

# Artificial Intelligence

CS4182 AI Essay

by

Team 5

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## **Abstract**

This essay describes what artificial intelligence is through four main topics: the history of AI, AI in entertainment, AI in government sectors, and the future of AI. The first instance of an idea for AI came from science fiction writers, namely L. Frank Baum. In entertainment, AI has several roles, such as controlling your enemies and non-player characters in video games, making predictions in gambling, and researching the best way to advertise movies and TV commercials. In healthcare, there is a possibility that AI could eventually diagnose patients without the need of a human doctor, and AI has been used to improve the work of military planners and pilots. For the future of AI, it could potentially drive our cars, improve the lives of students, and even treat brain disorders through human-AI symbiosis.

## **Introduction**

To begin, artificial intelligence, AI, otherwise known as machine intelligence, is the “intelligence shown by machines”. It is defined as any device that can take in its environment and make decisions with that information to increase its chance of completing any tasks given to it. Modern AI is considered to be understanding concepts such as speech, driving vehicles, making routes for delivery and the military, and performing in high level strategy games, but we will also talk about what was considered AI back when it was first made.

## **History of Artificial Intelligence by Andriy Kyrychenko (19247745)**

### **The Beginning of Artificial Intelligence**

Most of the world has definitely heard about Artificial Intelligence, but what percentage of those people actually know the history of it? The concept of AI was introduced to our world in the nineteenth century. The first ones who actually came up with the idea of AI and robots were science fiction writers: “[L. Frank] Baum wrote of several robots and described the mechanical man TikTok in 1907, for example, as an “Extra-Responsive, Thought-Creating, Perfect-Talking Mechanical Man ... Thinks, Speaks, Acts, and Does Everything but Live.””<sup>[1]</sup> Those stories had a high impact on the public and gave high inspiration for those to start researching Artificial Intelligence. In the early nineteenth century, modern computers were just invented and electronics started to improve. In well-known laboratories, such as Alan Turing’s in Manchester, the Moore School at Penn, IBM and many others, scientists started working on their projects more in-depth and were beginning to see results.

However, Turing was probably the most influential when it came to the development of AI: “Turing’s 1950 seminal paper in the philosophy journal “Mind” is a major turning point in the history of AI.”<sup>[1]</sup> He believed that there was a possibility that one could program an electronic computer to behave intelligently, like a human being. Turing was also the one to come up with the ‘Turing Test’.<sup>[2]</sup> This was a sensation in AI industry as this test was able to

observe a conversation and determine if whether or not it is a human speaking or a robot. If the test was positive, it meant that the machine was “thinking”.

### **The Advancement of Artificial Intelligence**

The work on researching and programming continued between 1950 and 1960 as AI was tested in games. For example, Christopher Strachey and Dietrich Prinz wrote a checkers and chess program respectively using the Ferranti Mark 1 machine that was located in the University of Manchester.<sup>[3]</sup> After many experiments, tests and improvements, people were able to bring AI to a point where they gained the necessary skills to challenge and play against amateur players. This measure of progress inspired researchers to continue.

Another important point in the history of AI happened at the Dartmouth Conference of 1956, which was organised by John McCarthy, Marvin Minsky, Claude Shannon and Nathan Rochester<sup>[4]</sup>. Scientists who created “programs with intelligence” were invited to this occasion and from there, they discussed about what to name this area of expertise. John McCarthy had persuaded attendees to accept the term “Artificial Intelligence”. However, this area of expertise was not only given a name, but was also given its first success, its mission and its major scientists. The scientists were astounded by what AI is capable of as the programs demonstrated showed off its potential. They managed to solve algebra problems, prove geometric theorems and even learn how to speak English. Obviously with this progress, they were satisfied and wanted to see more progress. Governments were providing agencies, like DAPRA, with any financial needs and they were expected to build a fully intelligent machine in less than 20 years.

In my opinion, the biggest invention in 1960s was the first chatterbot called “ELIZA”, which was developed by Joseph Weizenbaum.<sup>[5]</sup> Even nowadays, AI chatterbots are quite impressive. However, ELIZA wasn’t entirely great at speaking English and she would sometimes struggle to create coherent sentences. Nonetheless, people thought that they were speaking to a real human being. She could give a predetermined response to questions that were asked to her; she would rephrase what was said to her with some grammar rules and give an answer back to the speaker. This was a massive progress in the AI industry, and chatterbots are still used today.

