

Emerging Technologies

Matthew Crosby - 10170652

Contents

[Abbreviations 2](#_Toc9410889)

[Introduction 3](#_Toc9410890)

[What is Artificial Intelligence and the origins of AI 4](#_Toc9410891)

[How can AI converge with existing technology and how could it potentially replace them? 4](#_Toc9410892)

[How Ai affects the status quo of an industry, end user group and the current state of technology development. 6](#_Toc9410893)

[How did AI Affect us in the past? 6](#_Toc9410894)

[How AI affects us now 6](#_Toc9410895)

[How AI will affect us in the future? 6](#_Toc9410896)

[How AI influences a specific industry or user group as well as the political, economic and social factors. 7](#_Toc9410897)

[The benefits, features, advantages and disadvantages of AI 8](#_Toc9410898)

[Various Forms of Emerging Technology within Software Development 11](#_Toc9410899)

[Robotics 11](#_Toc9410900)

[Artificial Intelligence 12](#_Toc9410901)

[Driverless Cars 13](#_Toc9410902)

[Evaluation/Conclusion and the use of Emerging Technology when Designing Software for the Future 14](#_Toc9410903)

[Bibliography 18](#_Toc9410904)

[References 20](#_Toc9410905)

# Abbreviations

AI – Artificial Intelligence

B.C – Before Christ

MIT - Massachusetts Institute of Technology

CDSS - Clinical Decision Support Systems

AIDA – The Artificial Intelligence Design Assistant

# Introduction

Every day new technology is thought of, made into a concept and created but whether it will be useful is the main issue. Emerging technology is a new technology that is useful and can perform specific jobs which will make people want to own it. A new technology in cars is automatic braking when something steps in front of the car. This isn’t so much driverless cars but it’s a step forward. This is an emerging technology as it takes the human step of emergency braking out of the equation as the car will do it. This report will give information about what artificial intelligence is and how it will converge with/replace current technology. As well this I will be reviewing a specific industry and end user group who will be the most influenced by AI, I will be contrasting and evaluating the benefits, features, advantages and disadvantages of AI. Finally, I will be evaluating the ability of AI to disrupt the status quo.

# What is Artificial Intelligence and the origins of AI

There are many new technologies releasing every day, whether that be based off an already existing concept or a completely new idea, but the usefulness of the technology would depend on the task and what it can achieve. One of the most widely used emerging technologies is AI (Artificial Intelligence) which is “any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals” (Wikipedia) and has many different uses and abilities from problem solving to shopping.

These AI systems now may be widely available but from the research I have done I have found that the concept of AI dates back to B.C (Before Christ) as Greek myths of Hephaestus and Pygmalion had the idea of intelligent robots such as Talos who was a giant automaton made from bronze. The AI that people are more used to had been in concept for years before but in 1642 Blaise Pascal invented the mechanical calculator which had to be able to perform calculations. Back then, however, this technology was not developed enough and did not boom in an industry.



Four of Pascal’s calculators (Wikipedia)

The person who first gave meaning to the words artificial intelligence was John McCarthy who is considered “the father of AI” (world-information) who organized a conference for people with similar interest with AI to brainstorm. Following months later the Massachusetts Institute of Technology (MIT) started conducting research on AI.

# How can AI converge with existing technology and how could it potentially replace them?

When AI became widely available to everyone the technology we already had included the features required for AI to work correctly. Many of us have a mobile phone, with some of the most popular being Apple iPhones and Samsung Galaxy phones, and these phones all include front and rear camera(s) as well as a microphone. Match these with internet connectivity and you have a platform which AI can thrive on. What limits AI would be the specifications of the phone as even AI has its requirements. But all that would be required in order to widely spread AI through these phones is a simple software update to allow for the phones features to be utilized in a different way.

The common AIs on phones include Bixby by Samsung© and Siri by Apple© and how both of these AIs work by using a speech recognition to convert what you say to text. Back in 2011 when Apple introduced Siri into the iPhone 4 Siri “connected to a host of web services and offered voice-powered capabilities such as ordering taxis through TaxiMagic, pulling up concert details from StubHub, looking for movie reviews from Rotten Tomatoes, or sifting through restaurant data from Yelp.” (Techemergence) But today Siri can translate for you, playing music, and transferring money through bank accounts.

Another popular AI that converges with our current technology is Alexa by Amazon, this AI can be on our phones through updates utilizing the features of the phone but also through a separate device such as Amazon Echo which connects through Bluetooth to your phone allowing you to connect the Amazon Echo to your home Wi-Fi, from here your Echo device can now control most if not every Wi-Fi enabled device in your home making it a true personal assistant. The way Echo works is it “connects to Alexa-a cloud-based voice service” and from here it can play music from any room with a Wi-Fi speaker, turn lights on and off (if Wi-Fi enabled) and from recent advertisements can search any information you desire such as recipes if you are cooking or how to spell a word.

