ARTIFICIAL INTELLIGENCE FOR BUSINESS: OPPORTUNITIES AND CHALLENGES

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Abstract - AI technology is still in its infancy and many of the technologies we call as AI today may not be AI of tomorrow. AI is destined to disrupt almost every industryand revolutionize our lives. This paper explores how AI technologies are disruptive and how they are impacting our lives, withthe associated opportunities and challenges. We are currently living in the era of weak AI, and strong AI and super AI are things of the future. AI is helping the businesses to remain competitive by redefining its business processes by maximizing personalization and automation and minimizing redundancy. AI applications open big opportunities in personal technical support, customer experience, finance, manufacturing, agriculture, healthcare, automotive industry and software development. It is expected that AI will be the major driving force in the fourth industrial revolution. There are many challenges preventing the widespread adoption of AI technologies such as fear of job loss, data privacy and security issues, provability issues, algorithm bias, data scarcity, and trust issues.As thebenefits outweigh the limitations significantly, AIwill soon find its place in this world.

Keywords - Analytics, Artificial Intelligence, Automation, Technology Disruption.

I. INTRODUCTION

Artificial intelligence (AI) is the technology describing the advanced processes for machines to make decisions based on logic [1]. Autonomous machines are seeping their way into our daily lives, slowly influencing how we work and engage ourselves [2]. Today there are several examples and applications of AItechnologies. These includevoice-powered personal assistants such as Google Assistant, Siri, Google Now, Cortana, Amazon Echo, Alexa, etc. Other AI technologies include autonomously powered self-driving vehicles, behavioral algorithms, predictive algorithms, suggestive searches, etc. Many of these technologies could be pseudoAI technologies of tomorrow. Today we live in the age of voice and non-voice-based interactions with machines or in the machine-learning phase of the digital age [2].

AI terminology was coined by John McCarthy in 1956. AI can be classified [3] into Artificial Narrow Intelligence (ANI) or Weak AI, Artificial General Intelligence (AGI) or Strong AI, and Artificial Super Intelligence(ASI) or Super AI. Another classification is as Analytical AI, Human-inspired AI, andHumanized AI.The first-generation AI or Weak AI systems are designed to act intelligently towards completing narrow tasks or to solve specific problems. ANI systems enable self-driving cars, conversational chatbots, recommendation systems, face recognition systems, etc. Strong AIis the second-generation AI, which is expected to have lot many capabilities includingthat of mimicking the human brain, and the decision-making activitiesit performs could be similar to that of human beings. AGI systemsare futuristic, and likely to be able toreason, plan, and solve problems autonomously for which they were never designedto [3]. The Super AI is the third generation AI, which is conceived to be systems with consciousness and self-awareness and will be capable of making human beings redundant in many aspects. ASI systems are distant futuristic systems andwill be making AI universally applicable with general wisdom, and likely to have capabilitiessuch ascommonsense, creativity, innovation, sensibility and social skills [3]. ASI capabilities could be analogous to capabilities of the human mind with the extraordinary capability to understand almost everything like human beings, which could be the true form of artificial intelligence [4]. Analytical AI systems generate a cognitive representation of the world. Most AI systems used by businesses today belong to this group and their learningare based on past experiences whichare translated to future decisions [3]. Image recognition systems, financialfraud detection systems, self-driving cars, etc. are examples of analytical AI. Human-Inspired AI systems are capable of using both cognitive elements and human emotions while making decisions [3]. These systems can recognize customer emotions during interactions, which could be used by advertisers, brand developers, and market researchers for measuring customer reactions to products or messages. Affdex, a product of Affectiva, uses emotion-tracking technology for analyzing people's facial expressions through the camera and recognizes emotions like anger, joy, and surprise,likehuman beings. Humanized AI systems are futuristic systems, expected to be self-conscious and self-aware, and with cognitive, emotional and social intelligence capabilities [3].