The first appearance of Robotics was in Japan during 1972. Waseda University started working on the “WABOT project” around the year 1970.<sup>[6]</sup> WABOT-1 was a full-scale, intelligent, humanoid robot. It consisted of a limb-control system, conversation system and a vision system. WABOT-1 was able to communicate with a human being in Japanese. It could also walk and move objects around using its hands. This may sound like a standard

robot nowadays but back in the 1970s, this was the first ever robot, which moved scientists minds many years forward. However, it was “estimated that WABOT-1 has the mental faculty of a one-and-half-year-old child.” Scientists received a foundation for robotics and AI. From here, they have a way to make progress while improving their invention. With a high financial support from the Japanese government, the WABOT-2 project launched in 1980. This time around, WABOT-2 was an artistic robot. Scientists tested WABOT-2 and its capabilities through music. This was done by programming the robot to play keyboard instruments. It was able to keep conversation with a human, read and play average difficulty music on a keyboard instrument. In fact, WABOT-2 was the first stepping stone in developing a “personal robot”.

### **Artificial Intelligence in the Modern World**

In 1997, ‘Deep Blue’, a chess-playing computer developed by IBM, had managed to defeat world chess champion Garry Kasparov.<sup>[7]</sup> Although the computer had lost the first match, it managed to improve enough to the point that it was capable of processing 200 million moves per second. This went all around chess community and has greatly impressed them. The idea that a computer was able to beat a champion in chess was a crazy concept for people.

Years later, in 2005, a “driverless car” named Stanley was created by computer scientist Sebastian Thrun and a team from the Stanford Artificial Intelligence Laboratory.<sup>[8]</sup> Stanley was the first ever autonomous vehicle to complete a 132-mile course, which won a DAPRA Grand Challenge. Not too long after, in 2009, a multibillion company known as Google develops their own self-driving car.<sup>[9]</sup> In 2015, they let the car for the first time on a public road.

Siri is a virtual assistant that was originally developed by the SRI Artificial Intelligence Centre in 2010 but was acquired by Apple, a technology company.<sup>[10]</sup> This invention had a high impact on about billion users that use electronic devices made by Apple. Later on, Amazon launched a similar project called ‘Alexa’ in 2014.<sup>[11]</sup> Alexa was a virtual assistant that helps people with everyday tasks, such as shopping. Virtual assistants are considered to be really helpful in our daily lives, especially for people with disadvantages.

However, AI is still far from being perfect. In 2016, an AI chatterbot known as ‘Tay’ was released by Microsoft.<sup>[12]</sup> This bot was based on a 19-year-old American girl and the goal of Tay was to learn by interacting with people on Twitter. Unfortunately, the project shutdown after 16 hours, due to the offensive and inflammatory tweets that the bot was received.

These tweets eventually corrupted the bot to a point where it also began to start tweeting these same offensive tweets and had to be taken off of Twitter by Microsoft. Tay was later replaced with a new bot called 'Zo'.

Nowadays, new technology is still being developed quite quickly and new inventions are still being made every day. A lot of people are interested in sponsoring the AI researches, which means that the predictions that scientists have made in the past could still potentially come true.

## **Artificial Intelligence in Entertainment by Evan Boland (19229348)**

### **AI in Gaming**

Around 1972, the video game Pong was released by Atari, an American video game company. At the time, Pong was praised by many and was a major success for Atari. From then on, the video game industry advanced throughout the years. Alongside this, game developers found new ways to improve their games. The visuals of a video game got much better as game developers made a jump from 2D to 3D graphics. The gameplay also majorly improved as it became more complex with new additions. One of these additions was the use of artificial intelligence.

AI is a very important aspect of making a video game fun for the player. A lot of video games have characters within them, known as non-player characters or NPCs, that are controlled by AI. The purpose of NPCs usually varies from game to game but they are generally used to provide the player with a more immersive and fulfilling game experience.<sup>[13]</sup> They are also designed not just around knowledge of the game or with complex tactics more but around how a human would play a video game: "... they beat you by outthinking you, not by outshooting you."<sup>[14]</sup> This applies perfectly for some game genres, such as action games and strategy games. In action games, the AI is implemented in several NPCs, such as partner, support and enemy characters. While partner and support characters are designed to give assistance to the player, enemy characters are the opposite as they will try to stop the player by any means necessary, e.g. Half-Life, Grand Theft Auto. On the other hand, in strategy games, the AI must be capable of taking on the player and providing them a challenge. For example, in Civilization, the AI has the ability to expand their empires, use resources and units to their advantage, and has the power to negotiate with the player as well as other civilizations.<sup>[13]</sup>

AI used by game developers are, however, more simplistic in comparison to AI used for academic and industrial purposes. One reason was that there was usually a lack of development time. By the time developers were getting around to creating the AI, they had

most of the game finished and had to get it finished. Another reason is that there is a lack of understanding of advanced AI techniques in the gaming industry. Game developers use certain techniques to their advantage, such as finite state machines (FSMs), path-finding algorithms and flocking algorithms. However, it was harder to implement much more advanced techniques into games. The last reason I will mention is the fact that developers tend to prioritise graphics over other areas in a game, such as AI.<sup>[13]</sup> There are many other reasons but these are the main ones.

