Applications of AI in the Digital Age

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Abstract

This research paper is a collection of research and articles on the various applications of artificial intelligence in many different subject areas such as games, medical, industrial, ethics, social media, and more. This research focuses primarily on how artificial intelligence is being implemented into many different applications and subject areas, with some focus on history and how artificial intelligence works. This explanation of how artificial intelligence works will be brief, for there is exhaustive amounts of information on the topic, and this research paper will focus more on the uses and applications rather than how it works.

Keywords: artificial intelligence, AI, neural networks, machine learning, deep learning, analysis, algorithm, formula, automation, supervised learning, unsupervised learning, semi-supervised learning, Turing test.

Applications of AI in the Digital Age

Artificial intelligence is growing throughout time and is slowly being implemented into many different areas of expertise and applications of regular consumer products and interactions. As computers and technology grows, so does the knowledge associated with it. With artificial intelligence, you can improve or add features to already existing processes and technologies. Artificial intelligence is adaptable and can learn from itself with concepts like deep learning and machine learning, which will be discussed briefly. With artificial intelligence and technology, there also brings the questions of ethics and privacy. Will AI and technology eventually lead to a point where privacy is super important, or will we still have the underlying thoughts of not caring about our privacy in general?

What is AI and How Does It Work?

AI stands for Artificial Intelligence. Throughout this paper, the abbreviation of AI will be used. AI is "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings" (Copeland 2018). There are many ways to achieve this with computers through methods that utilize both hardware and software, whether it is through programming and code, or more advanced subsystems like machine learning or neural networks. Most AI programs and functions are made with math and calculations through the form of algorithms. An algorithm, used in math and computers, is a "systematic procedure that produces—in a finite number of steps—the answer to a question or the solution of a problem" (Britannica 2018). Machine learning is a process that allows for computers and computer programs to learn autonomously and solve problems.

With this, there are many different types of approaches to solving said problems. One of these methods, as described earlier, is neural networks. Neural networks are computer algorithms

that are based on the human brain's neural pathways and ways of thinking. The function of neural networks is to perform more cognitive functions as well as come up with more efficient solutions to problem solving, specifically with machine learning.

To work with machine learning and algorithms like neural networks, you have to set up a learning environment. There are also many ways to do this. The three main learning environments are: supervised learning, unsupervised learning, and semi-supervised learning. Supervised learning works by having a person give the algorithm inputs and data to work with. The algorithm can then create relationships and dependencies in data and use past data for reference. Unsupervised learning is when there is no "teacher" or extra input given to the algorithm. The algorithm simply learns on its own, which can lead to more interesting solutions to solving problems. This is especially useful for when a human expert doesn't know what to look for in data. Finally, there is semi-supervised learning. This type of learning can vary in name, but essentially, this is where select data and input is given to the algorithm to try and solve for unknown data and outcomes, pushing the algorithm in a certain direction (Fumo 2017). In conjunction with these learning environments, there are also specific types of algorithms commonly used for problem solving in machine learning, each serving different purposes. Some of them are: linear regression, logistic regression, decision trees, SVM, and more (Sunil 2017).

These applications and functions of AI lead to experimentation and adaptation of what AI can try to solve. While there are many applications and uses of artificial intelligence, the biggest function of it still being used today is with data mining and data analysis:

data mining, also called knowledge discovery in databases, in computer science, the process of discovering interesting and useful patterns and relationships in large volumes of data. The field combines tools from statistics and artificial intelligence (such as neural

networks and machine learning) with database management to analyze large digital collections, known as data sets (Clifton 2018).

With computer storage always increasing since the 1970s and 80s, data has grown as well. Having a machine know what to look for and potentially find previously unseen patterns in data is very useful in many different applications. A lot of uses of AI also utilize data mining and analysis to further improve upon their desired functions. This leads to many situations where an AI algorithm becomes an expert system. An expert system is when an algorithm or computer program functions to either aid or replace a human expert in specific field of expertise. These types of systems can appear anywhere, but are especially useful in manufacturing and industrial applications.

A Brief History of Artificial Intelligence and Machine Learning.

Artificial intelligence has a brief, but interesting history. The advancements in AI have been dramatic for the time that it has been implemented and experimented with. A lot of the very first applications of artificial intelligence were in games. Many would assume computer games, but this is not entirely the case. The first game to have a non-human World Champion was checkers (8×8 draughts). In 1994, the program CHINOOK won the World Man–Machine Championship (Schaeffer, Van Den Herik 2002). Many of the early AI programs worked with this simple, yet strategic games like checkers and chess. These algorithms studied and tested against top players to become a top-level player itself.

Along this same time period, was the experimentation of artificial intelligence and the newly popular classic arcade video games such as Space Invaders and Pong.