When business organizations are facing with the "innovate or die" situation, AI is helping them to remain competitive by redefining the industrial processes for maximizing personalization and automation and minimizing redundancy[5].AI is also changing the way industries do business by not only boosting the productivity but alsoimproving safety and

other critical aspects of organizational success [6]. AI's reputation is growing among business leaders, and it is already emerged as an emerging asset to the workforce in multiple industries, transforming the way businesses and societies operate [1].AI is already improvingthe overall standard of living with interventions inhealth, convenience, security and safety, privacy, vigilance, etc. [7]. AIalso can provide digital assistance indisease diagnosis, routine day-to-day tasks, preventing corporate and financial frauds, and preventing vehicle accidents.

The first industrial revolution was powered by steam power, the second by electric power, the third by the power of information communication technologies (ICT), and the fourth would be by AI [8]. AI is likely to become a cognitive multiplier in the nearby future and it will enable human beings to perform more intellectual functions than one person can ever be able to achieve [9]. This can trigger many transformations including extracting insights from data sets with hundreds of different variables, engaging human beings with broad interfaces such as voice, vision, touch, smell, taste, etc., and generating new ideas and insights from small data sets.

II. LITERATURE REVIEW

AI is one of the fastest growing industries of the world, dramatically changing the economic, social and labor landscape [10]. With the creation of conversational chatbots, self-driving cars, diagnostic systems and recommendation systems, AI has already impacted the world in a big way [1] and is growing in its reputation among the business organizations as an emerging asset, like the workforce. AI systems can provide reliable and data-oriented disease monitoring and projection data. Further, AI systems can conduct effective analysis of massive infectious diseases and provide surveillance data to support risk and resource analysis for hospitals, regulatory agencies, and healthcare service providers [11]. The combined power of man and machine has the potential to outperform all traditional human-only disease diagnosis [9].

An intelligent personal assistant can perform tasks or services based on a combination of user input and location awareness input [12].With the rapid developments in AI technologies, there is a tremendous growth in human-machine interaction researches including customer experience management (CEM), cognitive science, and machine intelligence. The AI-enabled experience management (AIEM) is a blend of AI and CEM, using facial expression recognition and speech emotion recognition algorithms, which also applies interactive intelligence during emotion acquisition, emotion recognition, and emotion interaction [13]. By examining analogousrevolutions happened in the industry, reference [14] claims that AI would bring extensive changes that will also impact all aspects of our society and life. Paper [15] examines the past 5000 years that have given rise to human's augmentation via AI and claims that many humans already unconsciously dependent on AI in how they behave, transact, communicate, and make sense.Paper [16] is on the application of AI in improving the efficiency of both currency and cryptocurrency markets and conducts an efficiency analysis of Bitcoins. Paper [17]studied the cultural and ethical implications of business automation for different stakeholders ranging from laborers to nations, and its framework was able to identify the ethical implications of business automation with a bestpractices'recommendation.

Paper [18] examines how AI technologies and robotics impact on the daily business life of people, individual countries, and world economics. They claimed that sales, CRM, banking, money, production, planning, Philips curve, jobless ratio, taxes, etc. will have significant impact with the adoption of AI technologies.Paper [19] is a study on how the rapid development and employment of AI is transforming the financial services industry along with many other sectors. It also examines how AIis helpingfinancial supervisors in identifyingthe potential violations and help regulators in anticipating the impact of regulatory changes.Paper [20] discusses how policy makers and technology practitioners can integrate AI and big data in smart cities in such a way toimprove the sustainability and livability conditions while boosting the economic growth and other opportunities.

III. OPPORTUNITIES

AI supported insights-driven businesses are growing [21] their revenue from $333 billion in 2015 to $1.2 trillion by 2020, and likely to disrupt many businesses. In this section we examine how AI is disrupting the different industry segments.

A. Call Centers

AI is very likely to replace the call center industry. Chatbots will be able to answer client's questions within seconds and human intervention will be needed only to answer those questions that were never consulted before [5].

