Artificial Intelligence and Internet of Things in the Future

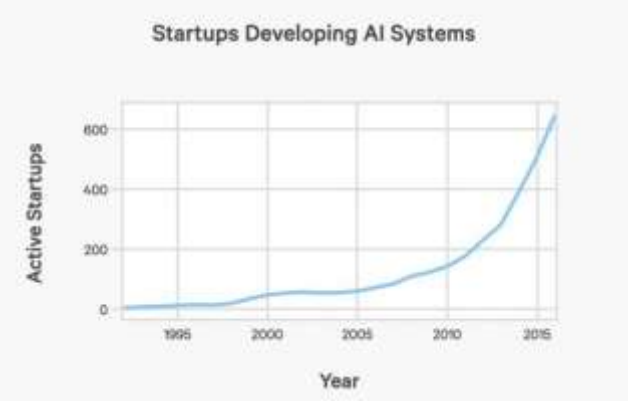
Huzaifa Zia, Hanzalah Patel, Zubair Islam, Shahab Zafar, Ziyad Khan

Abstract

Artificial Intelligence (AI) is the capability of a computer system to perform tasks that normally require human intelligence, such as visual perception, speech recognition and decision-making. The Internet of things (IOT) are physical objects that are embedded with sensors, processors and Artificial Intelligence that connect with other devices through the Internet. As the worlds shifts towards a technology focused directive, AI has increased its presence everywhere, but many believe it poses a threat to the current state of the Earth. However, most believe that AI is the next step to human evolution and the future should be all AI based.

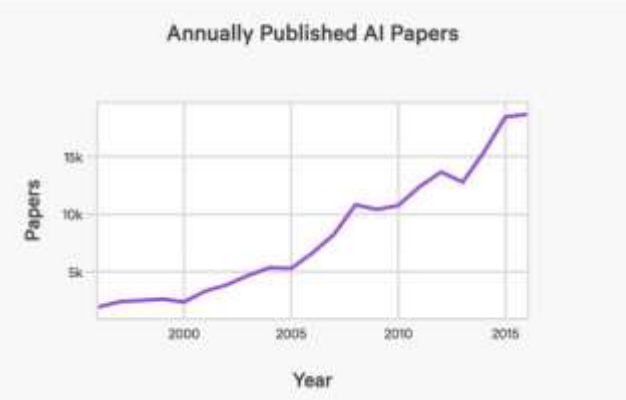
Introduction

This journal paper goes in depth on the impacts, advantages and disadvantages of Artificial Intelligence and Internet of Things in the future. However, it is first important to set a solid definition of AI and IOT. John McCarthy defined AI in his 2004 paper (McCarthy, 2020), "It is the science of engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable" (McCarthy, 2020). IOT are devices that have become 'smart' by being connected to the internet, such as fit bits, Alexa, Doorbells, Cameras, etc. In this paper, we discuss how AI and IOT will affect healthcare, warfare, education, finance, and automobiles in the future. We go in depth in the advantages and disadvantages of each and predictions on what impacts it will have in the future. In the end, a biased and unbiased conclusion is drawn on what our research has shown will be the most likely impact on the future. This paper has increasing significance in every industry. As the following graph shows. The rate at which start-ups are developing AI systems is increasing exponentially.



Related Work

There has been a rapid increase in research areas concerning Artificial Intelligence and Internet of Things. According to Forbes.com, there has been 14% increase in the number of active AI start-ups since 2000. Investments into AI venture capitalist has also increased 6% since 2000. Lastly, the share of jobs requiring AI skills has grown 4-5% since 2013 [Forbes, 2019]. The following graph shows the increase in AI published papers until 2015. From the graph it is obvious that the ultimate trend is exponentially increasing showing no sign of slowing down.



