in the workforce, but some people might have risks when computers are able to do their job better than them.

Some types of jobs will eventually be replaced with artificial intelligence. In an article by Clay Chandler form the Hult International Business School he explains:

> Computers can generate error-free corporate earnings reports and cover certain types of sporting events. Watson is far more accurate than human doctors at diagnosing lung cancer. A significant share of tasks performed by what are currently high-paying occupations such as financial planners, physicians, and equities traders can be automated with existing technologies. (Chandler, n.d.)

AI will also not become fully self away and try to take over the world or eliminate people all together. Some people are afraid of this doomsday scenario happening, but they need to understand the limits of artificial intelligence. People should also prepare for the changes that will be coming along with artificial intelligence. In a conference published on the white house archine it talks about how changes will be coming.

> The Seattle event drew a standing-room-only crowd, and we heard form industry leaders, academic experts, and policymakers there on the challenges involved in building sophisticated AI, applying models of liability to AI, how the government uses technology and regulates it, and concerns related to data, fairness, and ethics. At the recent DC workshop, which was livestreamed to over 3,500 viewers in the United States and around the world, researchers and practitioners talked about AI applied to problem solving in health, environmental sustainability, urban computing, criminal justice, and social welfare. We heard about the use of AI to help protect endangered wildlife, fish, and forests by analyzing illegal poaching and to improve medical care at Walter Reed National Military Medical Center, where it is used to build surgical care decision support

> tools drawing on clinical data and cutting-edge science. Researchers also presented on using AI to optimize network-based public transport systems, helping service more users faster and cheaper, and on the opportunities and challenges for AI in criminal justice to decrease incarceration and recidivism rates without replication or reinforcing inequality and other flaws in the current system. (Felten, 2016)

All these examples show how our government is aware of artificial intelligence and is preparing for a more automated society. Factories all over the world have started using some type of AI in their manufacturing process. Some full assembly lines are operated by automated machines while some will do most of the demanding work, but still requires an operator to monitor the process. That worker might also be required to move things from one machine to another once they have finished assembling their product. It will be very common for artificial intelligence to be in the factory business because AI will excel at repetitive tasks and knowing how to do the job the most efficient way possible.

Artificial intelligence in the workplace creates a more efficient environment. Most of these new automated environments work together with humans instead of completely replacing people. However, losing a job to a fully automated robot is possible when the machines become more resourceful than people. Creating intelligent machines will benefit our lives by making people perform their jobs more efficiently. These intelligent machines will be able to detect minor differences in datasets and adjust based on the information. AI in the medical field is the best example of this because of how the machines can scan millions of data points and compare health issues with other factors doctors might not even know about. These systems will be able

to scan images through social media, such as Facebook, and determine if a person is at risk of certain diseases just from those images and health history.

Using artificial intelligence to learn your preferences is used in many popular applications. Netflix, Spotify and Amazon all use information about your usage habits to create a profile unique to the user. Netflix will monitor the show content that the user watches and the user behavior when calculating recommended movies. Netflix reports more than 80% of all movies watched are listed in the recommended category. Spotify has the Niland team helping develop a system to recommend music to their customers. Amazon creates a profile for every unique user based on their online patterns. They try to have a recommended section where the user will see items they have been searching online for and want to purchase. If their business decided to start using advertisements with this same intelligent profiling method, it would generate more revenue because people will most likely be interested in those types of advertisements. If customers are interested in the products being shown to them they might give positive reviews about the service. This could include things such as introducing new artists to a listener of a certain genre to see if they are interested in buying a new album. This would give advertisers an incentive to run their ads with these artificial intelligent systems.