B. Technical Support

Intelligent Personal Assistants (IPA) have the ability to organize and manage emails, calendar events, files, etc. [12]. IPAs help users to get reminders on everythingthey set and can send user signals, photos, links, etc.by different means. IPAs can be used [12] to do research, identify landmarks, shop, identify places and things, and even translate foreign languages. Many of the calls into a service helpdesk couldbe uncomplicated queries such as opening hours or availability of a person, which can easily be answered by a bot. Thus,companies can connect IPAs to

enterprise software to get capabilities such as self-service diagnostics, scheduling optimization engines, or for booking appointment slots [5].

C. Customer Experience

Customer experience is reporting early success stories for AI across all industries. Many travel companies leverage chatbots to create always-on, personalized serviceswhich can help mitigate frustration during monotonous travel situations by making the customer understand the context and provide contextually relevant options to resolve the issue [5]. For getting five-star customer experiences, extreme personalization may be needed which could be done with the help of advanced machine learning [22].

D. Agriculture

2050 CE expects an increase of about 2 billion people in the world population and it will be putting lot of pressure on the farming sector to increase the yield. Agriculture is one sector which is suffering from labour shortages, particularly because of the strict immigration rules in some of the developed countries. AI can strengthen the industries experiencing labor shortages with its automation and efficiency benefits [5]. For big farming lands, AI tools can provide sustainable techniques [23] such as use of drones for taking detailed and periodic pictures of the crops, use of infrared to diagnose sicknesses and irrigation issues, minimize wastages, greater understanding of consumer demands using analytics tools, etc.

E. Energy and Mining

AI can contribute in a big way to the energy and mining market through ML when applied to drilling data such as pressure differentials, seismic vibrations, thermal gradients, strata permeability, etc. giving geoscientists better insights [5]. Cognitive AI can be applied to oil and gas industry to track tankers to decidetheir schedules, locations, and capacity.

F. Healthcare

AI offers tremendous opportunities in improving the quality of healthcare by predicting diseases, identifying high-risk patients, automating diagnosis, increasingthe speed of processes, increasing the accuracy of treatment, improving drug formulations, improving DNA analysis, and reducing the overall expenditure [5]. AI technologies are used to collect in-depth data for acute conditions like asthma attacks, Parkinson's tremors and heart attacks, assisting anesthesia delivery and for providing professional support during medical procedures [1].AI is now very successful in diagnosing Parkinson's disease by looking at the video footage of patients [24]. AI systems are much more accurate than doctors in diagnosing cancer from radiology reports [21].

G. Finance

AI can do things faster and more efficiently than human beings in the finance market,which include [1] managing investments, collecting financial data, predicting the changes in the stock market, guiding big financial firms for investment opportunities, etc. Bankers can take loan decisions quickly by assessing the risks and spending patterns of the customers, and payment history of rent and other utilities. The wealth management portfolio can be automated to offer personalized and tax-optimized investments to customers with AI support. In addition to customer service chatbots for basic inquiries and common transactions, security implementation can also be done with AI. Companies have started hiring and firing staff based on robot recommendations, which are truly unbiased [21].

H. Debt Collection

AI can give stress relief to people affected by debt collection by automating the debt collection process. AI can spot trends for defaulting loans and formulate early response processes, which can include some personalized approaches to clients. AI systemscan send emails, texts, and pre-recorded calls to customers, tailored to match the customers' schedule rather than arbitrary phone calls and mails [25].

I. Intellectual Property

IP relates to intangible assets such as patents, trademarks, copyrights, source codes, artistic works, industrial design, etc. Though day-to-day IP tasks can be time consuming, the use of AI technologies can allow IP professionals to focus more strategic decisions in their portfolio by making large volumes of data penetrable and accessible with improved accuracy and less risk. These help the IP professionals generate more business insights toopen new markets, accurately value IP portfolios, better understand IP investments, etc. [26]. Thus, AI systems will have increasingly important roles in the future IP administration.