The way AI is heading it may soon replace many current technologies. An example of this can be driverless cars as AI that can drive a car isn’t introduced into current cars, instead it is introduced into a new car designed for it and eventually many cars that can be seen on the road will be driverless. AI is also replacing the hardware in technology such as mobile phones, unlike what I have previously stated about AI being integrated though a software update, this will only have so many possibilities. For technologies such as biometrics, the hardware would need to change in order for the phone to do this so this type of AI would replace current phones and right now it already is as some phones such as the Samsung Galaxy S9 and S9+ have biometric scanners.

Within my household, I have a lot of emerging technologies. I have Bluetooth and Wi-Fi speakers, new mobile phones and many more but to tie them all together I have an Amazon Echo and with every generation of new technology I own I have noticed the change in complexity and tasks that can be performed. For example, Bixby was released on Samsung phones in August 2017 making tasks on my phone easier. Another change I have noticed is with my Amazon Echo, now I can tell Alexa to perform tasks such as playing music and ordering from Amazon.co.uk. With the future being tomorrow any new breakthrough could be discovered changing the way we see technology and I have no doubt that eventually, all that we have will be obsolete due to new emerging technologies.

# How Ai affects the status quo of an industry, end user group and the current state of technology development.

## How did AI Affect us in the past?

AI in medicine started around 60 years ago in the 1960s with the intention to automate diagnosis on patients, but back then the AI did not explain how it came to its conclusion so was not widely accepted in the medical community as ‘one of the initial observations was that doctors could not trust AI systems’ (Rowanalytics) Back in 1970 Clinical Decision Support Systems or CDSS were used and are software which has been developed to enable doctors to make decisions. They allowed for advice based on patient’s records. An early CDSS was MYCIN which focused on managing diseases within patients, this meant that it focused more on the management of the infected rather than the diagnostic of patients. Another type of AI was QMR which used a customized algorithm which was ‘modelled on the clinical reasoning of one single University of Pittsburgh internist’ (Researchgate) so initially it was called INTERNIST-I. This AI would use a large database of categorized diseases but QRM was unable to make a full determined diagnostic, instead it provided advice until a full diagnostic was made.

## How AI affects us now

Since these early AI machines in medicine AI has improved to be able to promise affordable healthcare with accurate diagnosis. Some of the more recent AI systems are apps made to utilize our phones features, an example being Apples fitness and health app which helps to promote healthy behaviour. Another big area in which AI is affecting us today is AI assisted surgery. Even though AI is not trusted enough to be able to perform a surgery with no humans at all, they can currently be used to assist us, an example is being able to make more precise insertions with a higher magnification. Currently AI can perform simple tasks such as stitching a cutting. Currently as well AI can detect life threatening diseases such as cancer at an early stage which increases the chance of survival. It does this by processing mammograms and radiology images 30 times faster and with 99% accuracy. Another example is Google’s DeepMind technology that has been programmed to detect more than 50 types of eye diseases, it does this by analysing 3D retinal scans to be able to give an accurate diagnosis of any conditions a patient may have. Another way AI has affected us now is having the ability to give a precise amount of medicine to a patient based on their characteristics.

## How AI will affect us in the future?

AI in the past 50 years has increased dramatically, things of science fiction back then included what we have today, an example of a common AI system are personal assistants. Another way AI will affect our future is by having complex AIs that will be able to perform round the clock surgery on patients without the need of humans. AI could also be used to diagnose patients and correctly treat them on the spot without the need of waiting and going to different consultants. With the ability of AI being able to spot trends, AI could eventually be able to predict diseases and cure them before the disease fully happens, an example is a simple cold, you only start getting the effects after the cold virus has multiplied enough but if an AI could detect the cold virus before this happened and isolate or destroy it before it multiplies itself them a cold will be cured before its really eve started. Another field AI will be good at is discovering new drugs quicker. How people do this is by breaking down different substances to see their makeup of compounds and then test to see how they respond to different diseases, now with an AI, it could do this task a lot faster and find new cures quicker.