Janna Anderson from PEW Research Center has published a 123-page article about Artificial Intelligence and the future of humans where she goes in depth about how humans and AI driven machines will coexist in the future [Anderson, 2018]. In another paper, Artificial Intelligence, and the Future of Warfare, the author M. L. Cummings, writes about his research in examining how AI will probably be used in future combat and whether it will be universally excepted or not. There are many more related articles that give in depth analysis of what Artificial Intelligence could become in the future.

AI in the Future

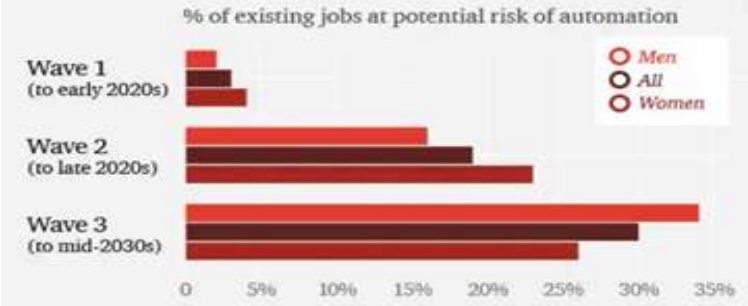
Healthcare

In the last few decades technology has improved greatly which has helped improve everyday healthcare for billions of people. To begin with, Artificial Intelligence is computers/robots that can think and learn over time. The way AI "thinks" is by using the internet of things to find and process data to create algorithms and analyze them to find a solution for problems faster than humans can.

In present times AI might not be as advanced as shown in movies but many everyday essentials used by people implement AI. A few examples are smart watches/bands that people use to check their heart rate and blood pressure, glucose monitors that check sugar levels using blood, ATM's, etc. Similarly, with healthcare advancing by leaps and bounds the data that has been accumulated is used by AI's and cross referenced with the internet of things to figure out how to best treat a disease or injury. Additionally, along with AI, mechanical technology has also advanced to the point that engineers and scientists are combining the two to create a "robot" capable of doing surgery with perfect precision. Moreover, many people focus on physical healthcare but forget that mental health is equally as important and with the advancements in AI, engineers have created chat

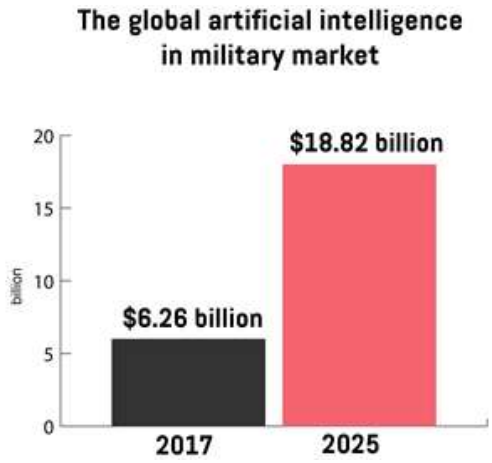
boxes that talk to people and give them intelligent answers to comfort them if they are not able to speak to other people.

Furthermore, after listing a few advantages there are obviously disadvantages that come with AI as well, the biggest being AI replacing human jobs. As AI becomes more advanced, they will start to replace human jobs as they do not get sick, do not need the weekend off, do not make simple mistakes, etc. The following figure shows how much percentage of jobs are estimated to be replaced by AI until 2030. Similarly, since AI uses historical data to create possible solutions for patients, they cannot do anything about new diseases or viruses that have mutated and changed overtime since no data exists for them. Also, when AI uses historical data to create solutions, they do not consider possible complications that may arise such as allergies and data about a patient. In conclusion, AI has been advancing at an astounding rate and will continue to do so, but with many advantages also comes disadvantages.