J. Real Estate

AI chatbots can be used in real estate management business for communicationwith owners and tenantsand to find the right estates for the right customers [21]. It helps customers to stay away from estates that do not match their requirements or liking. AI can automate the document scanning and verifying processes also.

K. Construction

The construction industry offers many new possibilities of AI usage. AI-based applications allow designers to create complex designs and estimators to develop estimates with greater accuracy in less time. AI can make the risky construction environments safer by tracking people with smart sensors. By optimizing the material usage with the help of robots and on-site remote monitoring, AI can make construction business cheaper [21].

L. Education

AI technology can better assist teachers rather replacing them (as feared by some teachers), driving efficiency and personalization, exploring on coursesand curriculum improvements, finding gaps in the lectures during classes to giveadditional support, and giving helpful feedback to both educators and students on improvingthe educational methods [1], [21].

M. Manufacturing

AI can transform the manufacturing industry by making better products with generative design, optimizingthe manufacturing supply chains, helping companies anticipate market changes, and performing taskssuch as visual inspection, predictive maintenance, and assembly in better ways [27].

N. Retail

The retail sector has enormous potential for improving customer interactionswith voice, visual and hyper-local searches and will take customers straight to what they are looking at. The supporting AI tools will recognize the clients by their face and credit the items straight into their accounts which avoids queues or checkouts [21].When customers have the option to use voice for navigating e-business retail sites, the chatbots will easily capture all audible reactions of the customer, including the customer experience. This will dramatically increase the amount of data collected about the customer, and thus the chatbots can give competitive advantages to such companies [5]. Now these retailers can better tailor and personalize the customer experience, focusing on customer happiness, and convert the customer as returning.

O. Software Development

AI technologies will have impact on all steps of the software development life cycle, helping the developers build better software faster. Theseinclude ML-assisted rapid prototyping, software design assistants, intelligent programming assistants, automated analytics and error handling, automatic code refactoring, automated software testing, AI enabled GUI testing, precise budget and timeline estimating, and strategic decision-making on product features[28].

P. Application Development

The AI ecosystem allows humans to interact with machines and increase their efficiency to understand humans better using smart apps by making interactive suggestions. Intelligent apps can have the ability to study the user context and preferences and predict what the users need, provide users with contextual information, proactively respond on behalf of the user, communicate on user's behalf by predicting what the user want to do, make user life easier by predicting the actions the user want to take, and act as a personal assistant by doing necessary things at the right time without disturbingthe user with notifications [29].

Q. Travel and Tourism

AI systems have revolutionized the travel and tourism industry to make the travel experiences as painless as possible. They can assist and communicate with customers, learn from each of these interactions, thereby improving all the future interactions. Chatbots can help plan our trip and can give us the best and most educated decisions. Every time when we book flights online, we may get recommendations on the nearest hotels and restaurants, which could be ordered by price and location by AI powered tools [25].

R. Transportation

AI can collect data from a variety of sources to adjust and optimize the shipping routes and simplify the distribution networks [1]. ML methods can be used to predict and prevent traffic jams and advise drivers on the best routes. Real-time tracking using AI tools can control traffic patterns effectively, optimally schedule, and route public transport systems.

S. Shipping and Logistics

AI is transforming the supply chain industry by increasing the predictability of shipments, reducing the manufacturing downtime and reducing oversupplies, leading to reduction in costs and overall improvement in performance. AI technologiescan be applied to optimize processes [30] such as space allocation in trucks and containers, dynamic management of route systems to improve delivery times, etc.Robots can be used to make the distribution more effective, as is done by Amazon, whichhas over 100,000 robots in its warehouses worldwide [31].

T. Law

AI machines can store big data, search for specific law information within seconds, andprovide in-depth analysis, thus can save time and money in legal processes. If combined with blockchain technology, AI has the potential toassist judges in decision-making based on law and facts without personal bias [21].