# How AI influences a specific industry or user group as well as the political, economic and social factors.

AI is a very wide topic and can be applied to almost any industry no matter how complex the AI might be. For example, a simple AI that sorts data could be implemented to a records company to help keep the information organized. A specific industry would be healthcare. Healthcare has a lot of unstructured data but with AI companies can structure the data such as reports to provide ‘better and faster health services.’ (Becominghuman) An example of an AI that does this is IBM Watson, this AI obtains structured data such as clinical notes and unstructured data, such as reports, that can be used to be able to correctly diagnose and give the most effective treatment plan to a patient. Essentially providing the service of a doctor. American physician William J. Mayo stated, “The aim of medicine is to prevent disease and prolong life, the ideal of medicine is to eliminate the need of a physician” and with AI this can correctly assess diseases and give treatment plans. Other technology that have a simpler version of AI include machines that can take a sample and be able to spot anything foreign in the sample. Now, if we take this type of AI and combine it with what IBM Watson can do to be able to give even more accurate readings a lot faster that having to send a sample off to a lab to get it analysed. Instead it is all done whilst you are at the doctors so a quick treatment plan can be given. Whilst this is just a concept for an AI diagnosis machine it would grant greater and faster medical services. Real doctors will still be needed to ensure that the AI is correct and to see patients that may have a more serious injury that just a cold for example. With this type of advancement in machines the healthcare industry is expected to grow the fastest in terms of data generation. AI is also helping in medical imaging, the discovery of new drugs and surgery. For example, the da Vinvi surgical robot was designed to be able to assist surgeons in complex surgeries with its dexterous robotic limbs. Due to all these benefits AI can provide mortality rate has decreased as AI can prioritize for patients with urgent and life-threatening illnesses. Another way AI influenced the medial industry is by having therapeutic animal robots which also links in with social factors as AI can help with quality of life and also reduce blood pressure, reduce anxiety and help with social skills, just like a real pet would do. Errors due to human fatigue can also be eliminated as AI does not suffer from fatigue, distractions, anything that could possibly affect the mood of a doctor. So due to this data can be processed a lot faster and a lot more accurate. The social aspect of AI in medicine can be very beneficial to patients, another example is some patients may have an embarrassing issue that they would feel a lot more comfortable taking about to a machine which will lead to more people getting treated. Now this does impact the social interaction with other people as less patients will be seen by doctors but in the medical industry eliminating social interaction with doctors is a lot more beneficial to people overall with more accurate and faster diagnostics happening due to AI. Now taking the economic factors into consideration, AI is expensive to produce, some in the millions but once this AI has been established it will cut costs overtime leading to money being spend improving other areas of the medical field such as vaccination. It can also undertake highly complex tasks and depending on the hardware and AI maybe more than one task at a time increasing productivity. Ai also has the ability to see any trends that may be occurring due to access of millions of bytes worth of data. In 2015 Google and Ethicon developed AI bases surgical equipment that enables an extremely high level of precision, far greater than what can be achieved manually leading to less blood loss, trauma and scarring. Within politics there is a lot of debate when it comes to the medical field and recently, late 2018, the NHS received cuts to their budget which means that new hospital equipment will be harder to afford. With AI, money will be saved in the medical field which could make up for these lost cuts. However, would it be justified for AI to be used on whole populations? This is a decision the government must take into consideration as at the minute we are still at an early stage of AI in healthcare. Current health campaigns aim to improve quality of living and life. So, will AI be a better campaign? Due to the benefits yes but it’s still a matter of social and ethical which needs to be taken into consideration.

# The benefits, features, advantages and disadvantages of AI

AI has many advantages, and many benefits because of these advantages, but what those advantages are depend on the features of the AI as they are usually built with a specific task in mind. Like all things that have advantages, AI will have some trade-offs or disadvantages meaning multiple approaches may need to be taken to find the suitable solution for whatever AI is needed.

Firstly, I will start with the advantages of AI. AI can deal with tasks that a person may not enjoy doing due to it being uninteresting for example. The way AI can achieve this is through automation to insure perfect precision and increase productivity. Due to AI being able to complete these boring tasks, people have the ability to perform the more creative tasks which would decrease negativity and increase enjoyment in the workplace. Another advantage of AI is that it can make extremely fast decisions and perform actions a lot faster than people. With people, we have a reaction time which to increase would take a lot of work, but the chance of getting the type of reaction speed that a computer can achieve is almost impossible and with hardware getting more and more powerful the speed of computers is constantly increasing. An example of this would be in factories where one smaller object will need to be inserted into a larger one to make a product, people would have to think about this, and their accuracy and reaction times would determine how fast this task can be completed. Whilst with an AI robot, these tasks can be completed at the same speed every time without mistake and at 100% accuracy. AI also has another advantage which is being able to aid humans by venturing to place we may not be able to, this could be due to space, toxicity and radioactivity. The best way to explain this advantage is by adding an example so if we look at the Mars rover, this AI robot can explore the surface of Mars with far less requirements than we would need such as water, food, sleep. A robot would only require power which can be generated via solar power when the rover is on the side of the planet the sun is. Something else an AI robot can achieve that we cannot is being able to withstand constant and drastic weather/temperature changes. We could also use this type of technology in areas such as underwater exploration to find new species and oil or in medical diagnosis. AI can also help with our daily lives, take Alexa for example. Alexa is a personal assistant that can answer questions you may have such as the weather, or how to spell a word, the way Alexa achieves this is by converting what you say into text and then searching for it on the internet before using text to speech to read out what it has found. Alexa can also assist in shopping as most people suddenly remember something, they need in the middle of doing some other job, with Alexa you can ask it to add the item to your shopping list so that you don’t have to stop whatever task you are already doing. This type of daily life AI can also be applied to your phone when taking photos. If we take a photo of a few people the AI could be used to identify faces and if the AI knows whose face is whose due to previous knowledge, this AI could give those faces a name. A service that does this is Facebook, Inc. Facebook can identify whose name belongs to whose face when a photo is uploaded and tag them. It can do this from previous knowledge of identifying a person when someone manually tags someone in a photo, Facebook learns from this to be able to automatically do this.