Warfare

The use of unmanned aerial vehicles (UAV), more commonly known as drones have already struck fear in many people's hearts and has initiated a heated debate on whether such technology should be uprightly banned. The more advanced Artificial Intelligence becomes and thus the stronger war robots become, the less humans will have to fight on the frontlines. These war robots could be in air, under water, or on land, and theoretically incorporate their AI to execute missions on their own. Fear is not only restricted to AI driven war robots but also to IOT devices being used in war such as IOT-connected radars and sensors that collect and relay enemy troops position, supplies and networks back to headquarters (Martin, 2020). With so much uncertainty and fear regarding AI and IOT future in warfare, many people question the ethical and logical reasoning behind whether research and development should continue or not in this field. As of now, the figure on the next page depicts an estimation of how much will be spent on average on AI in the military market. Many advantages and disadvantages are prevalent in the future of AI and IOT in warfare. One can argue that AI has no advantages depending on how one's outlook is on war,



however, for military personnel, AI is a God sent technology that will keep more soldiers out of the frontlines, make it much easier to find and target enemies, deploy, and launch attacks on its own and most importantly remove the fear of war that is highly present in a human's heart when fighting. These robots will not harbour such fear since they do not have a life which they wish to protect.

The advantages of such technology are appealing however, the foreseen disadvantages draw just as much attention. There are two types of disadvantages when discussing AI in the future. Firstly, it concerns military strength, such as technological limitations, inability to multitask, inability to explain how they made their decision and inability to distinguish between correlation and causation. The second is concerning ethics. These include topics like, principle of distinction (AI has a hard time telling the difference between a civilian and military officer) and accountability (who will be held accountable if civilians are killed). In response, many argue that the language of morality should not be applied to robots as they are to humans. For example, AI robots would not feel anger nor have the desire to take revenge (Maxwell, 2020). However, many prominent figures such as Elon Musk, Steve Wozniak and Stephen Hawking called for "a ban on offensive autonomous weapons beyond meaningful human control" (Maxwell, 2020).

Artificial intelligence will undoubtedly play a role in future military endeavours. It has a wide range of applications, where it will reduce workload on a user, enhance productivity and get tasks done more quickly than humans. Everyone has a bias on whether AI and IOT will be beneficial or disadvantageous for warfare in the future but as technology only ever increases, one can only wait and see what the future holds.

Automobiles

The term 'automotive IoT' alludes to embedding IoT innovations into car frameworks to make new applications and arrangements which can make vehicles more brilliant and cannier, working with protection, effectiveness, and open to driving (Guo, et al. 2018). IoT technology advancement is applied in the automobile industry to make inventive and progressed arrangements, including associated vehicle arrangements, Advanced Driver-Assistance Systems (ADAS), in-vehicle infotainment frameworks, route and telematics arrangements, prescient support arrangements and other operations.