Automatic vehicles are useful as personal vehicles and as a taxi service. Vehicles such as the Tesla automatic vehicle are appealing to the public because they offer fully automatic driving. These vehicles still have some issues, so the public might not be behind the idea of a fully automatic vehicle yet. These issues have given the company something to strive to achieve and when they are able to demonstrate a fully automatic, safe and reliable vehicle then the public will

be more open to these ideas. Companies such as Uber use these vehicles in select cities to drive people around like a taxi service. Uber also uses their phone application to determine the closest Uber driver that will accommodate everything a customer needs such as a van if they have more people riding and need extra seats. This phone application is why the Uber business model works so well. They are appealing to a new crowd of people by using a very sophisticated and easy to use phone application which allows customers to find ways to travel without ever exchanging cash in person. Customers can use the application and pay with their credit cards through it. Customers are also allowed to rate the Uber driver. Uber is offered in many areas while Uber's automatic vehicles are only offered in select cities.

Artificial intelligence in medicine or AIM is tremendously useful and one of the best applications of artificial intelligence in our current society. Certain programs in this field can detect visual and audio biomarkers and determine what health conditions a person is likely to have. If this system combined with a social media website such as Facebook it would create a database full of information about the health of the users. Using Facebook would help this system learn as well because it would have more data points to analyze in its database. Facebook already has a very advanced photo tagging artificial intelligence system. This system is known as DeepFace and detects the persons face in any uploaded picture with a 97% success rate. Another use of AI in the medical field is allowing these data points to be collected about a person's health, their family history and other biomarkers. When the data is collected into a database programs can scan every data point and find which diseases are related to another and how the family history of illnesses can be connected to each other. This medical neural network is named Deep Patient

and it connects the data points to relay health risks to patients and if they do have a certain condition it shows them what they need to do to get treated.

Voice recognition software is helping call centers maintain better relations with customers that are having issues and must call them. Cogito is software that gathers information about a customer just from their voice in real time. Cogito analyzes caller information and relays it to the representative working at the call center. This allows the worker to know when a customer is getting upset, so the worker can find another way to ask certain questions or resolve an issue. Siri and Cortana are also using an advanced type of voice recognition. These systems learn from the user and use neural networks to try and replicate human interactions. Another system like these is Connie, the robot hotel concierge powered by IBM's AI software Watson. Connie will welcome guests, tell them how to navigate around the hotel and find tourist attractions in the area. Connie also improves itself when people have frequent interactions to fine-tune its recommendations. Connie is a relatively cheap investment. This allows Connie to answer routine questions such as finding local attractions.

Another instance of AI in our society would be traffic control centers. These centers learn by common traffic patterns throughout the day and they improve to try and keep the traffic going with as few stops as possible. Another common type of artificial intelligence is found in factory jobs. Robots are replacing workers in factory jobs because they are easily able to replicate what a person can achieve. The robot is more efficient at its work because it works almost continuously with little downtime. An instance of using an AI system at home would be the Nest thermostat.

This thermostat learns from a person's everyday use, so it learns when to change the temperate in the house and when to go into energy saver mode.

Artificial intelligence is used in spam email filters as well. These systems work in Googles email service, Gmail. This is essential because if it just filtered out words then companies would easily be able to reword their unwanted emails, so it would bypass that type of filter. This technology can also be used to detect patterns about yourself. Systems such as these are used by banks to approve loans, detect identity theft and to maintain online security. If the system determines a charge is not usual for a specific person, it might hold the transaction or flag the charge for review. These systems also monitor login locations for online banking and if there is unusual activity on the account it will notify the account holder. These systems are helping to improve the online security of banking.

Artificial intelligence and automated machines are rapidly getting more popular in modern society. They offer personalized options for popular services as well as making the world more efficient. AI will continue to be implemented into new areas of life as it is improved over the years. With more data for these AI programs to analyze they will become more adaptive in their specific area of expertise. People should understand the possibilities with AI and try to use it in society in new ways. Some individuals will lose jobs, but an automated society will be more efficient. People do not know what types of changes will happen with this innovative technology, but completely new careers will develop with these changes.