Closely related to advantages is benefits. Benefits can have a large impact on businesses, for example, AI can save money and time within a business thanks to the advantage of being autonomous so that it can perform the same task over and over without fail. Money and time are two of the most valuable assets in a business so cutting down on both of these is a huge benefit. The medical industry is an example as thanks to AI patients can get diagnosed quicker and money can be saved which can be spent in fields that may need improving, for example, the research of new drugs to fight diseases. Another benefit is being able to increase productivity and the efficiency of this productivity. AI can either replace jobs that people can do, fill in the roles of jobs that would be too dangerous for people or work alongside people to carry out a task. All of this is possible due to the improvement of AI and deep learning. According to Accenture.com the United Kingdom has increased in productivity by 25% which is a very large amount allowing for people to make more efficient use of their time which can be used to focus on more important tasks. With the technology of AI including hardware increasing in performance, AI is at an all-time high when it comes to all the abilities and potential it has in my opinion. This leads to even faster processing time which means an AI can sort through a set of data extremely fast compared to people, which could increase the revenue of the company meaning that more money can be invested into the company to be able to increase profits and the turnover. This benefit also helps in optimizing a business to help it run correctly, efficiently and faster. This will be very beneficial to all businesses in achieving cost savings. A huge benefit with AI is its upgradability which was briefly mentioned above. AI has the ability to be upgraded at any time in terms of the hardware it uses to be able to compute faster, any extra features such as arms for holding items and the software that it uses to be able to use these added features to the best of their ability as software and algorithms that isn’t efficient will cause the AI to run slower which is not what is wanted in a business as cost and time will increase.

With any business there are requirements in order to make that business function correctly and efficiently and if a business was to introduce AI into their systems, the AI would require features to be able to fulfil the role needed. One of the most important features an AI would require for a business is machine learning. Machine learning is the act where an AI can take information and essentially learn from it to be able to do a job more efficiently without human intelligence. A more recent development in AI is deep learning which is a type of machine learning but based off of the human brain by having artificial neural networks and complex algorithms to mimic the human brain and have the ability to be able to learn from huge amounts of data. The reason deep learning is possible is because the amount of data we produce, we produce an estimated 2.6 quintillion bytes of data every day (Forbes) which makes deep learning possible. Thanks to this data AI can spot any patterns or anomalies in data and then alert people to this alteration. This helps reduce costs in maintaining the AI. A simple but effective example would be Netflix. Netflix looks at data from not just yourself but millions of other people with similar interests to yours, from here the AI involved will display programs and films that others like. This helps in keeping their business in profit as displaying programs the user would want to watch will urge them to keep a subscription with them. Another feature AI will need is natural language processing and natural language understanding. If you ever phone a business, there is more than likely going to be some sort of AI on the phone to direct you to the right people for the issue you have but for the AI to be able to do this it requires language processing and understanding. The AI will have the ability to understand what is being said and respond appropriately, also using the data being given to learn and improve its skills. The way AI does this is by converting voice into text, which allows for multiple languages and the analysis of what is being said. A real-life example of this could be phoning a bank for support/fraud protection, the AI would direct you to the right line.

Finally, with advantages there are disadvantages with AI. One of the main disadvantages with AI being the cost to create. The cost to create a powerful AI to be able to aid in maintaining a business will be very high as they are complex machine that need multiple algorithms to be able to function. Software is also another area that cost will be high as with AI changing and improving every day, the software assigned to it will need to be updated and maintained in order to be able to efficiently perform its job. As well as this, if the AI machine breaks down there will be a high maintenance cost to get the machine up and running again. For example, take hospitals, if a hospital system gets hacked like they have previously such as in May 2017, the AI systems may also get affected and instead of helping to keep people alive they could be hacked to do the opposite. Another disadvantage of AI is not being able to replicate humans, although this may be an advantage in a way, there are some disadvantages with not being able to achieve this yet. AI machines don’t feel any emotions, they don’t take morals into consideration, they simple do what they are programmed to do and if they do something different, they either perform incorrectly or break down. Not having the ability to be creative or have an imagination is another disadvantage of using AI as AI rely on facts and figures given to it. This is a simple disadvantage to some and may be classed as an advantage to not be able to express creativity. Now, one if the main disadvantages of AI is the unemployment of workers being replaced by AI as business owners may look at a job that can be done by a machine and chose to replace the person due to not having to pay a machine, this would save costs. Examples of this include Changying Precision Technology Company, this company used to employ over 650 people, now the factory is run by 60 machines that work 24/7 to perform the same job more efficiently. Only people that would need to maintain the robots and overlook what is happening in the company would actually still have a job.

# Various Forms of Emerging Technology within Software Development

## Robotics

Robotics are a somewhat recent emerging technology, it may not be as recent as technologies such as AI but it has been in the media over the past few years about people losing jobs, an article that supports this is “Robot automation will ‘take 800 million jobs by 2030’ – report” by BBC news. This article focuses on a study of 46 countries and 800 occupations by the McKinsey Global Institution, this study found out that up to a fifth of work globally could be replaced by robots, an example of the most likely to be affected are machine operators and food workers. The study also states that poor countries won’t be as affected as they will have less money to be able to invest into robotics. The study later shows that 39 to 73 million jobs will be at risk by 2030 in just the US alone.