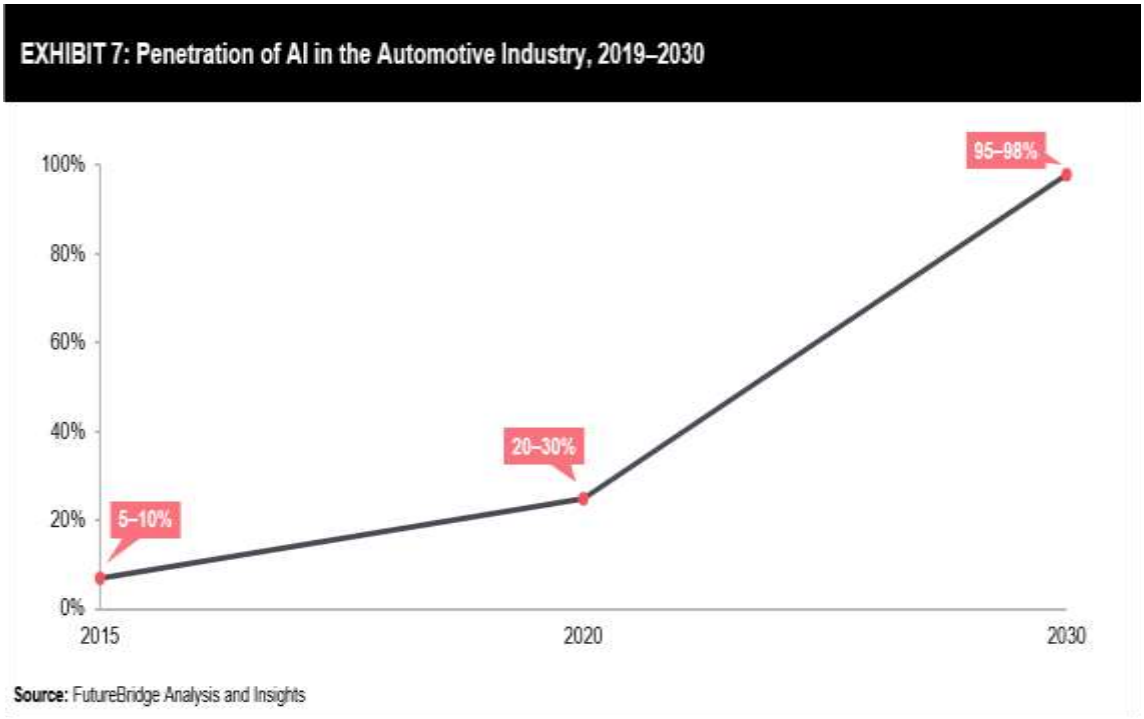
On relating the IoT to artificial intelligence in automobile industries, The Internet of Things and the Automobile Industry, the Internet of Things (IoT), is the primary driver of contemporary in-vehicle automatic transmissions. IoT allows digital instrument systems to communicate with other in-car systems and a peripheral device for network connectivity (Guo, et al. 2018). IoT-enabled intelligent appliances can provide documentation on mobility and telematics. They also offer a variety of amusement alternatives and facilitate mobile phone interconnection. Android-based navigation systems are poised to disrupt the market with Google's assistance and encouragement. Such digital instrument systems will support Google Maps, Google Assistant, and some other Play Store apps.

On the advantage, the Internet of Things has improved detection systems known as telematics systems in the vehicle industry. However, this technology uses telecommunications and information software to track and manage a vehicle's position, movement patterns, and other technical data. Automotive telematics systems can monitor authentic vehicle information such as speed and deceleration, fuel consumption, tire pressure, and mechanical problems. Telematics systems come in handy when it comes to tracking fleet activities. Routing protocol, reduced fuel usage, reduced operational charges, enhanced driver safety, increased fleet confidentiality, and remotely diagnosing repair requirements are just a few of the benefits of automation systems in traffic management.

Disadvantages: These are also drawbacks related to the internet of things and artificial intelligence in the automotive industry. They include Appropriate neural network training is one of the obstacles in successfully implementing AI systems (Özdemir, et al. 2018). The more complicated the problem is, the more complicated the machine learning algorithm must be. Creating and testing AI models that rely on enormous data sets to validate that model's function, as stated, takes a lot of money and experience. AI models necessitate considerable training, which necessitates the acquisition of vast databases. Although more significant training phases have already become available, training is still a time-consuming and costly process. To allow Approaches to learn and improve, most training instances must be classified by humans. A growing number of people are concerned that biases are sneaking into the training set.

Concluding, Machine learning has a wide range of potential applications in automotive manufacturing. Manufacturers may use AI technology to develop and create an invention, improve the performance of the supply chain, and enable proactive maintenance for machinery and equipment. However, despite its exciting promise, AI's use in the automobile industry is particularly complex. Computational biases,

reliability, and validity, and comprehending how a model arrived at a definitive conclusion are significant. The following graph shows the penetration of AI in the Automotive industry between 2019 and 2030.



Finance

IOT and AI are very useful tools for almost every field but, using these two can be extremely beneficial within the field of finance. They can provide a much more efficient and secure experience for consumers when you are in a field such as finance, where security and efficiency are top priority. IOT and AI can assist in making credit decisions helping to determine someone's loan eligibility as well as quickly and accurately finding fraudulent credit card transactions. Some examples are Orcolus, which is a program that analyzes bank statements, pay stubs, tax documents, mortgage forms, etc. to determine loan eligibility. Second, DataRobot, is an AI based technology used to determine fraudulent credit card transaction.