Applications of AI

As stated earlier, the advancements of artificial intelligence have been dramatic for the short amount of time and through the same processes throughout the years. While most AI algorithms are simple problem-solving programs, they have been used and manipulated in very unique ways, and are slowly being implemented into many different aspects of everyday life and work. Though some of these algorithms and uses of AI may be a proof of concept, it still shows how capable some of these implementations of technology are, and how with the right amount of dedication and support, could leader to even bigger advancements and collaboration of projects in the future. There is an overwhelming amount of applications and uses for artificial intelligence and the research for it has been going on for a long time and continues to grow. In this section, will be discussion of just some of the applications of AI, broken down into different subject areas and how artificial intelligence may be improving upon those areas.

Medical

There is a surprising amount of very interesting concepts of artificial intelligence in the medical field that could very-well improve the field in many ways. One of the most important areas in the medical field is the Intensive Care Unit, where high accuracy and focus may be required in any given situation. With this, there can be practice variation in how different nurses or doctors do their jobs. Artificial intelligence is being tested to help aid in reducing practice variation in the ICU.

Practice variation refers to how identical patients with exactly the same comorbidities and clinical presentation are managed differently by clinicians. It is increasingly recognized as

a major contributor to inefficiencies in healthcare delivery as well as medical errors. The

ICU is a place where significant practice variation exists (Celi et al. 2008).

With this, there is a constant need to monitor things such as fluid levels. By utilizing artificial

intelligence into these monitoring systems, case studies in medical situations have found positive

results that can potentially help with not only accurate fluid level requirements in the ICU, but also

help reduce practice variation as described earlier. With medical monitoring such as fluids, AI

could present itself as a very useful solution to high-priority and high-accuracy tasks. The AI still

needs to be improved, since it is 77.8% accurate. This factors in patient information as well as

fluid levels though and is still impressive for its functionality so far. The goals of these studies are

to have more confidence in the ICU and have more accuracy through traditional forms of medicine

that are evidence-based, expert opinions, as well as information that can come from empirical data:

In practice, clinicians fear over-estimating this fluid requirement. This may contribute to

the occurrence of hypotensive episodes especially during the period of maximal systemic

inflammatory response. These hypotensive episodes may be averted by being able to

predict more accurately the fluid requirement of the patient as the disease process evolves

in response to treatment or as a result of healing…The variables from day 1 that correlated

with the fluid intake on day 2 are the number of vasopressors, mean blood pressure, mean

heart rate, mean creatinine and day 1 fluid intake. The probability that a patient will require

a certain amount of fluid on day 2 can be predicted based on the values of the five variables

(Celi et al. 2008).

Along with improving fluid intake, there have been case studies and tests by implementing

monitoring of other medical-based levels such as one's glucose levels. One study looks to use AI

for artificial pancreases and allow for monitoring of glucose levels with things like AI controllers.

At their core, AI controllers seek to capture the human thought process by creating rules that mimic the exact reasoning used by humans. One example would be a logic rule that describes the low glucose suspend feature used by more advanced insulin pumps. Such a rule would take the form of: "if current glucose < (70 mg/dl) and current insulin flow > (0 units/hour) then next insulin flow = (0 units/hour) (J. DeJournett, L. DeJournett 2016).

As it is stated in the article, more testing will need to be done, but the results so far are promising. The goal of this application of AI is to improve the overall mortality rates and lower the morbidity rates while helping those with Type 1 Diabetes or those who need an artificial pancreas.

Another interesting application of AI in the medical field is with breeding environments and the growth of cockroaches. A chinese pharmaceutical company is using AI to grow and maintain about 6 billion roaches in a breeding site for "health potions" made out of roaches. By utilizing AI, the environment levels and breeding conditions of cockroaches can be monitored, to ensure more successful breeding and overall healthier cockroaches:

The giant facility is managed with the help of a "smart manufacturing" system powered by AI algorithms. The system is responsible for collecting and analyzing over 80 categories of data to ensure an optimal environment for the cockroaches to grow. These include factors such as humidity, temperature, food supply and consumption, as well as changes like genetic mutations. The system also "learns" from its historical data so it can make improvements to grow the population (Chong 2018).

This application of AI not only is monitoring real-time levels and making predictions, but it is also using previous data to further improve its predictions. This is a great example of how data analysis can be used in conjunction with other algorithms to achieve more successful results.

Artificial intelligence is slowly touching the medical field in interesting ways. By allowing for more efficient monitoring of fluids and levels of patients, AI can help reduce stress in high-accuracy and focus situations such as those found in the ICU. With these proof-of-concept studies, there can be further collaboration and combination of other ideas and advancements in technology such as with the artificial pancreas example and robotics in general. While it is still in its early stages, AI in the medical field could prove very useful.

Smart Homes and People

Another way that artificial intelligence is being used is through aiding people and interactions. Some of the most popular WIFI connected smart-home devices have artificial intelligence in which they are built upon. Each competing for faster responses and more relevant information as well as trying to work with natural human language. These devices are the ones such as Amazon's Alexa and Google's Home devices and Google Assistant. With these devices, there is always a push towards more accessibility and ease-of-use.

