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A REVIEW: FUTURE ASPECTS OF ARTIFICIAL INTELLIGENCE, BIG DATA AND ROBOTICS IN PHARMACEUTICAL INDUSTRY

Himan Patel*

Babaria Institute of Pharmacy, Vadodara, Gujarat, 391240, India.

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***Corresponding Author**
Himan Patel
Babaria Institute of Pharmacy, Vadodara, Gujarat, 391240, India.

ABSTRACT

The challenges facing our world are growing all the time. Humans are always been good at forward thinking. What change artificial intelligence will make in the world of work. AI use in pharmaceutical industry has increased over the last few years and expected to grow more, and the use of AI can save time and money while providing better results to the formulations and processes parameters in the development of drugs. Will a machine and AI soon be doing your job? Does the rise of the robots and AI mean the fool of humanity? Artificial intelligence (AI) is a branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. It replicates or simulates human intelligence in machines. The article is described about the march of the AI and Robots in Pharmaceutical industry, challenges to adoption of AI in drugs discovery. AI is doubtless the next big thing for Pharmaceutical companies that are more flexible and adopt AI faster will likely gain a strategic advantage. In fact, AI will soon be necessary to compete in the industry. But there is potentially a darker side to this technological revolution one which could profoundly change the world of work as we know.

KEYWORDS: Artificial intelligence (AI), Drug development, Pharmaceutical industry, Robots in Pharmaceutical industry, Drug Discovery, Big data.

1. INRODUCTION

Artificial intelligence refers to the ability of a computer or a computer enabled robotics system to process information and produce outcomes in a manner similar to the thought process of human in learning, decision making and solving problems. AI is the field of

science that includes machines with the capacity of performing functions such as logic, reasoning, planning, learning, and perception (Perez et al., 2018). It involves using computer-like machines to mimic even the basic human intellectual capability with the aid of several algorithms. (Wilson and Km, 2019). The goals of AI system are to develop system capable of taking complex problems in ways similar to human logic and reasoning. "Machines will be capable, within 20 years, of doing any work a man can do." –Herbert Simon, 1965(AI innovator).

Artificial intelligence (AI) can be applied to nearly every aspect of the pharmaceutical and healthcare industry, to enhance data processing. Adopting the technology will reveal the astonishing potential of the healthcare sector, with success rates flying higher than ever before – especially in the research and development of crucial, life-changing drugs. AI works as a machine learning system, continuously responding and analyzing data, which allows researchers to collect information effectively. Additionally, the more data AI responds too, the smarter it will become, continuously advancing the pharmaceutical industry (Sydney Tierney, 2020). Artificial intelligence in Pharma refers to the use of automated algorithms to perform tasks which traditionally rely on human intelligence. Over the last few years, the use of AI in the pharmaceutical and biotech industry has redefined how scientists develop new drugs, tackle disease (C Krishnaveni, 2007).

2. H ISTORY

Allen Newell and Herbert A Simon was developed the Logic Theorist (Flasiński M, 2016). It has been forecasted that the revenue from AI market will be increasing by as much as ten-fold between the years 2017 and 2022. Natural language processing market, which has several applications including text prediction, and speech and voice recognition has been said to achieve a growth of 28.5% in the year 2017. Worldwide revenue from big data and business analytics was US$ 122 billion in the year 2015 and it is being expected that the figures will rise to more than US$ 200 billion by the year 2020 (Statistica, 2020).

In 1997 when IBM's Deep Blue computer was able to defeat chess champion Garry Kasparov. By 2011, IBM's new Watson supercomputer was able to win the US$1m prize in the US game show Jeopardy. Since then, Watson has expanded into healthcare and drug discovery, including a partnership with Pfizer in 2016 to accelerate drug discovery in immuno-oncology. In December 2016 IBM in collaboration with Pfizer introduced IBM Watson, a cloud-based such asmedical lab reports and helps researchers with the ability to

identify relationships between distinct data sets through dynamic visualizations (Markoff J, 2017).

3. AI IN PHARMACEUTICAL SECTOR

The pharmaceutical sector is considered as one of the biggest in the market, investing billions of dollars for the development of new compounds and medicines every year. The pharmaceutical companies are day by day shifting the paradigm toward big data for the designing clinical trials to reduce the associated failures, consequently reduce the cost of R&D.