AI can play a huge role in data entry, review, and verification. When one is processing a credit card application the bank must enter the given information into their system, where they must then review and verify it. They can then use that information to calculate a risk score for that customer. When AI is in play the mundane and repetitive task of entering and reviewing data is all automated, freeing the employee to focus on higher value tasks. Using AI for repetitive mundane tasks financial institutions can reduce

the time needed to approve an application while also being more accurate without human error.

AI can also detect the complex methods of fraud which are used in today's financial world. As fraudsters come up with better ways to avoid being quickly detected by humans, AI has become increasingly valuable. An AI model can be trained with large amounts of data such as customer information and transaction records to recognize suspicious behaviour before it is too late. AI can also detect fraud more accurately than a traditional employee. When an employee is analyzing the activity on a credit card there is the possibility of false positives or negatives. When AI is in play this possibility is almost eliminated since it has been trained with thousands of examples.

Although AI and IOT have a great advantage within the Finance field, they also bring disadvantages with them. The technology created to solve these problems is very sophisticated and that causes it to be very expensive for most businesses looking to implement it. Many of the people within this field will also complain that they are being replaced by these software companies. As AI advances it will become unstoppable, and this will cause humans who are trained to their jobs to become obsolete. Ethical issues also arise with the introduction of AI into a field such as finance. There is always the possibility of consumer data being sold for other purposes and security is a major concern for people within this field. Overall, AI and IOT have potential to revolutionize the finance industry but, with the advancement of technology humans will become obsolete reinforcing the fight between man and machine.

Education

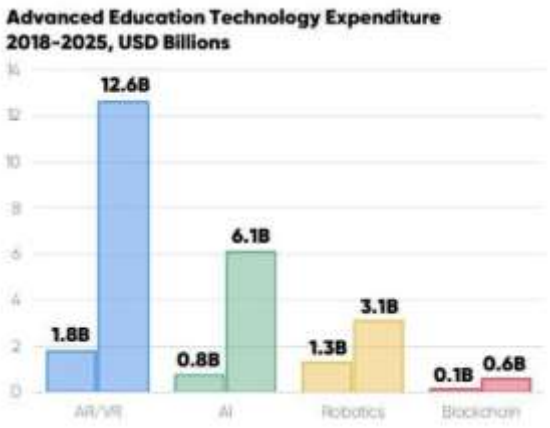
The Internet of Things (IOT) and Artificial Intelligence (AI) are beneficial when used together in the field of education. Through personal devices that students can carry implementing IOT technology and with the use of AI, specialized learning, attendance, grading, and helping decide students' futures can be made more efficient. IOT and AI can help students in many ways that aid their learning. There are many advantages to this technology in education, with one major disadvantage, which is jobs being lost.

For years, qualified educators have known that there is no such thing as a one-size-fits-all approach to learning. Every student learns things at their own pace. In a traditional classroom setting with multiple students, it can be difficult for the teacher to help each student enough that they can be fully caught up. To help this issue, IOT and AI can help keep every student on track through devices. AI can be implemented that can test these students and help them learn efficiently. AI can also help with grading work. When grading work, each teacher might mark things differently, which can result in improper grading. AI can help solve this problem through

precise grading. Furthermore, learning other languages can be made more efficient by having an AI interact with the student using a device to help guide them. Moreover, students might not be confident about what they might want to study after graduating school. There was a survey conducted which found that "only 10-15% of students in the U.S know which path to pick after graduating from school" (Martin, 2020). This is an issue because it might cause students to waste their time in a field of study that was not for them in the first place. This can be solved by AI, which can predict career paths based on an algorithm, using the students' information such as their interests and their grades.