But there are many that also believe that there is not enough for those with disabilities, creating a form of a digital divide or limitation to access of digital tools. One of Microsoft's biggest players believes this, and wants improvement for those with disabilities, for he knows from experience since his son has Cerebral Paulsy. Nadella believes that "Artificial intelligence is beginning to have an impact on the lives of people with disabilities, but it's only going to grow" (Sherr 2018). With this, Nadella and Microsoft have pushed the efforts of developing for disabilities by investing $25 million for a 5-year plan to use AI and Tech to solve issues with disabilities and ease of use. This may not seem like a lot for a larger company like Microsoft, but this could help others see what needs to be done or serve as a wake-up call for others.

With the technologies found in Alexa and Google Assistant, many can do a lot with only their voice. Even though these devices still have room for improvement, with proper learning and practice, they can aid those with disabilities such as those who are blind. Being able to do something like purchase items online by using your voice rather than dealing with screen readers and other lengthier processes, the smart home devices can help remove some access barriers that limit one from the things they want. One blog writer discusses how Amazon's Alexa has helped his blind father with communication and interaction digitally. Bogost's blind father has adapted to the new technology that is smart devices. He explains how it has an underlying use that may not always be seen:

> It doesn't really matter whether Alexa provides Dad with useful knowledge or a seamless way to communicate. It does something more fundamental: It allows him to connect with people and ideas in a contemporary way. To live fully means more than sensing with the eyes and ears—it also means engaging with the technologies of the moment, and seeing the world through the triumphs and failures they uniquely offer (Bogost 2018).

The artificial intelligence in the smart home devices allow for more human interaction and dialogue, rather than having to rely on tools such as a monitor and peripherals like a mouse and keyboard. With improvements, voice assistants could provide even more useful interactions and functions for anyone. Another form of this is with the process towards using smart device and voice assistant technologies to create "Smart Homes" to help reduce hard and repetitive work and allow for anyone, especially those with disabilities, to live more independently. The way smart homes can work is through "Synchronous languages [which] are optimized for programming reactive systems, i.e. systems that react to external events:"

[Smart Device/Home] Software follows a loop-based execution, in which a database containing an updated system state and event values is read and processed by eventual artificial intelligence (AI) modules to transform raw data into high level information. This information can then be used by third party applications (Guillet et al. 2013).

With optimizations and new ways to implement these types of software, home assistants like Google Assistant and Alexa can further improve in usefulness and speed.

But Amazon is not the only one with AI assistants. Google has notably had the most advancements and interesting uses for artificial intelligence applications and testing. Google has been working with AI and has focused on using it to make technology more naturally interactive with their voice assistants and apps. Google first started implementing AI into their search engines to improve search results, but they also slowly started adding it into their communication apps such as Hangouts and Allo. Alongside this, Google has more experimental AI testing, combining a lot of their previous efforts and iterations of past projects, to make bigger things. One of these bigger accomplishments is through the improvement of voice recognition:

[Google] researchers have developed a deep learning system that can pick out specific voices by looking at people's faces when they're speaking. The team trained its neural network model to recognize individual people speaking by themselves, and then created virtual "parties" (complete with background noise) to teach the AI how to isolate multiple voices into distinct audio tracks...It's potentially ideal for video chat services like Hangouts or Duo, where it could help you understand someone talking in a crowded room...There are potential privacy issues (this could be used for public eavesdropping) (Fingas 2018).

As Fingas states, this could prove very useful in improving ease of access and allow for better voice recognition in different scenarios, such as being in the shower or at a party. This also should

improve the overall voice recognition as well, making it more reliable. Though this can also bring in the question of whether it is ethical or not in certain scenarios like Fingas suggests. Ethics will be discussed in greater detail later, but initial thoughts on how this could potentially be fixed would be to involve some sort of consent.

Along the lines of human recognition, there are AI programs designed to identify people, through either images or video, determining body language, movement, and general characteristics of a person. Some AI algorithms are really accurate at finding the subtlest micro-movements. One such AI program exists in India, which is still in development. The AI algorithms analyze video camera footage and read human body language and anticipation to prevent and predict crime before it even happens. Cortica, an AI researcher, created the program with a neural network, but rather, using the "cortical segment of a rat's brain. By keeping a piece of brain alive...outside the body...and connecting it to a microelectrode array, Cortica was able to study how the cortex reacted to particular stimuli (Quain 2018). With this information and tools, he was able to monitor electrical signals and brain processes which were later translated into mathematical models and algorithms to simulate the brain's processes. This is a very unique way to utilize the power of the brain and technology in order to create something that can analyze humans at a deeper level. Artificial intelligence is good at analyzing data and mathematical-based ideas, but analyzing humans is still a work in progress. But this, is definitely a strong step towards more meaningful progress in AI research and applications.