What is the history of robotics? The word robot originated in 1921 and comes from the Czech for “forced labour.” A robot is an intelligent, physically embodied machine that can perform tasks autonomously. It wasn’t until the 1960s when robots started to be produced, the first being Shakey the Robot developed in 1966 by SRI, Shakey was the first mobile robot that could perceive its surroundings and perform tasks that needed planning such as route finding and being able to rearrange objects. This robot is the influence of modern robots. After Shakey was developed robotic arms were starting to be used in manufacturing, this first one being Unimate which was developed in 1961 and has the purpose to take die castings from machines and perform welding on auto bodies.

From here robots started trends, these trends include: the automation of robotics, this was the choice of improving efficiency within the manufacturing process and increase productivity, this is the most common trend as most robots now used within the production chain are programmed to be able to perform a job repeatedly without getting tired. Another trend is collaborative robots which help people in their jobs instead of taking them, these robots work alongside people to increase efficiency and productivity, some places that this type of robot could be used include healthcare, food preparation and consumer packaging. Drones are another trend that has blown up since 2016, drones can transport raw materials to an area where they are needed and can be used as surveillance to be able to monitor the work ethic, production line, count how much stock a company has and being able to assess the quality of products.

Once a robot has been created using different types of hardware such as sensors and cameras they need to be programmed to perform tasks, this is where software developers will come into play, companies that create robots usually have a team to program them as well such as Boston Dynamics, this company creates different robot concepts to be able to perform jobs such as moving items around, being a carrying robot for the military that can go over rough terrain and arms for the production line of products. The most common languages used in robotics are C++ and Python but in industry some use their own languages such as Kuka Robot Language used by Kuka.

## Artificial Intelligence

I have already described AI previously as well as the organs of it on pages 4, but there are some trends which I have not mentioned, one being AI-enabled chips that will be optimised for specific uses within AI, companies such as Intel, AMD, Nvidia and Qualcomm will produce these chips that speed up the time it takes to execute an AI application. Unlike a normal CPU which has been tailored for many different uses and scenarios, these chips will be suited to specific use case scenarios such as voice recognition and natural language processing. Another trend with AI is Deep Learning, in 2019 deep learning will be very popular within AI, Deep learning is a form of machine learning that is used to try and replicate the human brain by using artificial neural networks which are modelled from the human brain. The number of jobs between 2015 and 2018 has increased by 35-fold according to an Irishtimes article which shows that it is a fast and growing trend within AI.

Creating an AI isn’t as easy as it looks sometimes however as a lot of programming is required in order to make the AI learn from itself through trial and error, which is what most AIs do, an example is taking a small game of jumping over cubes, the AI will first do nothing other than go forward but once it learns that there is an optical there it will jump over it. The reason an AI will learn from doing this is because the developers will implement a reward and consequence system where if the AI dies it will create a negative number and if the AI jumps over the block it will create a positive number. The AI will be programmed to want the positive numbers so will learn from repeatedly attempting until the final generation knows exactly what to do. An example of where AI helps developers is the Artificial Intelligence Design Assistant which was deployed by Bookmark, a website to create websites. This AI will take a user’s needs and desires then search through thousands of styles until one is closely related to the users needs, then it will add different combinations of images, and different design elements. After this the AI will create a version of a website in around 2 minutes according to an article.

The reason I chose AI as my emerging technology is due to how diverse and widely available it is. By this I mean that AI is used everywhere such as in phones as personal assistants, being used to solve puzzles and spot trends and being used in driverless cars which has a whole host of uses. One of the most common uses for AI in the automotive industry include driver assist which puts the AI in a co-pilot position, this allows manufacturers to get comfortable with AI being in a vehicle before it can drive on its own. This AI in a co-pilot position monitors many sensors allowing for the AI detect dangerous situations that could occur and then alert the driver to avoid this or take control of the vehicle to avoid an accident. Another example is emergency breaking, if the car detects a hazard it can break with a faster reaction time than people. Another way which AI is being used within the automotive industry is driverless cars which at the current point in time is the most talked about AI within this field. Driverless cars need to have the ability to control the vehicles steering, braking and acceleration with the ability to judge how much do to these tasks. These tasks that an AI will be required to do will need to be programmed in a way that the AI can learn from itself and what’s happening around it. In my opinion I see AI as a centre point for most other emerging technologies such as driverless cars and personal assistants. AI is going to open the gateway for software developers to create software to ease quality of life for people. This could have many reasons such as robotic pets to ease anxiety, eliminating human fatigue by allowing AI to do tedious tasks, data being processes faster and eliminating the risk of getting distracted due to AIs not having the ability to do so. AI also allows for people speaking different languages to communicate thanks to a feature of AI called natural language processing and understanding, this means that an AI could translate one language to another allowing for these two different people to communicate. A software developer would have to integrate this natural language understanding into their software or could use an API such as google translate to do this which would save money and time.