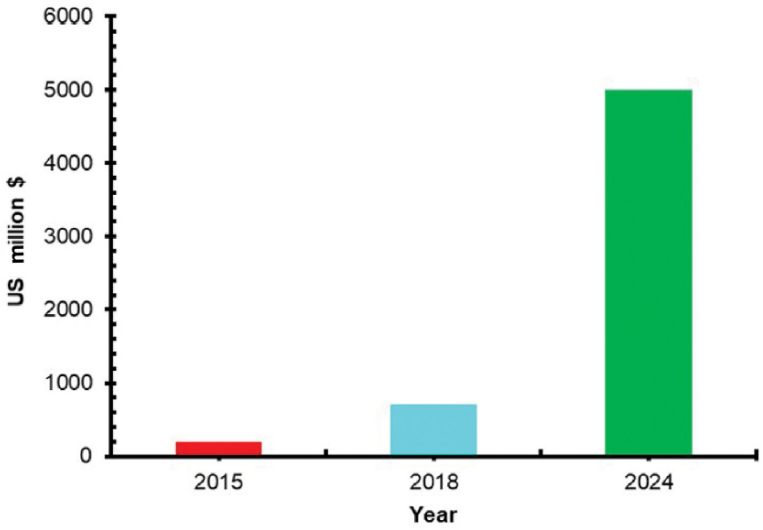

Figure 1: Artificial Intelligence market in sectors of medical diagnostics, personal AI assistants, drug discovery, and genomics.

As showed in Fig.1, the AI market is rapidly on the rise, increasing from $200 million in 2015 to $700 million in 2018 and is expected to rise to $5 billion by 2024. A mind-boggling 40% exponential growth of compound annual growth rate during the years between 2017 and 2024 shows us how AI will revolutionize the pharma and allied sectors in the near future (Mouratidis, 2018).

AI will helpful in Healthcare Managing Medical Records and other data, Doing repetitive jobs, Treatment Design, Digital Consultation, Virtual Nurses, Medication Management, Drug Discovery, Precision Medicine, Healthcare Monitoring, Healthcare System Analysis.

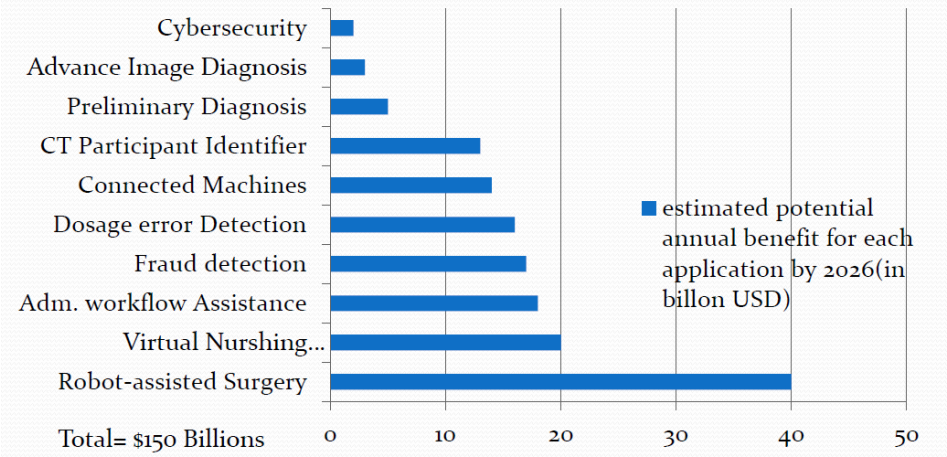

Figure 2: Estimated potential annual benefit for each application by 2026(in billion USD).

AI represents a significant opportunity for industry players to manage their bottom line in a new payment landscape, while capitalizing on new growth potential. To better understand the savings potential of AI, Accenture analyzed a comprehensive taxonomy of 10 AI applications with the greatest near-term impact in healthcare (Matthew Collier, 2016).

3.1. CURRENT SCENARIO IN PHARMACEUTICAL INDUSTRY

Many big Pharmaceutical players began investing in AI in order to develop better diagnostics or biomarkers, to identify drug targets and to design new drugs and products. Merck partnership with Numerate in March 2012 focusing on generating novel small molecule drug leads for unnamed cardiovascular disease target. In December, 2016 Pfizer and IBM announce partnership to accelerate drug discovery in immune oncology. Last year, Verdict AI asked businesses how vital artificial intelligence will be in their respective industries and over 70% of them thought it would be very important. From the same group, only 11% of businesses have not considered investing in AI technology. Furthermore, according to Narrative Science, 61% of companies investing in innovative strategies are using AI to identify opportunities that they would have otherwise missed. For pharmaceutical businesses that thrive on innovation, this is an important statistic to understand.