Games

As discussed earlier, games have played a great role in the applications of artificial intelligence. Almost every video game you play now-a-days has a form of AI programming in it, specifically with Non-Playable-Characters (NPCs) or enemies that you fight. AI has also been used

outside of building games, by analyzing how games are played as well as for how problem-solving works when playing games. One of these interesting uses of AI is the Google-owned AI company Deepmind, founded in 2010. Their Deepmind algorithm was an impressive display of how one AI computer algorithm is capable of doing a lot. The algorithm is capable of playing many different classic arcade games like Space Invaders and Pong. The algorithm is even able to beat human players in more than half of its learned 49 different arcade games. The algorithm is very versatile and works by:

> Joining two types of machine learning...The first, called deep learning, uses a brain inspired architecture in which connections between layers of simulated neurons are strengthened on the basis of experience. The second is reinforcement learning, a decision-making system inspired by the neuro-transmitter dopamine reward system in theanimal brain. Using only the screen's pixels and game score as input, the algorithm learned by trial and error which actions — such as go left, go right or fire — to take at any given time to bring the greatest rewards (Gibney 2015).

This type of AI algorithm is even re-creatable if you know the proper coding and learning environments. Google has obviously put more effort and made the AI at a much larger scale though. Despite this, Youtuber by the name of SethBling was able to make his own mini-machine learning algorithm that learned how to play Super Mario World for the Super Nintendo. In his video titled "MarI/O - Machine Learning for Video Games", he explains a very similar process to Gibney as to how he made the algorithm and how it worked its way to success. This goes to show that with the proper knowledge and dedication, many people, even at home, can develop AI algorithms.

As discussed earlier, in computer games, there is almost always AI involved. NPCs are the main stars of the AI show here. They act as not only other storytelling characters, but they also

take on many roles that may not seem as apparent at first glance. When coded and built correctly, an NPC can do a lot more for the connection of the player and the game. The NPC now has the role of a commentator, a technician, a camera-man, a director, and even a lighting and mood setter. The characters that are not playable in games can also be utilized as tools. In Funge's (2004) book on *Artificial Intelligence for Computer Games*, he describes not only how to create AI in computer games, but also how they function in relation to the player. In the book he describes how an NPC's AI can process controls and movement:

> Every character in a game has at least one controller associated with it and controllers can be shared between different characters. A controller acts as the character's brain, its inputs are information about the state of the game world, and the outputs are the action choices that affect the game world and produce the associated NPC's behavior…In this book, "controller" is used exclusively in the sense of the character's brain. The term "joystick" is used for the player's input device (Funge 2004).

Not only is AI in the non-playable characters (NPCs) of video games, AI is being used to further improve complexity of games. One AI in particular which is fairly new and being improved upon focuses on level design of the classic games of Super Mario Bros and Doom. The AI uses "GANS [which] are a form of AI used in unsupervised machine learning. Two neural networks -- the "generator" and the "discriminator" -- are pitted against each other so the generator learns better ways to fool the discriminator, which (of course) tries not to be tricked" (Chong 2018). This could lead to more creative design of levels in video games with even more complexity. The AI is still a work in progress, so we may not see it in action for a while, but with this AI, games and levels may become harder if this becomes a larger project that yields effective results.

Automation, Cars, and Robots

Robotics and automation are both widely used in many industries and is slowly growing with the implementations and improvements with AI. This field in itself is very robust and full of information, but the use of AI is still young and improving. With things like autonomous driving cars, robots in warehouses, and the various companies becoming involved with automation and artificial intelligence, could lead to many more expert systems that improve upon already great or efficient processes.

Companies like Tesla and Google have been experimenting with autonomous vehicles for some time now. The idea of self-driving cars has been around ever since robotics became more of a regular thing. The main problems of these autonomous cars though is accuracy and reliability, which can lead to ethical and safety concerns in the time of failure or emergency situations. The main focus of AI in autonomous vehicles has been with improving this accuracy and reliability. The processes of doing this have mainly been with 3D modeling, environment scanning with cameras, and integration of machine learning and AI to determine different types of objects. Two researchers of both Stanford and Toyota AI development wrote an article discussing efforts put into further improving autonomous vehicles and their path taking and logic. By combining multiple methods of environment analysis and prediction methods, this should further improve how autonomous vehicles navigate, making them more efficient and hopefully safer as well:

The core of our approach to path planning consists of two phases. The first phase uses a variant of A* search (applied to the 3D kinematic state space of the vehicle) to obtain a kinematically feasible trajectory. The second phase then improves the quality of the solution via numeric non-linear optimization, leading to a local (and frequently global) optimum. Further, we extend our algorithm to use prior topological knowledge of the

environment to guide path planning, leading to faster search and final trajectories better

suited to the structure of the environment (Dolgov et al. 2010).

