A Review Article on Artificial Intelligence on Trending Role: A Public Review

C. Sneha*, J. Bharathi[1], G. Bindu[2], N. Deepthi[2], R. Sabharish kumar[2], K. Obul Reddy[2], M. kishore Babu[3]

*Bachelor of pharmacy, krishna teja pharmacy college, chadalawada nagar, renigunta road, Tirupati, andhrapradesh-517506
[1]Department of pharmaceutics, Faculty of pharmacy, krishna teja pharmacy college, Tirupati, Andhrapradesh-517506, India.
[2]Bachelor of pharmacy, krishna teja pharmacy college, Tirupati, andhrapradesh-517506, India.
[3]professor, Department of pharmaceutics, krishna teja pharmacy college, Tirupati, andhrapradesh-517506, India.

ABSTRACT;
Artificial intelligence used in pharmaceutical technology has enlarge over the year and may affect the development of new drugs in the coming years. This technology is also used to reduce the time and cost while providing a better understanding of the relationships between different formulations and process parameter. Artificial intelligence [AI] is the stimulation of human behaviour in relation to the process of intelligence like involving in problem solving, human cognitive science reading, observation, preparation, reasoning; correction, speech recognition and other sources. It has greatly evolved into a science of commercial applications in pharmaceutical exploration, medical management programs like drug discovery dosage form design, cross- check, engineering and many more. The artificial intelligence was recently increased by the involvement tech giants combined with record rounds of funding. The long-term effects will range from safer and more effective therapies and cure the untreatable diseases on successful implementation of the AI in the pharmaceutical field, the delays in drug development failure at the clinical and marketing level can be reduced. This article concludes that focus un pharmaceutical AI place industry for future prospects. Although potential experts will have to be both medical and technology experts, it is evaluation of medicine not extinction.
Key words: Artificial intelligence, Simulation, Cognitive science, Medical management, Drug discovery, Cross-check, Implementation, Prospects.

I. INTRODUCTION AND HISTORY:

Artificial intelligence (AI) is a branch of computer science that deals with the problem-solving by the aid of symbolic programming. It has greatly evolved into a science of problem-solving with huge applications in business, health care, and engineering. One of the pivotal applications of AI is the development of the expert system.[1] The year 1956 is usually considered to be the year when AI was born, as it was in 1956 that Dartmouth College had organized the famous conference. However, the preceding year, that is, 1955, saw its first AI system that was called Logic Theorist and the people who developed it was Allen Newell, Herbert A. Simon. Nearly, 40 theorems of Principia Mathematica by Alfred N. Whitehead and Bertrand Russell were proved using this system. However, the designers of the system could not get it published.[2].In an interview with the BBC, theoretical physicist, Professor Stephen Hawking, had said that human efforts to create machines that can think are a huge threat to the existence of human race and that the race to develop a complete AI could mean that the human race would come to an end in the future. This warning was given by Professor Hawking after he was asked about revamping the technology that is used by him to communicate. The technology used by him involves AI of a basic nature.[3] However, the warning of Professor Stephen Hawking has not been taken seriously by the world. Throughout the world, innumerable researches are being carried out on AI. A large amount of money is being invested to create a system that can function far more efficiently and at a much less time than a normal human being. Be it an educational institute, a

manufacturing firm a government office, or a research organization; AI finds its application in every field. 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[4].

Classification of AI and types;

AI can be classified into two different ways: according to calibre and their presence (Figure 1) [5,6] According to their ability, AI can be categorized as: i) Artificial Narrow Intelligence (ANI) or Weak AI: It performs a narrow range task, i.e., facial identification, steering a car, practicing chess, traffic signalling, etc. ii) Artificial General Intelligence (AGI) or Strong AI: It performs all the things as humans and also known as human level AI. It can simplify human intellectual abilities and able to do unfamiliar task. iii) Artificial Super Intelligence (ASI): It is smarter than humans and has much more activity than humans drawing, mathematics, space, etc. According to their presence and not yet present, AI can be classified as follows:)

Table 1	Important milestones in the area of the AI uses
Year	**Events**
1943	Walter Pitts and warren McCulloch proved that logical operations like "and", "or" or "not" can be done by neurons connected in a network.
1956	The term 'artificial intelligence' was first appeared.
1958	Frank Rosenblatt created neuronal networks called Perceptron's which Which can transmit information in one direction.
1974	Initiation of "First AI Winter ".
1986	Georey Hinton promoted Back propagation algorithm design Which is widely used in deep learning.
1987	Initiation of "AI winter".
1997	Garry Kasparov (Russian grandmaster) was defeated by IBM Deep bule.
2013	Google carried out efficient research on pictures by utilizing the British technology.
2016	In this year, the Go Champion Lee Sedol was defeated by Google DeepMind, software AlphaGo.