## Driverless Cars

On a Forbes article about driverless cars it states that driverless cars have been in a thought process for decades but only recently is being put into practice due to AI being more widely available and advanced. It states that cars should eventually be able to identify how other cars behave, the weather conditions, any road issues on the journey as well as many other factors that may contribute to the journey. This means that the AI will need to be able to understand human behaviour when driver, such as how they will act as with human drivers everyone has a different skill level so some people may make more mistakes when driving, this is one factor the AI will need to understand. The article also states that cars have many assisted features to reduce human error, such as a new Nissan car, in their advertisement which I saw on TV it demonstrated someone walking in front of the car and then the car analysing this and breaking. Another article on McKinsey also states about driverless cars as this is a big upcoming deal currently and will be more common around 2030.

Not long after automobiles were invented people started to think about autonomous vehicles. In 1925 an inventor called Francis Houdina demonstrated a car that was controlled by a radio controller driving through the streets of Manhattan without anyone needing to turn the wheel. In 1969 John McCarthy, also known as one of the founding members of AI, stated that these cars should be capable of having the user enter a destination using a keyboard and then the car will navigate a public road using a camera. In those times these vehicles didn’t exist, but it gave a foundation for driverless cars that will be developed by engineers and software developers today.

There are many trends in driverless cars and below I shall explain a few that will help shape the future, these include: Optimization of routes in real time, if I compare this to Google Maps it is very similar as that will calculate the shortest route to a designation based on where you are. Autonomous vehicles being connected through a process called Vehicle to vehicle and another process called Vehicle to Infrastructure means that the vehicle will be able to gain real time information about road conditions, accidents and pile ups, from there it can calculate another route for you. Another trend that is with autonomous cars is to be able to increase how many cars can fit on the road as driverless cars can work in sync with each other so can be next to each other with a very small distance between them. With the cars being driven by an AI, if it is programmed correctly then it will have faster reactions so this will also reduce the amount of accidents that occur on the road. Another trend is reducing energy consumption, this is because driverless cars are lighter so will take less power to run, as well as this thanks to the materials we have today we can make a car lighter whilst keeping the structural integrity when accidents occur keeping a high level of safety.

So how does this relate to software development? Well, driverless cars will require software to be able to perceive its surroundings and also what the car should do in certain situations, as well as this some cars may have the ability to learn for themselves based on doing the same route every day, say if someone drive to work at 8am every day and the traffic was similar then the car would be able to calculate the arrival time and also another route that may be better. Software developers will also have to implement warning signs, traffic lights and other road markings/signs so that the car can identify them and understand what to do in that simulation as if this didn’t exist then the car may go over on a red light and cause a crash. As mentioned above about being related to google maps, software developers will need to program a map for the car or program the car to work with an already existing map, such as google maps, using APIs.

# Evaluation/Conclusion and the use of Emerging Technology when Designing Software for the Future

If we did not have many of the emerging technologies, we have today tasks would take a lot longer to complete. AI can shop for us, research for us, and help us with everyday tasks and in general make our lives easier and with the current rate in which AI is being researched and developed it won’t be long before it is integrated into more current technologies to either converge with them or replace them. AI is slowly becoming part of our daily lives and what once was though of science fiction is becoming reality. There are many advantages of AI such as increasing profits over time, aiding humans in getting to place we cannot, i.e. Space exploration and helping to cure people with diseases. With all the research we have gained from the 1970s, we have used this and inputted it into AI systems making them more complex than ever and thanks to machine learning the huge amount of data we create every day we can input that into an AI system speeding up the gap between reality and science fiction. Many emerging technologies today rely on another technology such as driverless cars relying an AI, without AI driverless cars would not be able to exist as the car won’t be able to perceive its surroundings. Many other emerging technologies such as updated smartphones and smart speakers also use AI for voice commands such as playing songs, asking the time/weather and sending texts through voice.

When designing an application in the future software developers will have the option to use AI to aid them, there are many examples of how useful AI can be in cases such as increasing productivity and efficiency. Previously I have mentioned about The Artificial Design Assistant used by Bookmark, this takes in the users needs and desires for a website and then creates a site that would be best suited to the user. In a business this can be extremely useful as it speeds up the process of developing websites meaning both time and money will be saved. Once AIDA has created a site based of the requirements it can then be left to the developer to add fine tweaks to the site to make it match the users needs as closely as possible. Without AIDA the process of making websites suit the users needs is still possible as even today most sites are created that way but in the future AIs such as AIDA will grow in the market and will expand to more businesses and users. If a business wanted to create a website the same way AIDA does, then they would have to go through millions of combinations until the best one matching the requirements is found whilst with AIDA one million combinations can be processed within 2 minutes and then finally return the best matching combination to the developer.

Another reason AI could be used in the future within software development is software testing. Applications today communicate with each other by using many different APIs, with these APIs growing and complexity daily, and with the complexity increasing this means that more and more challenges will be introduced. The way this can be avoided is by using AI tools that can create test information, explore the authenticity of information and finally testing. By using the correct AI testing performed can be error free, as well as this testers, who would have to repeatedly run manual tests, will now have more time to create software tests that are automated. Another advantage is AI testing is that repeating tests over and over can be very costly and time consuming so with AI it prevents this by automating the tests. An example of an AI testing too is the Functionize tool which allows for users to be able to quickly test and release thanks to AI enabled cloud testing. A developer/tester would only have to input plain English and it will be converted into a test case. As well as this the tool includes a feature called self-healing tests that will update in real time autonomously. Another tool is SapFix which is used by Facebook to generate fixes for bugs which will have been identified by Sapienz. From there the tool proposes the fix to the engineers for them to approve it and finally deploy it into production.