By combining multiple methods of calculation, the amount of data being accessible to the AI

improves, which should improve the way the AI learns as well. The different knowledge areas and

methods of gaining information can feed off of each other into the AI algorithm and further

improve the path planning and understanding of objects in the world. While this still may not be a

guaranteed fix or solution, it definitely adds more research and understanding to the problem in

question, as well as allowing for the development of the AI to take a different direction, which

could lead to more discoveries and results.

Another important task that utilizes automation is in warehouses and factories. Almost all

big companies that make packaged food from soda to chips or candy incorporate at least some

automation. The machines are able to produce products in much larger quantities at a fractionally

smaller amount of time compared to human work. With this, you also reduce the amount of

physical labor and need for simple jobs that may not be needed in the first place such as packaging.

Artificial intelligence is being added to these automation systems as well in conjunction to more

advanced engineering techniques. This is being experimented with particularly in warehouses,

allowing for fully autonomous work of organization and heavy lifting, while also reducing costs

for the business with things such as lighting and manual labor. The initial setup for these

automation systems can be costly, have long design cycles, and aren't that flexible for changes or

updates though. But the AI in them can lead to very efficient forms of storage and good

transportation, specifically in warehouses. For example, one solution to add more functionality

and utilize warehouse space is with the Kiva solution. "[It is] an inventory pod and a drive unit.

The drive units are small enough to fit under the inventory pod and are outfitted with a mechanical

lifting mechanism that allows them to lift pods off the ground. The pods consist of a stack of trays, each of which is subdivided into bins" (Wurman et al. 2008). This system allows for workers to have immediate access to any inventory item within the warehouse as well as keep everything organized and space efficient.

Another company is also considering the ways of autonomous vehicles, much like Tesla. The popular "taxi-like" service Uber is looking at using AI for self-driving freight trucks for deliveries. Uber is now utilizing autonomous vehicle AI into freight trucks, while keeping them only on highways in Arizona to make things simpler for now and the trucks will still have human drivers for backup and safety. In conjunction with this, Uber is allowing select Uber drivers to test their autonomous AI and vehicles by reading and inputting data and feedback, allowing for the vehicles and AI to be tested and used in regular commutes. Uber does eventually plan on having their autonomous vehicles become accurate and reliable enough to not have a driver present at all. "Uber's trick to making the self-driving trucks useful today is using transfer hubs, where a conventional truck and self-driving truck exchange loads. This system allows the self-driving truck to operate only where it's effective -- for now, highways" (McFarland 2018). This application of AI could prove very useful in the future, for truckers could sleep while still making progress on a long trip. It also allows for potentially better tracking and digitally connected data to be collected and sent. The vehicle could be tracked more accurately if the AI can link to high-accuracy GPS and allow for truckers or technicians to look at and verify travel and shipment data collected on a server and on the truck's AI interface as well. Currently, companies like Uber and Lyft utilize machine learning and data analysis AI algorithms to better learn from user experiences, GPS data, and commute times to better improve the user-experience and efficiency of the service. The

additional implementation of autonomous vehicles could potentially add even more value to the service and bring us closer to larger advancements in automation and AI with robotics.

Industrial

Artificial intelligence has also spread into the industrial and manufacturing realm. With complex and sometimes stressful large-scale jobs, AI can help these jobs become much easier and accurate tasks. The industrial and manufacturing world plays a big part in a lot of our resource production and many other tasks that people do not always acknowledge or realize. This ranges from things like oil drilling, resource renewal such as solar panels, bridge building, car manufacturing, and other large factory-based jobs.

One very impactful way that AI is being used in this area of expertise is with bridges. Large man-made structures like bridges break down over time. One issue with bridges is bridge-deterioration. This bridge deterioration model and analysis requires high-level expertise where condition of performance and other factors have to be accounted for. Many mathematical calculations have to be done and the structural behavior of the bridge can depend on these measurements in which parameters need to regularly be updated when new data is collected. With AI, the calculations needed for bridge performance can be calculated quickly and without the need for technical expertise or expert technicians. The "AI-based approach for updating parameters allows bridge deterioration model to self-update parameters when new information or data is collected using Bayesian theorem" (Chen et al. 2015). This can not only make the bridges more reliable, but also safer, as well as allow for better bridge designs and engineering decisions to be made for future-built bridges.

As stated earlier, industrial jobs and tasks can sometimes be very complex. With artificial intelligence, you can help reduce the complexity of some areas that would normally require expertise. You also can allow for better documentation and analysis of data to improve the AI and the future outcomes of work and tasks. In industrial situations, AI can be used to analyze various aspects of work for further efficiency and documentation. By analyzing transformer oil through both Particle Swarm Optimization (PSO) and Artificial Neural Networks (ANN), this efficiency and documentation could potentially be achieved. It is important to accurately predict faults in transformer oil in order to have correct maintenance performed which in return, will help reduce maintenance costs and lower the chance for errors.