3.2. RECENT AI ADOPTIONS IN PHARMA & HEALTHCARE INDUSTRY:-

a) Novartis uses AI to predict untested components researchers should explore to find new cures
b) IBM Watson helps match patients with the right drug trials

c) Verge Genomics uses AI to predict the effect of new treatments for patients suffering from ALS & Alzheimer's
d) Bayer and Merck & Co uses AI algorithms to identify pulmonary hypertension
e) Tencent Holdings leverages AI to remotely monitor patients with Parkinson's
f) Mission Therapeutics uses AI to develop treatments for Alzheimer's
g) Healx uses AI to help biotech companies find treatments for rare diseases
h) AiCure & AbbVie use image recognition to improve drug adherence
i) Santen and twoXAR are using AI to develop drugs for glaucoma
j) AstraZeneca and Alibaba build AI to help patients with automated cancer diagnostics
k) Apple uses AI to screen children for autism
l) GNS Healthcare and Genentech use AI to develop new cancer therapies
m) Deep 6 uses AI to proactively find drug trial candidates

3.3. CHALLENGES TO ADOPTION OF AI IN PHARMA

While AI has a broad potential to help reclassify the Pharmaceutical industry, the selection itself is not an easy task.

The newness of the AI – for some, pharma organizations, man-made intelligence actually appears to be a "discovery" attributable to its freshness and elusive nature.

Absence of legitimate IT foundation – that's on the grounds that most IT applications and framework as of now being used weren't created or planned considering AI. Indeed more terrible, pharma firms need to go through heaps of cash to update their IT framework.

A significant part of the information maximum data is in a free text format – that implies pharma organizations need to go above and beyond to collate and place this information into a structure that's ready to be analyze in AI. Regardless of all these restrictions, one thing is for sure: AI is as of now reclassifying biotech and pharmaceutical industry. Also, a long time from now, Pharma will just glance at man-made brainpower as a fundamental, ordinary, innovation.

Data governance: Healthcare and medical information is private and in available legitimately. Assent from general society or individual is significant.

Reluctant to change: Pharma organizations are known to be conventional and impervious to change. we need to break the disgrace to give the best consideration we can for society.

3.4. Applications of AI in Pharmaceutical industry

- Disease Identification: Berg, an innovative US biopharma company, is using AI to research and develop diagnostics and therapeutics in the fields of oncology, endocrinology, and neurology. Their unique AI-based Interrogative Biology platform combines patient biology and AI-based analytics to identify differences between healthy and disease environments.

2015- Report by Pharmaceutical Research and Manufacturers of America- more than 800 drugs and vaccines are in trial phase to treat cancer.

Oxford's Pivital® Predicting Response to Depression Treatment (PReDicT) project is aiming to produce commercially-available emotional test battery for use in clinical setting.

- Radiology & Radiotherapy: This is an area in which AI has been speculated to play a major role in the future.

Presently, Google's DeepMind Health is working on machine learning algorithms to detect differences between healthy and cancerous tissues. The goal is to improve the accuracy of radiotherapy planning while minimizing damage to healthy organs at risk.

- Clinical Trial Research: Advanced predictive analytics can analyze genetic information to identify the appropriate patient population for a trial.

Machine learning- to shape, direct clinical trials

Artificial Intelligence can also determine the optimal sample sizes for increased efficiency and reduce data errors such as duplicate entries.

AI will give different benefits in clinical trials Cutting costs, Improving trial quality, Improving trial time by almost half, Finding biomarkers and gene signatures that cause diseases, Recruiting trial patients in minutes, Reading volumes of text and data in seconds.

Remote monitoring and real time data access for increased safety; biological and other signals for any sign of harm or death to participants.

- Drug Discovery: A study published by the Massachusetts Institute of Technology (MIT) has found that only 13.8% of drugs successfully pass clinical trials. Furthermore, a company can expect to pay between $161 million to $2 billion for any drug to complete the entire clinical trial process and get FDA approval. With this in mind, pharma businesses are using AI to increase the success rates of new drugs while decreasing operational costs at the same time.

Ideally, this would also translate to lower drug costs for patients, all while offering them more treatment choices.

AI in drug discovery will help From initial screening of drug compounds to predicted success rate based on biological factors. R&D discovery technology; next-generation sequencing, Previous experiments are used to train the model, Optimization software (example: FormRules).

- Personalized Medicine & Rare Disease Identification & Treatment: Using AI, body scans can detect cancer and other diseases early, as well as predict health issues people might face based on their genetics.

Although far from perfect, IBM Watson for Oncology is currently the leader in AI for personalized treatment decisions in the oncology space. It uses each patient's medical information and history to optimize the treatment decision-making. Recently, Watson correctly diagnosed a rare form of leukemia in a patient originally thought to have acute myeloid leukemia. It reportedly examined millions of oncology research papers in 10 minutes after which it successfully diagnosed the patient and recommended a personalized treatment plan.