GUI testing is also an area which AI could improve in the future. Most pieces of software today use GUIs/Graphical User Interfaces and testing is crucial to ensure that there are no failures. Currently the way the GUIs are tested is through a method called ad hoc which requires the tester to perform large tasks such as manually creating test cases, identifying conditions, when to check these conditions and finally evaluating whether the GUI has been sufficiently tested. As well as this if the GUI is altered after testing then the whole GUI would have to be retested costing a lot of time and resources. A tool such as Applitools can test GUIs thanks to AI. Applitools tests whether the visual code for the GUI is functional or not and ensure that the visual look of the GUI is what it is expected to look like. As well as this it allows for the user to look at what the GUI will look like on different screen layouts to see if it will fit all designs.

# Bibliography

En.wikipedia.org. (2018). Artificial intelligence. [online] Available at: https://en.wikipedia.org/wiki/Artificial\_intelligence#History [Accessed 5 Nov. 2018].

En.wikipedia.org. (2018). History of artificial intelligence. [online] Available at: https://en.wikipedia.org/wiki/History\_of\_artificial\_intelligence [Accessed 4 Nov. 2018].

En.wikipedia.org. (2018). Mechanical calculator. [online] Available at: https://en.wikipedia.org/wiki/Mechanical\_calculator [Accessed 4 Nov. 2018].

En.wikipedia.org. (2018). Timeline of artificial intelligence. [online] Available at: https://en.wikipedia.org/wiki/Timeline\_of\_artificial\_intelligence [Accessed 4 Nov. 2018].

Samsung Electronics America. (2018). Bixby. [online] Available at: https://www.samsung.com/us/explore/bixby/ [Accessed 5 Nov. 2018].

Techopedia.com. (2018). What is Artificial Intelligence (AI)? - Definition from Techopedia. [online] Available at: https://www.techopedia.com/definition/190/artificial-intelligence-ai [Accessed 5 Nov. 2018].

artificial-intelligence. (2019). A new dawn. [online] Available at: https://www.ubs.com/microsites/artificial-intelligence/en/new-dawn.html [Accessed 29 Jan. 2019].

Clickatell. (2019). How businesses can benefit from artificial intelligence | Clickatell. [online] Available at: https://www.clickatell.com/articles/technology/businesses-can-benefit-artificial-intelligence/ [Accessed 29 Jan. 2019].

Dataquest Data Science Blog. (2019). From admin tasks to early diagnosis. [online] Available at: https://www.dataquest.io/blog/how-ai-will-change-healthcare/ [Accessed 2 Feb. 2019].

Frank, A. (2019). How Artificial Intelligence Will Impact the Future of Work. [online] CMSWire.com. Available at: https://www.cmswire.com/digital-workplace/how-artificial-intelligence-will-impact-the-future-of-work/ [Accessed 2 Feb. 2019].

GeeksforGeeks. (2019). Linked List vs Array - GeeksforGeeks. [online] Available at: https://www.geeksforgeeks.org/linked-list-vs-array/ [Accessed 1 Feb. 2019].

Guta, M. (2019). 6 Features You Should Look for in Any AI Solution - Small Business Trends. [online] Small Business Trends. Available at: https://smallbiztrends.com/2018/03/features-of-ai-solutions.html [Accessed 29 Jan. 2019].

PMLive. (2019). Artificial intelligence in healthcare. [online] Available at: http://www.pmlive.com/blogs/digital\_intelligence/archive/2018/october/artificial\_intelligence\_in\_healthcare [Accessed 2 Feb. 2019].

Psychology Today. (2019). The Future of AI in Health Care. [online] Available at: https://www.psychologytoday.com/gb/blog/the-future-brain/201806/the-future-ai-in-health-care [Accessed 29 Jan. 2019].

Roe, D. (2019). 6 Ways Artificial Intelligence Will Impact the Future Workplace. [online] CMSWire.com. Available at: https://www.cmswire.com/information-management/6-ways-artificial-intelligence-will-impact-the-future-workplace/ [Accessed 2 Feb. 2019].

Stack Overflow. (2019). What is the advantage of linked list over an array and vice versa?. [online] Available at: https://stackoverflow.com/questions/7496251/what-is-the-advantage-of-linked-list-over-an-array-and-vice-versa [Accessed 1 Feb. 2019].

Thecshandbook.com. (2019). Runtime and Memory - The Computer Science Handbook. [online] Available at: http://www.thecshandbook.com/Runtime\_and\_Memory [Accessed 1 Feb. 2019].

World Economic Forum. (2019). This company replaced 90% of its workforce with machines. Here's what happened. [online] Available at: https://www.weforum.org/agenda/2017/02/after-replacing-90-of-employees-with-robots-this-companys-productivity-soared [Accessed 29 Jan. 2019].