> The advantages of PSO are simplicity and easy implementation. The effectiveness of various PSO techniques in combination with ANN is validated by comparison with the results from the actual fault diagnosis, an existing diagnosis method and ANN alone. Comparison of the results from the proposed methods with the previously reported work was also performed to show the improvement of the proposed methods.

Again, like with the bridge deterioration model, implementation of artificial intelligence can make industrial processes more accurate, require less expertise, and make the jobs potentially safer with better analysis of data and environmental conditions.

One important aspect of the industrial world is with renewable energy and research regarding it. There is a lot of energy from what we do as humans as well as energy from our planet that is going to waste. By reusing some of this energy, we can be more efficient with the way we live and do jobs. A common way to renew energy is through photovoltaic applications, or better known as, solar panels. By capturing energy from the sun's rays, we can essentially get free power. One way AI is being utilized in helping with renewable energy is in these photovoltaic applications

like solar panels. Like with the other applications stated earlier, AI can provide techniques that offer alternative approaches to the ways things can be achieved. In this example specifically, AI can help provide alternative approaches to things like physical modeling as well as provide less computational effort while also allowing for less knowledge of internal or complex parameters. "The implementation of AI techniques based on hardware circuit... present a promising method in PV applications for developing intelligent PV systems, which can be used for control supervision, diagnosis and monitoring" (Mellit and Kalogirou 2008).

With artificial intelligence implementation, many tasks done in the industrial and manufacturing fields can be achieved much more accurately and grow better over time. While initially, it may take more effort to train an AI algorithm, in the end, you can achieve more accurate results that could potentially be automated as well, allowing for human experts to focus more on other areas of their jobs and reduce stress in potentially hazardous situations.

Data and Analysis

With artificial intelligence testing and overall data analysis, many can believe that Google is also highly involved, and those who think that would be right. Google has been implementing artificial intelligence for a long time, even in their search engines and more experimental things such as communication apps and the Deepmind game algorithm. Throughout the years, Google has tried to make technology more useful and interactive to people, focusing on communication and regular motions and ways of thinking while also being efficient at looking through data in meaningful ways. One way Google has improved upon finding information by using AI is through book and article searches. To make searching more like a natural conversation or asking of

questions, Google is implementing AI into new testing websites that will search for books and articles for you:

> "The models driving this experience were trained on a billion conversation-like pairs of sentences, learning to identify what a good response might look like," Kurzweil and Berstein explain. "Once you ask your question (or make a statement), the tools search all the sentences in over 100,000 books to find the ones that respond to your input based on semantic meaning at the sentence level; there are no predefined rules bounding the relationship between what you put in and the results you get. Of course, as you might suspect, there are some limitations here. The tool is better for answering raw factual questions and doesn't perform quite as well handling complex geopolitical questions or topics of modern cultural and historical importance" (Statt 2018).

By adding the functionality and data analysis potential of a changeable AI algorithm, you can get more accurate results as well as focus on helping users get more out of their searches and get to the information they need much more easily.

With programming and creativity, artificial intelligence can allow for a very unique perspective and new ways of analyzing data. One of the most interesting and potentially useful applications of AI in data analysis involved a dog. Research is regularly done and many people wonder what animals think and how they differ with interacting with the world compared to us. Some recent research in AI has taken a different approach by analyzing dogs and how they think:

> [Researchers]…collected [data] in the form of videos and motion information captured from a single dog. A total of 380 short videos were taken from a GoPro camera mounted to the dog's head, along with movement data from sensors on its legs and body…With this information in hand, the researchers analyzed [the dog's] behavior using deep

learning...Taking the neural network trained on the dog's behavior, they wanted to see if it

had learned anything else about the world that they had not explicitly programmed...[They

wanted to figure out if the AI could use a dog's natural visual intelligence. With this]..The

researchers applied two tests to the neural network, asking it to identify different scenes

(e.g., indoors, outdoors, on stairs, on a balcony) and "walkable surfaces"... In both cases,

the neural network was able to complete these tasks with decent accuracy using just the

basic data it had of a dog's movements and whereabouts.

With this information, we could potentially not only learn more about the animals, but we could

use this information to further improve on developments in things like robotics and how they are

controlled.

Data analysis and AI that reads data can not only find data in unique and more efficient

ways, but it can also learn from past data and tests as well as predict future data. Researchers are

trying to utilize AI to better predict future data, for this can be very useful and is still not as strong

as other applications of data analysis for past and present data. Some more recent advancements

in AI could prove useful for looking for problems or chaotic situations. The AI can help with chaos

prediction, for most of the time, equations for the chaotic system may not be known and need to

be discovered, which can make calculations and analysis much harder. The AI can help fight this

though, for the algorithm doesn't have to know or see chaotic theorems to do its job:

"[The algorithm] sees data recorded about the evolving solution to the equation. This makes

the machine-learning approach powerful…Besides weather forecasting, experts say the

machine-learning technique could help with monitoring cardiac arrhythmias for signs of

impending heart attacks and monitoring neuronal firing patterns in the brain for signs of

neuron spikes. More speculatively, it might also help with predicting rogue waves, which

endanger ships, and possibly even earthquakes.