Taking attendance can be very time-consuming to do everyday. To help speed this process, chips could be placed inside student's ids which can be detected by sensors at the entrance of classes to immediately update the attendance of the student. Additionally, students may sometimes not be able to attend class in person due to many reasons, such as being sick, or living far away. If a student is sick and cannot come to class, classes can be recorded as needed and notes can be posted online by the teacher, to ensure they do not fall behind. This helps the student from not falling behind by being able to go over what they missed at home. Also, if a student lives far away, they can instead learn the material online and get help as needed, through their computer using AI.

Disadvantages in this field are that teacher's jobs can be at risk. With the easy accessibility of free courses and YouTube tutorials online, students might not feel the need to enroll in a university program and rather learn for free online.



This graph shows in what areas of education that investments are being made. Investors are focused on AR/VR technology and second AI in education. They understand the importance of AI and are continuing to invest more into the field.

Conclusion

Artificial Intelligence and IoT are emerging technologies that have many years of further evolution to go through. It is premature to make any arbitrary estimation on what they will become as technology is independent of linear evolution and predictions cannot be made with absolute certainty. However, research has proved to predict somewhat accurately what something might go to become in terms of trend. Our research has taken in biases from both sides

to create a prediction of what AI and IoT might hold in the future, especially in the fields of healthcare, warfare, education, finance, and automobiles. Currently, Artificial Intelligence advantages and disadvantages are still being investigated in most fields as it is in its fetus stage. In healthcare, AI has the potential alongside with IoT to create even smarter devices to monitor health and thus, save many lives. Similarly, in warfare, AI, soon can be used to create ever stronger robotic weapons that need not be controlled by humans. In Education and Finance, Artificial Intelligence and Internet of Things devices have the capability to make regular transaction much simpler, such as attendance in school and in depositing, withdrawing, and trading in banking. Finally, in automobiles, AI has a never-ending potential in self driving cars and technologies such as lane assist, emergency brake systems, and navigation. However, as mentioned in this article, many disadvantages cloud over the fame and hope of AI. Most are related to loss of Human jobs and ethical implementations. Many fear that since AI has made many tasks much more efficient and cost effective compared to humans, that they will not be able to keep up with demand.

Furthermore, AI has very serious ethical discussions surround it mainly in the field of warfare. People do not trust AI, as it cannot be held responsible for innocent human deaths or even wrongful attacks. In the future Artificial Intelligence and Internet of Things devices will play a major role in every industry. Our research has shown that many advantages are present in AI that will help humans live more comfortable lives, nevertheless, only time will tell whether disadvantages outweigh advantages or vice versa. The age of Artificial Intelligence is already upon us. The future is here!

Future Directions

Since its inception in the 1950s, the field of artificial intelligence has experienced periods of rapid growth and rapid decline. Factors such as increased computational power and the availability of vital data have sparked renewed interest in the field in recent years. Because AI research is constantly evolving, the definition of what constitutes AI is also changing. On an unprecedented scale, AI has progressed from a theoretical concept to a practical application. From autonomous driving cars and stream history-influenced video viewing recommendations (Netflix, Los Gatos, CA, USA) to online purchase recommendations, advertisements, and fraud detection (Amazon, Seattle, WA, USA), AI has become deeply ingrained in many aspects of society and often operates invisibly in the background of our personal electronic devices (Helm, et al. 2020).

With great advancements and discoveries come huge risks of deterrence in human rights and growth as a society. Besides disturbing the basic morals of human society such as making us increasingly reliant on technology, uncontrolled AI developments such as, in the health sector

and warfare, can cause great distress to human society. With the greatest threat being the takeover of AI of numerous jobs across different sectors and causing unemployment at a large scale. This is bound to be one of the repercussions in the future with the growing research on AI and IoT. However, despite all the predictions and measurements made regarding AI and IoT, only time will tell what benefits or harm it is going to cause to human society in the future.