Some argue that using AI in video games is a good idea when used for research.<sup>[15]</sup> Reasons in favour of this include realism in video games, possibility of modifying the game (also known as mods), a complex world similar to reality, and the fact that the video games industry is a “multi-million dollar worldwide industry.”<sup>[13]</sup> However, others argue against this as there are several drawbacks to doing research with game AI. Some of these drawbacks include a lack of formal structure, a lack of contact between researchers and game developers, and suspicion against game companies for their degree of secrecy. However, some people think it’s a good idea to use video games for research, especially the military. For example, the Soarbot project created agents to play Quake, a 3D action game, while using the rule-based SOAR architecture.<sup>[16]</sup> Another example of the military using games for research is when a military system designed to analyse terrain in order to plan attacks was adapted for use in strategy games.<sup>[17]</sup>

### **AI in Gambling**

Artificial intelligence is quite useful in making predictions. For example, IBM’s supercomputer Deep Blue beat grandmaster Gary Kasparov in a game of chess in 1997. However, since AI is good at making predictions, it is sometimes used in predicting sporting events. One example of this involves a company known as Unanimous AI. This company took advantage of “swarm AI” in order to predict major sport events. During the 2016 Kentucky Derby, the company managed to successfully predict which horses would come first in four races.<sup>[18]</sup> As well as this, during the 2017 Super Bowl, Unanimous AI successfully predicted a 34-28 win by the Patriots.<sup>[19]</sup> However, this is only one example of how AI is used to predict wins in sports.

In gambling, AI is used in two main ways: one in favour of the player and the other in favour of the organisation. For the player, people are trying to find a way to win through AI. For example, Carnegie Mellon University developed an AI called Libratus that managed to win against four professional poker players.<sup>[20]</sup> For the organisation, they use AI to predict “problem gamblers” as well as create more appealing game design, marketing campaigns and user interface. For example, Manu Gambhir, CEO of a gambling site called 24/7, has AI that predicts problematic gamblers with a certainty rate of 60%.<sup>[21]</sup>

## **AI in Movies and Television**

The movie industry is known for the creative minds of humans behind it. With this in mind, it sounds unlikely that AI would be used in an industry like this. However, some studios are trying to find new ways to implement AI for better marketing. For example, IBM released a trailer for a 20<sup>th</sup> Century Fox movie called Morgan in August 2016.<sup>[22]</sup> The trailer was created by using AI to select moments from the movie that can be used for a trailer and was edited into the trailer by a filmmaker. The trailer wasn't 100% made by AI as it had human assistance but this could be the first step for AI-created movie trailers.

Some people also thought of ways to use AI in the TV industry as well. For example, an advertising agency known as McCann Erickson Japan launched an AI creative director known as AI-CD  $\beta$ .<sup>[23]</sup> The AI was "trained on data including specific elements of TV shows" so that it could gather enough information needed to direct a TV commercial. The AI was tested in a friendly competition against another creative director, Mitsuru Kuramoto, as they were both tasked in creating an advertisement for a Japanese mint. However, a poll showed that Kuramoto's ad was preferred over the AI's ad. This is only the beginning for the use of AI in this industry, however, as it does have potential.

## **AI in Government Sectors by Jordan O'Sullivan Cronin (19272987)**

AI has applications in many different areas. According to a journal by Thomas Davenport and Ravi Kalakota (2019)<sup>[24]</sup>, in the healthcare sector, that the most common application of traditional machine learning, or artificial intelligence, is precision medicine. Precision medicine is the prediction of what treatments are the most likely to succeed on the patient, based on different characteristics of the patient and the context.

A more complex application is the neural network. The neural network has been used in the healthcare sector for a few decades. It has been used to do things like figuring out whether a particular patient will come down with a disease or not. The neural network looks at things as inputs, outputs, the weights of variables that link inputs with outputs. The neural network has been compared to how the brain works, but the comparison is not great.