U. Automotive

The value of AI in automotive manufacturing and cloud services is expected to cross $10.73 billion by 2024 [32]. The technology for self-driving cars can detect and manage all kinds of traffic situations. Google's Waymo claims that 94% of crashes involve human choice or error in the US and with the use of AI technologies, considerable drop can be there in these numbers. Some self-driving cars can start from voice and are provided withdriver's eye detectors to assume control when the driver is tired [21].

IV. CHALLENGES

There are many challenges preventing the widespread adoption of AI technologies, which include fear of job

loss, resistance to change, data privacy and security, provability issues, algorithm bias, data scarcity, lack of compute power, lack of people power, lack of standards, trust issues, and fear of autonomous and intelligent systems. A significant percentage of workers of IT and other industry believe that AI could be a job killing disruptive technology. There is still the cultural issue of resistance to new technologies and AI is no exception. Most AI applications use huge volumes of data, which could be sensitive and personal in nature, to learn and make intelligent decisions [6]. This makes AI systems vulnerable to hacking, robbery, data breach, and identity theft.

AI tools such as ML and deep learning techniques require a lot of processing power to carry out the calculations [33]. Cloud computing can support this in the short term, but better paradigms of computing like quantum computing may be helpful to address the compute power requirements in the future. There is severe shortage of people with skills to operate autonomous machines, which can think and learn for themselves and to enable industries or business segments to unleash the vision of machine-controlled ecosystems. Though people will feel more comfortable and trust a system when they understand the logic of decision-making, the AI systems are destined to remain as black boxes due to their increased complexity [33]. Provability is the level of mathematical certainty behind AI predictions [34]. Organizations are looking for provable, explainable, and transparent AI systems, but the black box approach may not allow that.

The most powerful AI machines are trained using supervised learning method and this training requires labeled data, which is limited [34]. Deep learning will only aggravate the problem of data scarcity. The AI systems can be only as good or as bad as the data with which they are trained. Bad data could be with ethnic, communal, racial, or gender biases and if the AI system is trained with such data, it can lead to unethical or unfair consequences [34]. The fear about autonomous systems are more related to the application of AGI and ASI, where the systems may gain intelligence in multiple domains.

V. DISCUSSION

The AI technologies have the potential to impact all jobs currently performed by human beings, reduce the portion of work left for people to do, and increase the wealth inequalities [14]. Most ofthe AI development is done by a few companies like Amazon, Baidu, Google, Facebook, IBM, and Microsoft and about 10,000 people in roughly seven countries are writing the codes for all AI applications [10]. So, the datasets used to develop such AI systems are likely to be biased and may not be generalizable for the entire world population, resulting in a technocracy where a small biased minority decides everything.

We can see that the potential of AI is now hindered by the lack of interoperability standards which could be addressed by a distributed, decentralized, and democratized market for AIs running on a distributed ledger technology [10]. A study of the Economic Policy Institute [35] argues that automation is in fact increasing the job opportunities. There could be reduction in the routine and repeatable kind of jobs, but AI is creating lot many job opportunities. However, there are chances that majority of these work could be part-time, and they may receive lower incomes.

Canada is likely to have a deficiency in 100,000 farm workers soon and adopting to AI and other automation technologies can be a matter of survival for the agriculture industry there [5]. Many IPAs are already in use such asGoogle Assistant, Siri, Google now, Cortana, Amazon Echo, Nina, BlackBerry Assistant,SILVIA, Viv, Dragon Go, Hey Athena, Ubi Kit, Hound, Aido, Jibo, Bixby, Braina VirtualAssistant, Lucida, Maluuba, Mycroft, Vlingo, and Cubic [12], which could contribute to improving our quality of life. The Wells Fargo bank uses an AI-driven chatbot to interact with customers for discussing on account related information or to reset their account password [1].