2017	A propositional logic Boolean satisfiability problem (SAT) solver proves A long-mathematical conjecture on Pythagorean triples, An Open AI- Machined learned bot played is demonstration game against Professional Dota 2 player dendi.
2018	Google duplex, a service to allow an AI assistant to book appointments Over phone. LOS angles time judges the AI's voice to be a "nearly flawless" imitation of human sounding speech.
2019	DeepMind's Alpha Star reaches Grand master level at star2, outperforming 99.8 Percent of human players.
2020	Open AI's GPT-3, a state-of- the- art autoregressive language model that uses deep learning to produce a variety of computer codes.
2021	AI has an exponentially growing influence on the development of our society, economy, and military. Google's Alpha fold is profound impact advanced AI can have on our lives.
2022	The first AI-developed drug enters phase 1 trial. In February 2022 Insilico medicine For drug discovery.

CLASSIFICATION OF ARTIFICIAL INTELLIGENCE

According to their calibre

Weak intelligence or artificial narrow intelligence(ANI)

Artificial general intelligence(AGI)

Artificial super intelligence(ASI)

According to their presence

Type 1: Reactive machine

Type 2: Limited memory system

Type 3: Based upon "Theory of Mind"

Type 4: Self-awareness

i) Type 1: It is used for narrow purpose applications, which cannot use past experiences as it has no memory system. It is known as reactive machine. There are some examples of this memory, such as a IBM chess program, which can recognize the checkers on the chess playing board and capable of making predictions.

ii) Type 2: It has limited memory system, which can apply the previous experiences for solving different problems. In automatic vehicles, this system is capable of making decisions there are some recorded observations, which are used to record further actions, but these records are not stored permanently.

iii) Type 3: It is based upon "Theory of Mind". It means that the decisions that human beings make are impinged by their individual thinking, intentions and desires. This system is non-existing AI.

iv) Type 4: It has self-awareness, i.e., the sense of self and consciousness. This system is also non-existing AI.

ARTIFICIAL INTELLIGENCE IN MARKETING:
The pharmaceutical business is a deal driven part, with AI getting more valuable in refining the style of advertising and systems that organizations use. Organizations realize that

investigating and finding the most legitimate type of promoting is the most ideal route for them to support their incomes and guide them to the most productive road. Pills on blue background Using AI; an organization can diagram the normal client venture. This can permit the organization to distinguish the immediate advertising strategy the client was dependent upon and at last convinced they make a buy [7]. Acquiring this data is essential to guaranteeing similar showcasing strategies are preceded, to just advance beneficial achievement. Having AI examine past crusades is basic to empower organizations to devise the most worthwhile showcasing strategies3 and will diminish the odds of time or cash being squandered, as its expectations can be trusted. At that point, in a little while, the pharmaceutical business will have a completely enhanced advertising methodology that works without fail. Artificial Intelligence technique in the Pharmacy has been closely associated with the utilization for mechanized calculations by performing different tasks that is generally depend on the human knowledge. Throughout most recent five years, the utilization of Artificial Intelligence technique in the biotech industry has reclassified in a way that researchers grow updated medications, tackle infection. Given the developing significance of AI in business organization success, the researcher needed to make the far reaching report that can enables each of the business head to comprehend greatest forward leaps in the biotech space which are helped by the sending of Artificial Intelligence innovations. A year ago, Verdict AI asked organizations how crucial Artificial Intelligence will be in their individual ventures and over 70% of them figured it would be significant. From a similar gathering, just 11% of organizations have not thought about putting resources into AI innovation. Besides, as per Narrative Science, 61% of organizations putting resources into creative techniques are utilizing AI to distinguish openings that they would have in any case missed. For pharmaceutical organizations that blossom with advancement, this is a significant measurement to comprehend**.**

AI Market in Health care[8]**;**
According to venture capital firm Rock Health, 121 health AI and machine learning companies raised $2.7 billion in 206 deals between 2011 and 2017. The value of 10 promising AI applications and found that they could create up to $150 billion in annual savings for U.S. health care by 2026. Reducing health costs by Image processing, safeguarding patients' personal records against cybercriminals and assisting in surgeries.AI-enabled workflow assistants are aiding doctors free up their schedules, reducing time and cost. AI helps pathologists in analysing tissue samples and thus, in turn, making more accurate diagnosis. As per Harvard Business Review and Accenture, there are 10 potential applications of AI which could change the health care industry.