There is another, more complex use of AI in healthcare called deep learning. Deep learning is a neural network with a lot more levels of variables to predict outcomes. One of the most common uses of deep learning is identifying possibly cancerous areas in radiology photos. Another use is for radiomics, which is the finding of important features in image data that cannot be found by the human eye.

Despite the useful AI mentioned above, there is still an "inconvenient truth" about AI in healthcare that Trishan Panch, Heather Mattie, and Leo Anthony Celi (2019)<sup>[25]</sup> talk about. AI in healthcare has shown the possibility that healthcare data, aggregated from

interactions with patients, can be used to make models that can automatically diagnose patients with no interactions with a doctor, saving time, money, and the doctor from potential risk. The “inconvenient truth” they talk about is the fact that the algorithms that are talked about that could provide this kind of service are not usable on the frontlines in the healthcare sector. They say this for two reasons. One is that AI does not change the reasons for why hospitals and the like work the way they do. There are political and economic reasons as to why doctors work the way they do, along with medical norms. Adding AI would not create any sustainable change according to the article. The second reason is that most hospitals, or healthcare organisations in general, do not have the data infrastructure needed to get the data required to properly train the algorithms to suit the local population or to test the algorithms for bias, meaning that the algorithm could potentially make preventable mistakes. The example given in the article is that an algorithm trained on primarily Caucasian patients would not have the same accuracy when used on a patient in the minorities. An extra point against this again is that, even if they could afford to check for this bias, it would need to be checked over and over again to make sure it’s usable, as medical practices and the patients being tested always change overtime.

This article finishes off by saying that to realise the potential of AI in healthcare, some issues have to be addressed, namely: who owns health data, who is responsible for it, and who can use it? They also say that there is a choice in health systems: either reduce the enthusiasm surrounding the potential of AI in healthcare, or to resolve the issues of data ownership, so the potential of AI can be realised.

A use for AI in the military is AI-based tools to help decision making. In an article by Robert Rasch, Alexander Kott, and Kenneth D. Forbus (2003) <sup>[26]</sup>, they talk about how they had given army officers AI based tools, described as “necessarily crude but sufficiently usable”, and put them into controlled experiments. They say that the results gotten helped lift concerns about the negative impacts of the tool, and it showed the potential for saving immense amounts of time.

Proper military planning, be it for peacekeeping or for battle, takes a lot of time, resources, and highly trained professionals. Planning is a manual process, and the amount of time this process takes forces the planners to limit the amount of options they can look into. An AI aid can allow them to look into a wider amount of options, with a larger amount of diversity, or maybe analyse the same options in more depth in the same amount of time.

To go with the benefits of an AI aid in planning, there are also some concerns. They could potentially reduce the speed and dynamics of the command, forcing some reliance on slow processes. They could also impose the need for more training and requirements needed to use them. They could also possibly cause a loss of adaptivity in favour of by the book analysis.

In an article by Lukasz Apiecione, Dariusz Biernat, Wojciech Makowski, and Miroslaw Lukasik (2015) <sup>[27]</sup>, they talk about how after moving away from older generations of plane, their number of war planes has dropped, but they have new, more modern technology now to make up for it. They wanted to increase the pilot’s access to information, which directly



increases the pilot's success rate and odds of returning safely. To do this, they implemented AI into the planes that can take in information and analyse it for the pilot, updating them on a regular basis, without distracting him.

## **The Future of Artificial Intelligence by Maksymilian Rajchel (19247508)**

Throughout the years, many people have speculated through movies that the future of the human race, with the rise of more advanced Artificial Intelligence, can be very grim even to the point that it can endanger our existence. Personally, I highly disagree with these speculations and I would say that, on the contrary, Artificial Intelligence will bring many benefits with its continued advancements.

### **Artificial Intelligence in Cars**

One aspect that comes to my mind straight away when I think about Artificial Intelligence are self-driving cars. In 2014, a classification system with six levels was published by SAE International. These levels range from zero to five, zero being fully manual and five being fully automated.<sup>[28]</sup> At the moment, one of the most popular cars with a self-driving feature are cars manufactured by Tesla. Even though we probably all heard stories about how drivers fell asleep behind the wheels and the Artificial Intelligence inside their Tesla managed to bring them home safely, Tesla cars are still only classified as a level two SAE automation level, meaning that they need a constant driver monitoring. At the end of 2019, however, the founder and CEO of Tesla, Elon Musk, has stated that they plan on releasing cars with the necessary hardware built-in for a level five SAE system. He even claims that by the end of this year, Tesla will release "robotaxis" in USA, which function like normal taxis but are fully operated by Artificial Intelligence.<sup>[29]</sup>

Of course, like everything else, fully autonomous cars bring many ethical problems with it. One of the most popular of those ethical dilemmas is how the Artificial Intelligence may react to danger on road. Given that it may be pre-programmed to minimise the human fatality rate, it may, for example, choose to quickly swirl into another vehicle if it decides to prioritise your safety over the safety of other vehicle. Even though that's a valid argument, we cannot forget that almost 94% of traffic accidents happen because of human error.<sup>[28]</sup> A car with a SAE level five system can greatly reduce the amount of overall accidents on our roads, even if it has to sometimes make calculated yet ethically unpleasing decisions.