References

A brief history of artificial intelligence. (n.d.). Retrieved April 14, 2017, from http://watson.latech.edu/book/intelligence/intelligenceOverview4.html

Angelo, K. (2016, November 29). Big data, artificial intelligence drive innovations in health care. Retrieved April 18, 2018, from https://www.uml.edu/News/stories/2016/Digital-Health.aspx

Artificial intelligence and life in 2030. (2016, September). Retrieved March 4, 2018, from https://ai100.stanford.edu/sites/default/files/ai_100_report_0901fnlc_single.pdf

Artificial intelligence in health care – audio/visual biomarkers aid in diagnosis. (2017, September 05). Retrieved February 27, 2018, from http://sma.org/artificial-intelligence-health-care-audiovisual-biomarkers-aid-diagnosis/#1484749746448-a114da8a-3796

Artificial intelligence in medicine (AIM). (n.d.). Retrieved February 22, 2018, from https://www.cedars-sinai.edu/Patients/Programs-and-Services/Medicine-Department/Artificial-Intelligence-in-Medicine-AIM/

Artificial intelligence the road ahead in low and middle-income countries. (2017, June). Retrieved March 2, 2018, from https://webfoundation.org/docs/2017/07/AI_Report_WF.pdf

Bilal, A. (2018, January 31). Artificial neural networks and deep learning. Retrieved March 2, 2018, from https://becominghuman.ai/artificial-neural-networks-and-deep-learning-a3c9136f2137

Careaga, A. (2018, April 10). After Uber, Tesla incidents, can artificial intelligence be trusted? Retrieved April 12, 2018, from https://phys.org/news/2018-04-uber-tesla-incidents-artificial-intelligence.html

Chandler, C. (n.d.). Will robots steal my job? Retrieved April 11, 2018, from http://bento.hult.edu/will-robots-steal-my-job/

Clapaud, A. (2016, March 13). Video of the week: Nao, hired as concierge of the Hilton McLean hotel. Retrieved March 8, 2018, from http://www.4erevolution.com/en/robot-nao-concierge-hilton/

Cogito's leading solutions. (n.d.). Retrieved April 2, 2018, from http://www.cogitocorp.com/solutions/

Coyle, M. (2017, March 7). Netflix develops AI to help optimize video for mobile devices. Retrieved February 22, 2018, from http://www.etcentric.org/netflix-develops-ai-to-help-optimize-video-for-mobile-devices/

Dahlgren, K. (2018, January 5). Blanket security: How AI is remaking risk management. Retrieved March 26, 2018, from https://www.bai.org/banking-strategies/article-detail/blanket-security-how-ai-is-remaking-risk-management

Elmahdy, H. N. (n.d.). Medical diagnosis enhancements through artificial intelligence. Retrieved February 22, 2018, from http://scholar.cu.edu.eg/ehesham/files/medical.pdf

Eustis, S. (2017, August 9). Artificial intelligence in cars: What to expect from 2017 to 2021. Retrieved February 16, 2018, from https://blog.marketresearch.com/artificial-intelligence-in-cars-what-to-expect-from-2017-to-2021

Feldman, M. (2018, March 20). 10 Real-world examples of machine learning and AI [2018]. Retrieved April 2, 2018, from https://www.redpixie.com/blog/examples-of-machine-learning

Felten, E. (2016, June 27). How to prepare for the future of artificial intelligence. Retrieved March 11, 2018, from https://obamawhitehouse.archives.gov/blog/2016/06/27/how-prepare-future-artificial-intelligence

Gupton, N. (2016, August 10). Understanding artificial intelligence. Retrieved April 14, 2017, from https://www.fi.edu/understanding-artificial-intelligence

Hodges, A. (2002, June 03). Alan Turing. Retrieved February 11, 2018, from https://plato.stanford.edu/entries/turing/

Hofmann, M., Neukart, F., & Back, T. (n.d.). Artificial intelligence and data science in the automotive industry. Retrieved May 7, 2017, from https://arxiv.org/ftp/arxiv/papers/1709/1709.01989.pdf

Human dx: Visualizing progress. (2016, August 03). Retrieved February 24, 2018, from https://continuations.com/post/148402057520/human-dx-visualizing-progress

Korosec, K. (2017, March 14). Tesla's autopilot has caused one insurer to slash rates. Retrieved February 21, 2018, from http://fortune.com/2017/03/14/tesla-autopilot-insurance/