Micro biosensors and devices, mobile apps with more sophisticated health-measurement and remote monitoring capabilities; these data can further be used for R&D.

DermCheck; The app available in Google play store in which images are sent to dermatologists (human not machines).

- Epidemic Outbreak Prediction: To predict malaria outbreaks, from data like temperature, average monthly rainfall, total number of positive cases, etc.

ProMED-mail is an internet based reporting program for monitoring emerging diseases and providing outbreak reports.

3.5. Why AI in Pharma is a good idea? BENEFITS AND ISSUES

Pharmaceutical industry can accelerate innovation by using technological advancements.
The recent technological advancement that comes to mind would be artificial advancement such as visual perception, speech recognition, decision-making & translation between languages.

An estimate by IBM shows that entire healthcare domain has approx. 161 billion GB of data as of 2011.

With humongous data available in this domain, AI can be of real help in analyzing the data & presenting results that would help out in decision making, saving human effort, time, money & thus help save lives.

AI would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed.

AI can think logically without emotions, making rational decisions with less or no mistakes.

As seen partially with smart phones and other technology already, humans can become too dependent on AI and lose their mental capacities.

Imagine a Future where, AI is able to design new drugs, Find new drug combination, Deliver clinical trials within minutes.

Drugs are not tested on real humans or animals, but on virtual model that are engineered to mimic the physiology of organs.

Robots help in the manufacturing of medication as well as their distribution.

Counterfeiting drugs become almost impossible. Block-chain technology secures the entire distribution channel.

Local pharmacist 3D prints personalized drugs in any shape & desired dosage.

Epidemic outbreak prediction; utilizing machine learning/man-made brainpower one can consider the historical backdrop of epidemic flare-up, examine the online media action and foresee where and when epidemic can impact the society.

4. ROBOTICS IN HEALTHCARE AND PHARMACEUTICAL INDUSTRY

WHAT IS A ROBOT?

A re-programmable multifunctional manipulator designed to move material parts tools, or specialized devices through various programmed motions for the performance of a variety of tasks.

The world is changing and today we stand on the brink of a fourth industrial revolution one that will transform the way we work, the way we live and even what makes us human. There's a group of technologies that are combining to create transformation across almost every industry include Pharmaceutical industry at the moment and those technologies include things like Artificial intelligence, 3d printing, Robotics, Big data and then some things in on the sort of life sciences front in terms of genetics and medical imaging and that these things are sort of combining in a way that's bringing about a host of transformative changes across industries. In Pharmaceutical industry Semi automatic machines, automation machines or labor work will be replace by Self automated machines, AI or Robots. In Healthcare By 2050 one in four people in the WORLD will be over the age of 65. The NHS will be unable to cope with the likely increase in chronic illness. To meet this challenge, health and local authority services must reconfigure, placing greater emphasis on community care and the effective use of technology. One promising technology is ROBOTICS.

WHY ROBOTICS? Compared with humans, robots are quicker to train, cheaper to maintain, easier to refuel and repair and less prone to be bored by repetitive tasks.

They could help the elderly and chronically ill to remain independent, reducing the need for careers and the demand for care homes.

ADVANTAGES

Accuracy - Robots once instructed can perform a task without fatigue and with accuracy, even after long hours of operation. A robot would also eliminate hand-tremors of the surgeon, due to fatigue or other reasons and increase accuracy of the operation.

Smaller Scars - Robots perform surgery by making smaller cuts to the patient s body, thus leaving smaller scars to the patients.

Less Blood Loss - Smaller incisions lead to lesser amount of blood loss for the patients.

Less Pain - Patients suffer lesser pain due to the smaller cuts made by the robots.

Faster Recovery - Smaller external cuts, eventually leads to faster healing, decreased possibility of infections, and therefore a faster recovery for the patients.

Shorter Hospital Stay: Speedier healing and recovery leads to a shorter stay in the hospital thus saving costs.

4.1. CURRENTLY AI ROBOTS IN HEALTHCARE

Robotic Pharmacy: A robotic pharmacy leverages robots and automation to perform all the repetitive tasks – right from filling the patient prescriptions to organizing the medications and delivering the same to correct patients via a recognition 'coded bar'

Medical robots: Medical robots allow surgeons to more dexterously manipulate surgical instruments or catheters inside the patient's body during minimally invasive surgeries. During robotic procedures, surgeons control the surgical instruments with joysticks or telemanipulators as easily as moving virtual objects in computer games.