In almost any application of artificial intelligence, data analysis and collection plays a big role in

improving and making a system work. Using the power of automation and changeable programs,

data analysis and future data prediction by utilizing past and present data can lead to more

revolutionary advancements in future applications.

Ethics and Social Media

With any type of interaction with humans, come ethics. Artificial intelligence and tech in

general defeintely has ethics involved, specifically with privacy and data concerns. One major area

that AI is being utilized in more recently is with social media. Social media also brings the

questions of ethics with it and even more so with AI being developed to work alongside it.

Facebook is a major player in the social media outlet, reigning supreme over connections

and active users. Though in the past, they have been through a lot of troubling times regarding

their platform and ethics. From data collection and privacy concerns with Cambridge Analytica,

experiments that can alter the moods of users, and issues with freedom of speech and abusive posts

just to name a few. With the implementation of AI, Facebook hopes to help remove some toxicity

and negativity with posts that could be potentially abusive, but with it comes challenges:

'It's much easier to build an AI system that can detect a nipple than it is to determine what

is linguistically hate speech,' [Zuckerberg] said…Something like hate speech is harder to

police solely with AI because there are often different intents behind that speech...It's also

harder to detect hate speech in languages that are less widely spoken, because the software

has fewer examples to lean on. 'The combination of building AI and hiring what is going

to be tens of thousands of people to work on these problems, I think we'll see us make very

meaningful progress going forward,' Zuckerberg said (Nieva 2018).

Facebook, in conjunction with all of this, has had a problem with fake news surfacing. But even

with Facebook's attempts in AI, many think that it could still not be enough, for AI and fake news

is only just beginning with social media. Like Nieva (2018) points out the problems that AI have

with intent and meanings, Vincent (2018) agrees as well stating that

> AI fails on a number of levels because it just can't understand human writing the way
>
> humans do. It can pull out certain facts and do a crude sentiment analysis (guessing whether
>
> a piece of content is "happy" or "angry" based on keywords), but it can't understand
>
> subtleties of tone, consider cultural context, or ring someone up to corroborate information
>
> (Vincent 2018).

Along with this, you have the gray areas that can even be hard to gauge for humans. How can an

AI determine these gray areas if a human can't either?

Though this may be an underlying problem with AI in general. As humans we have the

amazing ability of not only deep comprehention, but creativity and unique alternative outlooks on

things in life. One's view of the world is different than another's. According to Boden (1998),

there are 3 main types of creativity. Combination creativity where familiar ideas are combined in

likely improbable ways, ie. poetry. There is also exploratory creativity by going into different areas

of ideas. Finally, there is transformation creativity which focuses on changes ideas and spaces to

make things that weren't possible before. "Computer models of creativity include examples of all

three types. As yet, those focused on the second (exploratory) type are the most successful" (Boden

1998). This is because this type of creativity is closest to achievable computational analysis,

whereas the other areas bring "difficulty of approaching the richness of associative memory [as

well as] the difficulty of identifying our values and expressing them in computational form"
(Boden 1998).

Earlier, voice-assistant devices like Google Home and Alexa were discussed for their
practicality and uses of AI. With these devices though, there has also been privacy and ethical
concerns considering the devices have to listen for information and sometimes make other
connections to people and devices. By knowing how these devices work, hackers are able to
manipulate them which could lead to even more problems in the future. By sending commands to
voice assistants that humans cannot hear, researchers were able to have the assistant complete tasks
for them. Inside university labs, the researchers have been able to secretly activate the artificial
intelligence systems on smartphones and smart speakers, making them dial phone numbers or open
websites. In the wrong hands, the technology could be used to unlock doors, wire money or buy
stuff online — simply with music playing over the radio" (Smith 2018). Thankfully these types of
hacks and breaches of intended function are in a controlled lab environment. Though if these
problems do not get fixed in the near future, problems could arise like Smith states.

Another concerning use of AI is intentional and very powerful, but could become an issue
if used in devious ways or abused. Google has been working on their AI and Google Assistant
capabilities throughout the years, to make a truly powerful voice assistant that can do tasks for you
almost like a personal human assistant would. The issue with Google's latest work with Google
Assistant is that it is now capable of making calls and appointments for you. The way it does this
is by imitating a human on the phone with very convincing results. With the newest Google
Assistant, a phone call was made to book an appointment:

Of course, this was a phone call with a difference. [The call was driven by Google Assistant
which] did an uncannily good job of asking the right questions, pausing in the right places,

and even throwing in the odd "mmhmm" for realism...the most impressive thing was that

the person on the receiving end of the call didn't seem to suspect they were talking to an

AI. [But this] also opens up a Pandora's box of ethical and social challenges.Does Google

have an obligation to tell people they're talking to a machine? Does technology that mimics

humans erode our trust in what we see and hear? And is this another example of tech

privilege, where those in the know can offload boring conversations they don't want to

have to a machine, while those receiving the calls (most likely low-paid service workers)

have to deal with some idiot robot? (Vincent 2018).