Krisberg, K. (2017, November 14). Artificial intelligence transforms the future of medicine. Retrieved February 23, 2018, from https://news.aamc.org/research/article/artificial-intelligence-transforms-future-medicine/

Light sensing robot. (2011, October 25). Retrieved February 5, 2018, from http://icrobotics.co.uk/wiki/index.php/Light_Sensing_Robot

Meet Connie: Pilot of the first cognitive-powered robot. (2016, March 9). Retrieved March 3, 2018, from https://www-03.ibm.com/press/us/en/pressrelease/49307.wss

Miotto, R., Li, L., Kidd, B. A., & Dudley, J. T. (2016, May 17). Deep patient: An unsupervised representation to predict the future of patients from the electronic health records.

Retrieved February 23, 2018, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4869115/

Molina, M., Robledo, M., & Fernandez, A. (2000, September). A propose-and revise system for real-time traffic management. Retrieved February 21, 2018, from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.5.7812&rep=rep1&type=pdf

Neill, D. B. (2013, March/April). Using artificial intelligence to improve hospital inpatient care. *IEEE Intelligent Systems*. Retrieved March 2, 2018, from https://www.cs.cmu.edu/~neill/papers/ieee-is2013.pdf

Nest support. (n.d.). Retrieved April 2, 2018, from https://nest.com/support/article/An-introduction-to-learning

Niland team joins Spotify. (2017, May 17). Retrieved March 9, 2018, from https://press.spotify.com/us/2017/05/17/niland-team-joins-spotify/

Nosseir, A., Nagati, K., & Taj-Eddin, I. (2013). Intelligent word-based spam filter detection using multi-neural networks. *International Journal of Computer Science*, *10*(2), 1st ser., 17-20. Retrieved February 23, 2018, from https://pdfs.semanticscholar.org/014d/921a7f85ca22edbbc59d056cb4af17502917.pdf

Quinn, D. (2016, March 30). Introducing trip branding and personalization. Retrieved February 27, 2018, from https://www.uber.com/newsroom/trip-branding/

Russell, J. (2017, May 18). Spotify buys AI startup Niland to develop its music personalization and recommendations. Retrieved March 7, 2018, from https://techcrunch.com/2017/05/18/spotify-buys-ai-startup-niland/

Sahu, M. (2016). Plagiarism detection using artificial intelligence technique in multiple files. *International Journal of Scientific & Technology Research, 5*(4), 111-113.

Retrieved February 22, 2018, from http://www.ijstr.org/final-print/apr2016/Plagiarism-Detection-Using-Artificial-Intelligence-Technique-In-Multiple-Files.pdf

Sakr, S. (2016, October 3). On the cutting edge: Artificial intelligence in medicine. Retrieved February 27, 2018, from https://www.mcgill.ca/library/files/library/sakr_surya_2016.pdf

Seidenberg, S. (2017). Who's to blame when self-driving cars crash? *ABA Journal*. Retrieved March 8, 2018, from http://www.abajournal.com/magazine/article/selfdriving_liability_highly_automated_vehicle

Szolovits, P. (1999). Artificial intelligence and medicine. Retrieved April 18, 2018, from https://groups.csail.mit.edu/medg/ftp/psz/AIM82/ch1.html

The benefits & challenges of using artificial intelligence for emergency management. (n.d.). Retrieved April 18, 2018, from https://safetymanagement.eku.edu/resources/infographics/the-benefits-challenges-of-using-artificial-intelligence-for-emergency-management/

The human diagnosis project. (n.d.). Retrieved February 24, 2018, from http://www.humandx.org/

Volpicelli, G. (2016, March 09). IBM Watson now powers a Hilton hotel robot concierge. Retrieved March 8, 2018, from https://arstechnica.com/gadgets/2016/03/ibm-watson-hilton-robot-connie/

West, D. M. (2015, October). What happens if robots take the jobs? The impact of emerging technologies on employment and public policy. Retrieved March 4, 2018, from https://www.brookings.edu/wp-content/uploads/2016/06/robotwork.pdf