World Economic Forum. (2019). What impact will automation have on our future society? Here are four possible scenarios. [online] Available at: https://www.weforum.org/agenda/2018/02/what-impact-will-automation-have-on-society-four-scenarios/ [Accessed 29 Jan. 2019].

# References

Amazon.co.uk. (2018). Amazon Echo (2nd Gen) - Smart speaker with Alexa - Charcoal Fabric. [online] Available at: https://www.amazon.co.uk/dp/B06Y5ZW72J?tag=googhydr-21&hvadid=224384081743&hvpos=1t1&hvexid=&hvnetw=g&hvrand=15809503471796945732&hvpone=&hvptwo=&hvqmt=e&hvdev=c&ref=pd\_sl\_5a451lrvs7\_e [Accessed 5 Nov. 2018].

Jesus, A. (2018). AI for Speech Recognition - Current Companies, Technology, and Where Its Headed. [online] TechEmergence. Available at: https://www.techemergence.com/ai-for-speech-recognition/ [Accessed 5 Nov. 2018].

Accenture.com. (2019). Future of Artificial Intelligence Economic Growth | Accenture. [online] Available at: https://www.accenture.com/gb-en/insight-artificial-intelligence-future-growth [Accessed 29 Jan. 2019].

Anon, (2019). [online] Available at: https://www.researchgate.net/publication/326751518\_Use\_of\_Artificial\_Intelligence\_in\_Healthcare\_Delivery [Accessed 28 Jan. 2019].

Arrk Group. (2019). Arrk | Artificial Intelligence: The Advantages and Disadvantages. [online] Available at: https://www.arrkgroup.com/thought-leadership/artificial-intelligence-the-advantages-and-disadvantages/ [Accessed 29 Jan. 2019].

En.wikipedia.org. (2019). Mycin. [online] Available at: https://en.wikipedia.org/wiki/Mycin [Accessed 2 Feb. 2019].

MobiHealthNews. (2019). In-Depth: AI in Healthcare- Where we are now and what's next. [online] Available at: https://www.mobihealthnews.com/content/depth-ai-healthcare-where-we-are-now-and-whats-next [Accessed 1 Feb. 2019].

nibusinessinfo.co.uk. (2019). Business benefits of artificial intelligence. [online] Available at: https://www.nibusinessinfo.co.uk/content/business-benefits-artificial-intelligence [Accessed 29 Jan. 2019].

OpenMind. (2019). The Impact of Artificial Intelligence in Healthcare - OpenMind. [online] Available at: https://www.bbvaopenmind.com/en/el-impacto-de-la-inteligencia-artificial-en-la-asistencia-sanitaria/ [Accessed 1 Feb. 2019].

Raghunandan, M. (2019). 5 Real-World Examples of AI in Healthcare - The Kolabtree Blog. [online] The Kolabtree Blog. Available at: https://blog.kolabtree.com/5-real-world-examples-of-ai-in-healthcare/ [Accessed 31 Jan. 2019].

Uckun, S. and Uckun, S. (2019). AI in Medicine – A Historical Perspective | RowAnalytics. [online] RowAnalytics. Available at: https://rowanalytics.com/blog-post/ai-in-medicine-a-historical-perspective/ [Accessed 2 Feb. 2019].

WiseStep. (2019). Advantages and Disadvantages of Artificial Intelligence - WiseStep. [online] Available at: https://content.wisestep.com/advantages-disadvantages-artificial-intelligence/ [Accessed 29 Jan. 2019].

BBC News. (2019). Robots to 'take 800 million jobs by 2030'. [online] Available at: https://www.bbc.co.uk/news/world-us-canada-42170100 [Accessed 2 May 2019].

Robothalloffame.org. (2019). The Robot Hall of Fame - Powered by Carnegie Mellon University. [online] Available at: http://www.robothalloffame.org/inductees/03inductees/unimate.html [Accessed 2 May 2019].

Simon, M. (2019). Everything You Ever Wanted To Know About Robots. [online] WIRED. Available at: https://www.wired.com/story/wired-guide-to-robots/ [Accessed 2 May 2019].

Sri.com. (2019). SRI International. [online] Available at: https://www.sri.com/work/timeline-innovation/timeline.php?timeline=computing-digital#!&innovation=shakey-the-robot [Accessed 2 May 2019].

Anon, (2019). [online] Available at: https://schooledbyscience.com/robotics-trends/ [Accessed 2 May 2019].

The Irish Times. (2019). The top six trends in artificial intelligence for 2019. [online] Available at: https://www.irishtimes.com/business/technology/the-top-six-trends-in-artificial-intelligence-for-2019-1.3751459 [Accessed 2 May 2019].

The Irish Times. (2019). The top six trends in artificial intelligence for 2019. [online] Available at: https://www.irishtimes.com/business/technology/the-top-six-trends-in-artificial-intelligence-for-2019-1.3751459 [Accessed 2 May 2019].

Business Intelligence. (2019). Top-3 Trends that will Drive the Market for Autonomous Vehicles - Business Intelligence. [online] Available at: https://www.infinitiresearch.com/thoughts/top-3-trends-will-drive-market-autonomous-vehicles [Accessed 3 May 2019].