Distribution of Work

Huzaifa Zia

Abstract, Introduction, AI in Warfare, Conclusion, Compilation of report, presentation

Zubair Islam

AI in Education, presentation

Hanzalah Patel

AI in Healthcare, presentation

Shahab Zafar

AI in Automobiles, Future Directions, presentation

Ziyad Khan

AI in Education, presentation

Acknowledgments

The authors are grateful to each other for their support and teamwork.

Declaration of Conflict of Interests

The authors have declared no potential conflicts of interests with respect to the research, authorship, and /or publication of this article.

Funding

The authors have received no financial support for the research, authorship, and/or publication of this article as it was part of a school project.

References

Artificial Intelligence and the future of humans. (n.d.). Retrieved November 22, 2021, from https://www.elon.edu/u/imagining/wp-content/uploads/sites/964/2019/07/AI_and_the_Future_of_Humans_12_10_18.pdf.

(PDF) artificial intelligence-based Semantic Internet of things in a user-centric Smart City. ResearchGate. (n.d.). Retrieved November 22, 2021, from https://www.researchgate.net/publication/324801167_Artificial_Intelligence-Based_Semantic_Internet_of_Things_in_a_User-Centric_Smart_City.

14, M. lyam-J., -, M. lyam, Writer, A. M. lyam-, Writer, M. lyam-, Guest WriterGuest. (2020, May 29). *Revolutionizing IOT through ai: Why they're perfect together*. IoT For All. Retrieved November 22, 2021, from https://www.iotforall.com/artificial-intelligence-and-iot.

3 benefits of AI in Financial Services. GoodData. (n.d.). Retrieved November 22, 2021, from https://www.gooddata.com/blog/three-benefits-ai-financial-services/.

Application of IOT in Automotive Industry: Future of Automobiles. An End-To-End IoT Solutions Provider. (n.d.). Retrieved November 22, 2021, from https://www.biz4intellia.com/blog/iot-applications-in-automotive-industry/.

Artificial Intelligence and the future of Warfare. (n.d.). Retrieved November 22, 2021, from https://www.chathamhouse.org/sites/default/files/publications/research/2017-01-26-artificial-intelligence-future-warfare-cummings.pdf.

Cohen , H. (2020, July 14). *An introduction to IOT applications in Education*. IoT For All. Retrieved November 22, 2021

Columbus, L. (2018, January 19). *10 charts that will change your perspective on Artificial Intelligence's growth*. Forbes. Retrieved November 22, 2021, from https://www.forbes.com/sites/louiscolumbus/2018/01/12/10-charts-that-will-change-your-perspective-on-artificial-intelligences-growth/?sh=1577fbb04758.

Cordes, S. (2021, September 21). *5 benefits of using AI in Healthcare*. WWT. Retrieved November 22, 2021, from https://www.wwt.com/article/5-benefits-of-using-ai-in-healthcare.

F., C. W., William F. Clocksin William F. Clocksin School of Computing and Mathematical Sciences, Clocksin, W. F., & William F. Clocksin School of Computing and Mathematical Sciences. (2003, June 19). *Artificial Intelligence and the future*. Philosophical Transactions of the Royal Society of London. Series A: Mathematical, Physical and Engineering Sciences. Retrieved November 22, 2021, from https://royalsocietypublishing.org/doi/abs/10.1098/rsta.2003.1232.

Guo, K., Lu, Y., Gao, H., & Cao, R. (2018). Artificial intelligence-based semantic internet of things in a user-centric smart city. Sensors, 18(5), 1341.

Helm, J. M., Swiergosz, A. M., Haeberle, H. S., Karnuta, J. M., Schaffer, J. L., Krebs, V. E., … Ramkumar, P. N. (2020). Machine Learning and Artificial Intelligence: Definitions, Applications, and Future Directions. Current Reviews in Musculoskeletal Medicine, 13(1), 69–76. https://doi.org/10.1007/s12178-020-09600-8

How AI and IOT are changing daily operations in hospitals ... (n.d.). Retrieved November 22, 2021, from https://www.hcinnovationgroup.com/analytics-ai/article/21132663/how-ai-and-iot-are-changing-daily-operations-in-hospitals.