Even with such ethical issues, there are still some ideas that were put forward in order to stop things like this from happening. Allowing the Artificial Intelligence in self-driving cars to communicate with each other is one of these ideas. With it, if a danger occurs on the road, the Artificial Intelligence in other vehicles may work together to allow a safe passing for the endangered car, but this scenario would, unfortunately, only work with all vehicles being fully operated by Artificial Intelligence and for that we might have to wait a while.

### **Human-Artificial Intelligence Symbiosis**

Another very interesting aspect that we could utilise the advantages of Artificial Intelligence for, in my opinion, is human and Artificial Intelligence symbiosis. This could be achieved by planting chips and thin threads into the subject's brain through sewing-like machines. Even

though this sounds very like science fiction and seems like we could be long way off, there are companies that are already carrying out tests with such possible technology. The most known, and very likely the first company to start full work on it, is Neuralink. Neuralink plans on using 4 to 6  $\mu\text{m}$  wide threads with experiments already carried out on lab rats, where 1500 electrodes were planted inside its brain, and the Artificial Intelligence was able to read the information from rats' brain.<sup>[30]</sup>

Such technology may have many benefits as it can help in treating many brain disorders. It can also help people involved in accidents by creating a brain machine interface controlled by Artificial Intelligence. Such tests were already carried out on monkeys where it managed to achieve a level of mind-based Artificial Intelligence control.<sup>[31]</sup> The most interesting aspect of human and Artificial Intelligence symbiosis is the human enchantments that can come along with such symbiosis.

Many people worry that one day Artificial Intelligence may surpass humans and our intelligence. However, if we manage to achieve full symbiosis, we may be able to easily keep up with Artificial Intelligence on many levels. With the use of symbiosis, we could be also able to access eternal software and electronics, like our phone, without even touching it all thanks to those small machine-controlled chips and threads inside our brains. This could greatly boost our development as a race and bring us way above what we imagined is possible. Some philosophers and professors even believe that symbiosis with Artificial Intelligence may be the key to reach transhumanism and transform ourselves into different beings with enhanced abilities that are greatly developed compared to standard humans.<sup>[32]</sup> We could even call ourselves "post-humans" but that part, unfortunately, sounds too advanced to ever happen.

### **Artificial Intelligence in Education**

Education is a field in which Artificial Intelligence is starting to get a lot of momentum in recently and is definitely not stopping anytime soon. Many programs that are being used by students and teachers already implement Artificial Intelligence to help them in their work. For example, programs like Word implement Artificial Intelligence to scan a student's work and give them helpful tips whereas PowerPoint uses Artificial Intelligence to record a student's activity and give them helpful tips on their presentation.

However the learning experience students receive from Artificial Intelligence could be far more enhanced than simply implementing it into text and speech correction. We can already see that robots, like Nao, are being used in the education system to help teach younger kids.<sup>[33]</sup> With the advancements of Artificial Intelligence, every student could have a personal assistant similar to that of Nao or even to the structure of devices like Alexa, which could carry all the information that the student would be required to know and be able to teach it whenever it is needed. These kinds of personal assistants could also process the emotional state of the student. This use of Artificial Intelligence can already be seen in projects like ARTIE. This can analyse the student's emotional state by using keyboard and mouse interaction data. This data could be used by teachers to approach a student in an effective way, like changing their facial expressions, body language, tone of voice, etc.<sup>[34]</sup> Of course,

the most interesting question regarding Artificial Intelligence and education is “will robots replace teachers in their jobs?”. Even though it’s not an impossible scenario, many people speculate that Artificial Intelligence would not have the emotional aspect that a teacher would have.

## **Conclusion**

Overall, Artificial Intelligence has the potential to do amazing things. While it has done amazing things, there are things holding it back from meeting its full potential. For example, AI in the healthcare sector. However, if you give it enough time, we could have AI automatically diagnosing patients, helping students with their work, or even providing us with all the entertainment we could want. It might not be easy to achieve, but if we continue the research and work needed, this could easily be our future.

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