Health Application	Motivation for adoption
Robot assisted surgery	Technological advances in robotic solution for more types of surgery
Virtual nursing assistants	Increasing pressure caused by medical labor shortage
Administrative workflow	Easier integration with existing technology infrastructure
Fraud detection	Need to address increasingly complex service and payment fraud attempts
Dosage error reduction	Prevalence of medical errors, which leads to tangible penalties
Connected machines	Proliferation of connected machines/devices
Clinical trial participation	Patent cliff; plethora of data; outcomes-driven approach
Preliminary diagnosis	Interoperability/data architecture to enhance accuracy
Autonomous image diagnosis	Storage capacity, greater trust in AI technology
Cyber security	Increase in breaches; pressure to protect health data

ARTIFICIAL INTELLIGENCE APPLICATIONS AT RESEARCH STAGE AND DEVELOPMENT

TARGET IDENTIFICATION:

Drug research starts with target identification, a process of reviewing the literature and analysing target databases in search of targets playing a role in the disease (Deore, 2019)[9]. The availability of relevant prior research, typically conducted at academia and other research centres, is critical to this step's success (Matthews et al., 2016). Target identification is also the most critical part of the process. It determines the entire research project's success – failing to select a treatable target will ensure a failure years later. Recent studies have shown how machine learning may be used to accelerate the identification of treatable targets. Costa et al. (2010) proposed a classification method that categorizes many potential targets as treatable/non-treatable based on prior knowledge about the properties of already identified targets. Two other studies described how Natural Language Processing (NLP) techniques were used for automatic extraction of the relationship between targets and diseases from the MEDLINE database containing a large body of research (Bravo et al., 2015; Kim et al., 2017)[10]. It is worth noting that future improvements of such NLP techniques could foster a scientific debate by enabling quick identification of studies reporting contradictory results.

TARGET VALIDATION:

In the next step, target validation, the identified candidate targets are narrowed down to the most promising ones (Deore, 2019). A good target exhibits two essential characteristics. First, it plays an essential role in the disease. Second, it has surface cavities of such shape and size that a potential drug could bind with it (Deore, 2019). Several recent studies proposed automating different parts of target validation: Google developed a machine learning algorithm that predicts the structure of identified targets more accurately than experienced field experts (Hutson, 2019)[11]. Besides, Nayal and Honig proposed a classifier trained using data about known protein cavities to making predictions about whether supposed targets are "druggable" or not (2006).

LEAD IDENTIFICATION:

Once a promising target is identified, the next step is lead identification. Lead is a chemical molecule that is likely to bind with a specific target while exhibiting several properties such as low toxicity (Deore, 2019). In a recent study, Zhavoronkov et al. (2019a) described a machine learning method of lead identification that allowed them to find a candidate fibrosis drug in a matter of weeks compared to months or years. Similarly, Imperial College identified 110 candidate anti-cancer molecules in an innovative study where several volunteers agreed to run AI-based computations using their phones' idle times (Veselkov, 2019)[12].

LEAD OPTIMIZATION:

Drug molecules may interact not just with the intended target but also with several other proteins causing unwanted side effects. In the next step, lead optimization, candidate molecules are evaluated and refined. The goal is to reduce the chance of side effects and improve several properties such as stability, specificity, or toxicity. Farimani et al. (2018) proposed a machine learning technique to predict lead molecules' properties and other similar compounds using significantly, less time and data compared to traditional statistical methods.

PRECLINICAL TRIALS:

Once the target is identified and several lead compounds are selected, their efficacy and safety in verified in trials on animals, also known as preclinical research or preclinical trials. One of the most considerable problems of preclinical research is that drug molecules may exhibit different behaviour in animals than in humans (Pound & Ritskes-Hoitinga, 2018)[13]. To remedy the problem, Normand et al. proposed a new ML method to predict cross-species differences between mice and humans (2019). The information identified by the model could help identify false leads early in the process and prevent bearing the cost of clinical trials.
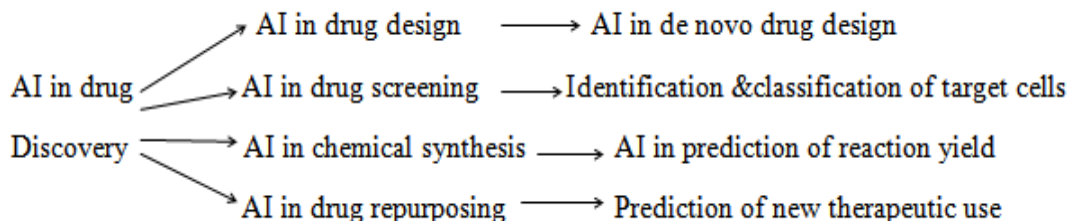
PHARMACEUTICAL INDUSTRY APPLICATIONS OF ARTIFICIAL INTELLIGENCE[14,15,16]
 a) Discovery and Development of New Drugs.
 b) AI is helping big pharma create cures for complex and rare diseases, Alzheimer's, Parkinson etc.
c) Drug-Adherence and Dosage.
 d) Using AI to Make Sense of Clinical Data and to Produce Better Analytics.
e) Finding More Reliable Patients Faster for Clinical Trials.
f) Introducing Automated Robot Pharmacies to fill prescriptions and dispensing.
g) Marketing, Logistics and Supply Chain.
h) Management of data, including medical records.

g) Healthcare systems analysis to determine errors or inefficiencies.

Treatment and Management of Rare diseases;
 Advances in AI, renewed interest in rare disease treatments. Currently, there are over 350 million people with over 7,000 rare diseases around the world. However, it's not all gloom and doom for patients with rare diseases as Heal, a UK-based biotech firm, has secured $10 million in Series funding to use AI to develop innovative drugs for rare conditions. Thera chon, another Swiss biotech company that leverage AI to develop drugs for the treatment of rare genetic diseases, has received $60 million in funding.

High accuracy in epidemic prediction:
        Utilize Artificial Intelligence to follow and foresee pestilence episodes utilizing all the most recent data running from satellite pictures to social data. Regardless of whether it is a jungle fever or Ebola episode, utilizing AI-based programming can altogether assist specialists with forestalling the danger of a plague infection [17,18]. This may help pharmacy organizations create potential arrangements before any pestilence/pandemic.

Automated control process system (ACPS):
        The objective of an ACPS is to ensure that a process is carried out in a safe and profitable manner. This is achieved by continuallymonitoring the various process variables which include temperature, pressure, flow, vacuum, and concentration and as and when required, taking necessary actions such as slowing down pumps, opening valves, and turning the heaters up so as to ensure that the process variables are maintained at the required values. The advantages of ACPS are

good quality achieved at low cost, saving of material, assured personnel, plant, and processes safety, increased yield, andreduced labour cost[19] The elements of ACPS include (1) sensing process variables' value, (2) transmission of signal to measuring element, (3) measure process variable, (4) presenting the value of the measured variable, (5) set the value of the desired variable, (6) comparison of desired and measured values, (7) control signal transmission to final control element, and (8) control of manipulated value.

Berg:

Berg is Boston-based biotech and is one of the key players employing AI in its various processes. It has an AI-based platform for drug discovery, which has a huge database of patients and this is used to find as well as validate the various biomarkers responsible for causing diseases and then decides therapies according to the obtained data. The motto of the company is to speed up the process of drug discovery and to bring about a reduction in the cost with the aid of AI as it obliterates guesswork that is involved in the process of drug development. The steps that are followed by Berg include procurement of sequencing data from samples of human tissue, finding information regarding metabolites, and protein formation, and testing of data using algorithms of AI to correctly determine the actual cause of disease[20].

II. CONCLUSION:

Human being is the most sophisticated machine that can ever be created. the human brain, which is working hard to create something that is much more efficient than a human being in doing any given task and it has great success to extent in doing so. Although potential experts will have to be both medical and technology experts, it is evolution of medicine, not extinction. There are various AI and machine learning applications in pharmaceutical applications, including disease identification/diagnosis, personalized treatment/behavioural modification, drug discovery manufacturing, radiology and radiotherapy, smart electronic health records, prediction of epidemic out breaks, sales, marketing, predictive analytics and so on. The AI tools like Watson for oncology, tug robot and robotic pharmacy has changed the face of the profession considerably. This sector is going to rely heavily on AI for most of its future works. This is good news from the point of view of productivity and efficiency. This sector not only

increases efficiency but also minimizes errors that are much more frequent when a human is handling the task. As result of the uses of AI approaches, the designing of the new hypothesis, strategies, prediction and analyses of various associated factors can easily be done with the facility of less time consumption and inexpensiveness.