Surveillance autonomous devices such as cameras, drones, and sensors could be used by project managers to monitor their job site activities. Doxel is one AI-based application [36] which can measure the installed quantity of materials by analyzing a job site in 3D. AI systems like Google's DeepMind can self-improve on past iterations, getting smarter and more aware, allowing it to enhance its capabilities and its knowledge, without relying on pre-defined behavioral algorithms [2].Efforts are there to make AI capable of producing expressions and the Google’s Magenta project investigates on AI music production [21].By 2025, AI is expected to spread in every walk of life and by 2040, AI may replace the human beings from the decision-making processes[7].

There is lot of uncertainty about the future impact of AI anditschances tocreate a utopian or dystopian world [14]. In this context, it can be a good idea to exploit the benefits of AI while minimizing the adverse consequences. It is recommended that we spend enough time in discussing and debating on the adverse consequences of AI technologies, before it is getting implemented. However, this should not derail the research and development activities in AI.

Let us recollect the statement by Stephen Hawking: “The rise of powerful AI will be either the best or the worst thing ever to happen to humanity. We do not yet know which.” AI and ML have the potential to disrupt

any type of industry. If all decisions are data driven and ultimately taken by AI, what happens if AI makes a bad decision, particularly in the medical field? If the doctor follows suggestions from the AI system and the patient is killed by an adverse reaction [37], will the doctor be responsible? The bottom line is to manage the big challenge of availing all the benefits of AI technologies while avoiding the dangers and disadvantages such as increased unemployment, greater wealth inequalities, and other social and ethical issues.

VI. CONCLUSION

AI is revolutionizing almost every industry and our lives. Many people are apprehensive about AI because on one side it has lot of decision-making powers and on the other side it is a black-box with lot of associated uncertainties, which they think can be detrimental tohumans. However, the potential benefits of AI outweigh the negatives very heavily. In any case,AI is finding its place in this planet and it is here to stay.

REFERENCES

[1] https://becominghuman.ai/4-industries-artificial-intelligence-is-transforming-fe27b750769b. [Accessed: March 11, 2019].

[2] https://www.forbes.com/sites/robertadams/2017/01/10/10-powerful-examples-of-artificial-intelligence-in-use-today/#16b26960420d.[Accessed: March 12, 2019].

[3] A. Kaplan and M. Haenlein, “Siri, Siri, in my hand: Who’s the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence,” Business Horizons, Vol. 62, pp. 15-25, 2019.

[4] https://www.marutitech.com/ways-ai-transforming-finance/. [Accessed: March 17, 2019].

[5] https://www.cmswire.com/information-management/11-industries-being-disrupted-by-ai/. [Accessed: March 14, 2019].

[6] https://www.aem.org/news/why-artificial-intelligence-will-transform-industry-business-models/. [Accessed: March 19, 2019].

[7] A. J. Oswaldn and S. J. Mascarenhas, “Artificial Intelligence and the Emergent Turbulent Markets: New Challenges to Corporate Ethics Today" In Corporate Ethics for Turbulent Markets, pp. 215-242, Oct 2018.

[8] N. Syam, and A. Sharma, “Waiting for a sales renaissance in the fourth industrial revolution: Machine learning and artificial intelligence in sales research and practice,” Industrial Marketing Management, Vol. 69, pp. 135–146, 2018.

[9] https://emerj.com/partner-content/3-waves-of-ai-transformation-in-industry/. [Accessed: March 19, 2019].

[10] G. A. Montes, and B. Goertzel, “Distributed, decentralized, and democratized artificial intelligence,” Technological Forecasting and Social Change, Vol. 141, pp. 354-358, April 2019.

[11] Z. S.Y. Wong, J. Zhou, and Q. Zhang, “Artificial Intelligence for infectious disease Big Data Analytics,” Infection, Disease & Health, Vol. 24, pp. 44-48, 2019.