As with all technology and digital data related products and services, there is privacy and ethical

concerns. While all of these issues may seem very troubling, most people have gotten to the point

where the do not care about their privacy anymore, since there is so much connectivity with apps,

products and services. Only the very tech-savvy and extreme privacy-concerned people will make

efforts to hide themselves with things like the Tor browser or avoiding certain search engines.

One area of rising concern that may need to tread carefully though is with autonomous

vehicles. There is always the risks of hiccups in function and safety. A car can hurt or even kill

people with the amount of weight and speed being thrown around. Not being careful and correctly

teaching self-driving AI can lead to possible crashes and injured people. What happens when a

tough decision has to be made? Bonefon et al. explain this very well:

Autonomous Vehicles (AVs) should reduce traffic accidents, but they will sometimes have

to choose between two evils—for example, running over pedestrians or sacrificing itself

and its passenger to save them. Defining the algorithms that will help AVs make these

moral decisions is a formidable challenge...Although these scenarios appear unlikely, even

low-probability events are bound to occur with millions of AVs on the road... even though

participants still agreed that utilitarian AVs were the most moral, they preferred the

selfprotective model for themselves (Bonnefon et al. 2016).

Again, this can be looked at in a different way, much like with privacy and data issues. While these

issues may occur, this is only the beginning of autonomous vehicles. With better training through

data analysis and prediction as described earlier in this paper, the vehicles will become much

smarter. By also having vehicles communicate with each other, we can further reduce incidents.

In the end, with a well-developed AI system, we can have fully autonomous vehicles that involve

less human variables. This will make things safer in the end, since accidents and bad situations can

be looked at through data and be troubleshooted for even more reduction of possible repetition.

The hardest part is getting there since there is a strong initial hurdle in the beginning that we have

to get past first.

Final Thoughts and the Future of AI and Tech

The future is looking bright and ever-expanding with the potential of an increase in AI

development and speed of AI development. Companies are now realizing the potential of AI-based

solutions and are trying to put the power of development into the hands of consumers. By having

a larger audience and more of an open source approach, AI development can further improve at a

faster pace while also potentially being safer in the end since there will be more people there to fix

things.

Google is always looking towards the future and has this exact idea in mind. "Google has

found a new role to play [in AI] by equipping budding engineers with the tools they need to learn

about AI and build their own AI solutions...[They] just announced two new 'AIY' (it's like DIY,

but for artificial intelligence) kits that...ship with everything a student might need to build AI

solutions, including a Raspberry Pi Zero WH board" (Epstein 2018). With kits like Google Cardboard and now these AI kits, learning and advancement can be done at home, allowing for more creativity and education in general. This could be paired with programs like STEM and other interactive learning environments, whether they are online or in person. These types of advancements and ideas can help make AI and technology even more accessible and help the overall growth and advancement of technology and AI by giving part of it to regular consumers and students.

Many more companies are looking into AI development and implementation as well. Specifically Lyft, Mastercard, and drone companies are considering how they can further improve upon their services with AI:

> insurance companies like Allstate have been using drones to inspect homes for storm damage. One reason is that inspecting home rooftops is one of the most dangerous jobs, said drone startup Kespry CEO George Mathew… The future, according to German energy company Innogy executive Thomas Birr, may involve powerful electrical grids that are linked to everything from Internet-connected dishwashers to solar panels to electric cars… Will Summerlin, the founder of Pinn Technologies, is exploring how AI can be used to prevent fraud and better verify customer identities [by utilizing fingerprints and other biometric phone sensors]… One reason ride-hailing company Lyft is testing self-driving cars is to help the company expand into more rural areas (Vincent 2018).

These companies are looking towards the future and how they can improve their technologies and utilize AI to further improve their data analysis.

While AI may bring ethical and privacy concerns, it is still young and being developed to improve upon itself. There will always be ethical problems and concerns of privacy when it comes to digital media and product consumption. With companies like Google and the others stated before, AI will rapidly advance in the near future thanks to more power given to the people and more companies accepting and experimenting with AI. Throughout this paper, the different ways AI is being implemented was discussed and how those applications may affect their respective fields of focus. There is much more out there to AI and how it is being used and it is growing with technology every day. In general, if implemented and developed with though and care, AI can prove to be very useful in many areas, being potentially innovative, safer, and even more efficient than current methods of work. By utilizing AI to its fullest potential, we can better use past and present data while also predicting and improving the future. These are just some of the ways AI has proved to do so.

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