IOT is Transforming Modern Warfare. Lockheed Martin. (2020, January 15). Retrieved November 22, 2021, from https://www.lockheedmartin.com/en-us/news/features/2017/internet-of-things-transofrming-modern-warfare.html.

Jasper, A., & *, N. (2021, October 12). *IOT vs AI: Top differences to know between two strong rivals*. Valuecoders. Retrieved November 22, 2021, from https://www.valuecoders.com/blog/technology-and-apps/iot-vs-ai-the-difference-between-internet-of-things-iot-and-artificial-intelligence-ai/.

Lynch, M. (2018, May 27). *7 ways that artificial intelligence helps students learn*. The Edvocate. Retrieved November 22, 2021

Martin, D. (2020). *Machine learning for education: Benefits and obstacles to consider in 2020: Machine Learning, machine learning deep learning, education*. Pinterest. Retrieved November 22, 2021, from

Maxwell, P. (2020, April 20). *Artificial Intelligence is the future of warfare (just not in the way you think)*. Modern War Institute. Retrieved November 22, 2021, from https://mwi.usma.edu/artificial-intelligence-future-warfare-just-not-way-think/.

Muddana, V., Varshita MuddanaVarshita works as Content Writer at Soft Script Solutions Pvt. Ltd. She writes about e-commerce, & *, N. (2019, August 13). *What is the future of IOT or internet of things in Next 5 years?* Softscript Solutions Blog. Retrieved November 22, 2021, from https://www.softscripts.net/blog/2019/01/future-of-iot/.

Muddana, V., Varshita MuddanaVarshita works as Content Writer at Soft Script Solutions Pvt. Ltd. She writes about e-commerce, & *, N. (2019, August 13). *What is the future of IOT or internet of things in Next 5 years?* Softscript Solutions Blog. Retrieved November 22, 2021, from https://www.softscripts.net/blog/2019/01/future-of-iot/.

Özdemir, V., & Hekim, N. (2018). Birth of industry 5.0: Making sense of big data with artificial intelligence, “the internet of things,” and next-generation technology policy. Omics: a journal of integrative biology, 22(1), 65-76.

Pros and cons of Autonomous Weapons Systems. Army University Press. (n.d.). Retrieved November 22, 2021, from https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/May-June-2017/Pros-and-Cons-of-Autonomous-Weapons-Systems/.

The Pros and cons of using AI applications in the finance sector. The Pros and Cons of Using AI Applications in the Finance Sector | FP&A Trends. (n.d.). Retrieved November 22, 2021, from https://fpa-trends.com/article/pros-and-cons-using-ai-applications-finance-sector.

Phaneuf, A. (2021, January 29). *Use of AI in Healthcare & Medicine is booming – here's how the medical field is benefiting from AI in 2021 and Beyond*. Business Insider. Retrieved November 22, 2021, from https://www.businessinsider.com/artificial-intelligence-healthcare.

Ranger, S. (2020, February 3). *What is the iot? everything you need to know about the internet of things right now*. ZDNet. Retrieved November 22, 2021, from https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/.

The terrifying prospects of autonomous weapons. Richard van Hooijdonk Blog. (2021, June 4). Retrieved November 22, 2021, from https://blog.richardvanhooijdonk.com/en/the-terrifying-prospects-of-autonomous-weapons/.

The dangers of AI in the healthcare industry [report]. Thomasnet® - Product Sourcing and Supplier Discovery Platform - Find North American Manufacturers, Suppliers and Industrial Companies. (n.d.). Retrieved November 22, 2021, from https://www.thomasnet.com/insights/the-challenges-and-dangers-of-ai-in-the-health-care-industry-report/.