[12] https://www.predictiveanalyticstoday.com/top-intelligent-personal-assistants-automated-personal-assistants/. [Accessed: March 12, 2019].

[13] Y. Qian, J. Lu, Y. Miao, W. Ji, R. Jin, and E. Song, AIEM: AI-enabled affective experience management, Future Generation Computer Systems, Vol. 89, pp. 438–445, 2018.

[14] S. Makridakis, “The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms,” Futures, Vol. 90, pp. 46–60, 2017.

[15] E. Farrow, Futures, https://doi.org/10.1016/j.futures.2019.02.022

[16] M. J. Silva de Souza et al., Can artificial intelligence enhance the Bitcoin bonanza, https://doi.org/10.1016/j.jfds.2019.01.002

[17] S.A. Wright, A.E. Schultz, “The rising tide of artificial intelligence and business automation: Developing an ethical framework,” Business Horizons, Vol. 61, pp. 823-832, 2018.

[18] C. Dirican, “The Impacts of Robotics, Artificial Intelligence on Business and Economics,” Procedia - Social and Behavioral Sciences, Vol. 195, pp. 564- 573, 2015.

[19] L. D. Wall, “Some financial regulatory implications of artificial intelligence,” Journal of Economics and Business, Vol. 100, pp. 55–63, 2018.

[20] Z. Allam, Z.A. Dhunny, “On big data, artificial intelligence and smart cities,” Cities, Vol. 89, pp. 80-91, 2019.

[21] https://www.disruptordaily.com/top-10-industries-ai-will-disrupt/. [Accessed: March 14, 2019].

[22] https://www.forbes.com/sites/allbusiness/2019/02/17/customer-experience-artificial-intelligence/#6c675ebd15bd. [Accessed: March 22, 2019].

[23] https://www.disruptordaily.com/top-10-industries-ai-will-disrupt/. [Accessed: March 14, 2019].

[24] https://www.forbes.com/sites/samshead/2018/10/08/tencent-aims-to-train-ai-to-spot-parkinsons-in-3-minutes/#2a49dc256f36. [Accessed: March 19, 2019].

[25] https://www.geospatialworld.net/blogs/how-artificial-intelligence-is-changing-business-in-every-industry/. [Accessed: March 16, 2019].

[26] https://www.ipwatchdog.com/2017/07/27/role-artificial-intelligence-intellectual-property/id=86085/. [Accessed: March 22, 2019].

[27] https://www.cio.com/article/3309058/5-ways-industrial-ai-is-revolutionizing-manufacturing.html. [Accessed: March 23, 2019].

[28] https://www.forbes.com/sites/mariyayao/2018/04/18/6-ways-ai-transforms-how-we-develop-software/#35324d7026cf. [Accessed: March 23, 2019].

[29] https://www.geospatialworld.net/blogs/how-ai-is-revolutionizing-app-development/. [Accessed: March 17, 2019].

[30] https://gomedici.com/8-industries-that-ai-will-change-forever/. [Accessed: March 15, 2019].

[31] https://datafloq.com/read/7-industries-taken-over-ai-robots/4128. [Accessed: March 15, 2019].

[32] https://igniteoutsourcing.com/automotive/artificial-intelligence-in-automotive-industry/. [Accessed: March 25, 2019]

[33] https://www.bernardmarr.com/default.asp?contentID=116. [Accessed: March 22, 2019].

[34] http://www.forbesindia.com/blog/technology/artificial-intelligence-key-challenges-and-opportunities/. [Accessed: March 22, 2019].

[35] https://www.livemint.com/Opinion/41pHBAFL5kSavHHJ4hJToN/Should-we-fear-Artificial-Intelligence.html. [Accessed: March 27, 2019].

[36] https://esub.com/applications-artificial-intelligence-construction-management/. [Accessed: March 23, 2019].

[37] https://www.inc.com/james-paine/5-industries-ai-will-disrupt-in-the-next-10-years.html. [Accessed: March 19, 2019].

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