REFERENCES:

[1]. Dasta JF. Application of artificial intelligence to pharmacy and medicine. Hosp Pharm 1992;27:312-5, 319-22.

[2]. Flasiński M. Introduction to Artificial Intelligence. 1st ed. Switzerland: Springer International Publishing; 2016. p. 4.

[3]. Cellan-Jones R. Stephen Hawking Warns Artificial Intelligence Could End Mankind. Available from: http://www.bbc.com/news/technology-30290540. [Last accessed on 2017 Jun 24].

[4]. Statistica. Artificial Intelligence (AI). Available from: https://www.statista.com/study/38609/artificialintelligence-ai-statista-dossier/. [Last accessed on 2017 Jun 24].

[5]. Manikiran SS, Prasanthi NL. Artificial Intelligence: Milestones and Role in Pharma and Healthcare Sector. Pharma Times. 2019;51(1):10-1.

[6]. Cherkasov A, Hilpert K, Jenssen H, Fjell CD, Waldbrook M, Mullaly SC, et al. Use of artificial intelligence in the design of small peptide antibiotics effective against a broad spectrum of highly antibiotic resistant superbugs. ACS Chem Biol. 2009;4(1):65-74.

[7]. R. R. Nadikattu, The Supremacy of Artificial intelligence and Neural Networks, International Journal of Creative Research Thoughts, 5 (2017) 950-954.

[8]. Kalis B, Collier M, Fu R. 10 Promising AI Applications in Health Care. (2018 May 10) https://hbr.org/2018/05/10-promising-ai-applications-in-health-care (Accessed on November 23, 2019).

[9]. Deore, A. B., Dhumane, J. R., Wagh, R., & Sonawane, R. (2019). The stages of drug discovery and development process. Asian Journal of Pharmaceutical Research and Development, 7(6), 62–67. https://doi.org/10.22270/ajprd.v7i6.616.

[10]. Bravo, À., Piñero, J., Queralt-Rosinach, N., Rautschka, M., & Furlong, L. I. (2015). Extraction of relations between genes and diseases from text and largescale data analysis: Implications for translational research. BMC Bioinformatics, 16(1), 55. https://doi.org/10.1186/s12859-015-0472-9.

[11]. Hutson, M. (2019). AI protein-folding algorithms solve structures faster than ever. Nature. https://doi.org/10.1038/d41586-019-01357-6.

[12]. Veselkov, K., Gonzalez, G., Aljifri, S., Galea, D., Mirnezami, R., Youssef, J., Bronstein, M., & Laponogov, I. (2019). HyperFoods: Machine intelligent 38 mapping of cancer-beating molecules in foods. Scientific Reports, 9(1), 9237. https://doi.org/10.1038/s41598-019-45349-y.

[13]. Pound, P., & Ritskes-Hoitinga, M. (2018). Is it possible to overcome issues of external validity in preclinical animal research? Why most animal models are bound to fail. Journal of Translational Medicine, 16(1), 304. https://doi.org/10.1186/s12967-018-1678-1.

[14]. Dasta JF. Application of artificial in telligence to pharmacy and medicine. Hosp Pharm 1992. 27; 312- 5:319-22.

[15]. Eye for Pharma. Artificial Intelligence - A Brave New World for Pharma. http://www.social. eyeforpharma.com/clinical/artificialintelligence-bravenew-world-pharma.

[16]. Natalie Yeadon. Artificial Intelligence in Pharma. https://becominghuman.ai/artificial-intelligence-in-pharma-4608b076a503.

[17]. Z. Wu, T. Lei, C. Shen, Z. Wang, D. Cao, T. Hou, ADMET evaluation in drug discovery. 19. Reliable prediction of human cytochrome P450 inhibition using artificial intelligence approaches, Journal of chemical information and modeling, 59(11) (2015) 4587-4601.

[18]. Z. Yang, Z. Zeng, K. Wang, S. S. Wong, W. Liang, M. Zanin, J. Liang, Modified SEIR and AI prediction of the epidemics trend of COVID-19 in China under public health interventions, Journal of Thoracic Disease, 12(3) (2016) 165.

[19]. Modi CD. Automated Process Control System. Available from: http://www.authorstream. com/Presentation/ chetu30-1009116-automated-process-control-system/. [Last accessed on 2017 Jun 24].

[20]. Keshavan M. Berg: Using Artificial Intelligence for Drug Discovery. Available from: http://www.medcitynews. com/2015/07/berg-artificial-intelligence/. [Last accessed on 2017