TUG robot: A TUG is an autonomous mobile robot made specifically for hospitals by Aethon, a company based in Pittsburgh. It deliver medications, meals, specimens, materials, and haul carry heavy loads such as linen and trash. It uses a built-in map and sensors to navigate hospital halls and communicates with elevators, fire alarms and automatic doors via Wi-Fi (Aethon, 2018).

AUTHOR'S PERSPECTIVE

The world has been through revolutions before the advent of mechanization then electronics then the digital revolution, all profoundly changed the world's economies but this revolution of AI, Big data and robotics could be even more disruptive. For healthcare in particular the advantages of machine learning, AI, Big data or data science are immense those have an incredible chance to address very both very infrequent diseases and diseases which affect

different parts of the population very differently, if we're going to cure cancer it's probably going to come through data science.

AI is doubtless the next big thing for Pharmaceutical companies that are more flexible and adopt AI faster will likely gain a strategic advantage. In fact, AI will soon be necessary to compete in the industry.

But there is potentially a darker side to this technological revolution one which could profoundly change the world of work as we know.

This technological revolution will cost jobs, the human jobs before aren't going to be human jobs anymore. For example particularly in Pharmaceutical industry the all machines and maximum labor work will replace by robots and AI. If not all, Pharma manufacturing and R&D operations will be the primary targets. In turn, this should theoretically improve the drug development success.

As theoretical physicist Prof. Stephen Hawking had said that human efforts to create machines that can think are a huge threat to the existence of human race & the race to develop a complete human AI could mean that the human race would come to an end in the future.

What is key as part of this revolution as productivity goes up as the economy continues to evolve and new jobs are created you need to make sure those displaced workers in the industry are given the skills to move into these new positions. But I think the key point is you need to make sure if you've lost thousand or million jobs in one sector how do you create more than that in another sector. That will be the key and I think in past industrial revolutions that's what we've seen happen and hopefully it will be happens again.

I would say that if you look far enough into the future there is no job anywhere in the world, there's nothing that is completely safe. And you know the kinds of jobs that you would imagine right now are completely beyond the scope of artificial intelligence millions and millions of those jobs are going to be lost and it's unlikely that enough jobs are going to be created to absorb all of those workers.

Imagine having a workforce of people and you could train one employee to do a particular task and then you could clone that worker and have a whole army of those workers that's a bit like the way artificial intelligence works.

I still remain cautious believing artificial intelligence is going to fundamentally change the way we live and work and it will challenge us like never before. So I think that all of that is really possible and it could be one of the best things that have ever happened to humanity but it will require that we adapt to it and that's going to be a staggering challenge.

COCLUSION

Human being is the most sophisticated machine that can ever be created. Healthcare and Pharmaceutical industry is actually one of the areas where the impact of artificial intelligence and robotics could be extraordinarily positive in the future. However, the transformation will not happen overnight. Instead, it will gradually occur over the next 10 or 20 years. Robots cannot match Human Brain Intelligence and Original Creativity of human at some stage. Disease Identification, Radiology & Radiotherapy, Clinical Trial Research, Drug Discovery, Personalized Medicine & Rare Disease Identification & Treatment Robotic pharmacy, and medical robots that are going to be the most important fields of research in Pharma and healthcare. But there is potentially a darker side to this technological revolution one which could profoundly change the world way we work and way we live today.

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REFERENCES

1. Perez, J.A., Deligianni, F., Ravi, D., Yang, G.-Z., 2018. Artificial intelligence and robotics. arXiv Prepr. arXiv, 1803.10813.
2. Wilson, B., Km, G., 2019. Artificial intelligence and related technologies enabled nanomedicine for advanced cancer treatment. Future, Med, 15: 433.
3. Artificial intelligence in pharma: utilising a valuable resource, Sydney Tierney (Technical writer), March 2020.
4. C Krishnaveni. RÍache Brazil ThePharmaceutical Journal. Dec, 2007.
5. Flasiński M. Introduction to artificial intelligence 1st ed. Switzerland:Springer International publishing, 2016.

6. Statistica. Artificial Intelligence(AI). 2020. Available from - • Artificial Intelligence (AI) | Statista.
7. Markoff J (2017) On 'Jeopardy' Watson win is all but trivial. The New York Times.
8. Mouratidis, Y., 2018, November 30. An insight of AI's penetration in drug development market. Available from - An Insight Of AI's Penetration In Drug Development Market (forbes.com).
9. Matthew Collier, 2016. Artificial Intellegence (AI): Healthcare's New Nervous System. Available from - Artificial Intelligence (AI) in Healthcare | Accenture.
10. Aethon. TUG robots, 2018. Available from - Aethon - Autonomous Mobile Robots - Healthcare and Hospitality.