ARTIFICIAL INTELLIGENCE IN PHARMACY PROFESSION

A Project Report Submitted

In Partial Fulfilment of the Requirements

for the Degree of

BACHELOR OF PHARMACY

By

RITESH KUMAR
18021020128

Under the Supervision of

Dr. Shaweta Sharma
Professor
Galgotias University
Greater Noida.

Department of Pharmacy
GALGOTIAS UNIVERSITY
Greater Noida
May, 2022

ARTIFICIAL INTELLIGENCE IN PHARMACY PROFESSION

A Project Report Submitted

In Partial Fulfilment of the Requirements

for the Degree of

BACHELOR OF PHARMACY

By

RITESH KUMAR
18021020128

Under the Supervision of

Dr. Shaweta Sharma
Professor
Galgotias University
Greater Noida.

Department of Pharmacy
GALGOTIAS UNIVERSITY
Greater Noida
May, 2022

TABLE OF CONTENTS

List of Tables

List of Figures

List of Abbreviation
BHMI-Biomedical and Health Information
MEDI-Medicine and Engineering Designing Intelligence
QSAR-Quantitative Structure Activity Relationship
CT SCAN-Computed Tomography Scan
FDA-Food and Drug Administration
MEG-Magneto Encephalo Graphy
HIV-Human immune deficiency virus
ANN-Artificial neural network
DNN-Deep Neural Network
RNN-Recurrent Neural Network
MRI-Magnetic Resonance Imaging
R&D-Research and Development
SAR- Structural Activity Relationship
ECG-Electro cardio graph
AI- Artificial Intelligence
AL-Artificial Learning
ML-Machine Learning
CXR-Chest-X Ray

CERTIFICATE

This is to certify that project work entitled **"Artificial Intelligence in Pharmacy Profession''** done by **Mr. RITESH KUMAR** submitted to Department of Pharmacy, is a bonafide research work done by **Mr. RITESH KUMAR** under the supervision and guidance of **Dr. SHAWETA SHARMA** Professor, Department of Pharmacy, School of Medical and Allied Sciences, Greater Noida. The work is completed and ready for evaluation in partial fulfilment for the award of Bachelor of Pharmacy during the academic year 2021-2022. The project report has not formed the basis for the award of any Degree/Diploma/Fellowship or other similar title to any candidate of any University.

Date:

Prof. Pramod Kumar Sharma
Dean
School of Medical and Allied Sciences
Galgotias University
Greater Noida (U.P.)

BONAFIDE CERTIFICATE

This to certify that the project work entitled **"Artificial Intelligence in Pharmacy Profession"** is the bonafide research work done by **Mr. RITESH KUMAR** who carried out the research work under my supervision and guidance for the award of Bachelor of Pharmacy under Galgotias University, Greater Noida during the academic year 2021-2022. To the best of my knowledge the work reported herein is not submitted for award of any other degree or diploma of any other Institute or University.

Dr. SHAWETA SHARMA
Guide
Professor
School of Medical and Allied Sciences
Galgotias University
Greater Noida (U.P.)

DECLARATION

I hereby declare that the work embodied in this project report entitled **"Artificial Intelligence in Pharmacy profession"** in Partial fulfilment of the requirements for the award of Bachelor of Pharmacy, is a record of original and independent research work done by me during the academic year 2021-22 under the supervision and guidance of **Dr. SHAWETA SHARMA** Professor, Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Greater Noida. I have not submitted this project for award of any other degree or diploma of any other Institute or University.

Date: **(Mr. RITESH KUMAR)**

Place: **Name and Signature of candidate**

ACKNOWLEDGEMENT

I consider it a great privilege & honour to have had the opportunity to undergo and conduct a project work in Galgotias University. Hence, I would like to offer my heartiest thanks to Dr. P.K Sharma (Dean, SMAS Department) and Dr. G.S.N. Koteswara Rao (HOD, Department of Pharmacy). I am greatly indebted to **Dr. Shaweta Sharma** (Professor, School of Medical and Allied Sciences) for her huge support, suggestions and affectious cooperation during the whole course of my project work. I also thanks to my parents for appreciating and supporting me for this grateful work project at last, but not least, I am greatly thankful to all my seniors and colleagues in Galgotias University for extending their constant cooperation which went a long way toward the completion of this Project Work.

Date

RITESH KUMAR
B Pharma VIIIth sem
Enrollment no. 18021020128
Galgotias University, Greater Noida

ABSTRACT

Now days many software like Insta fb video configuring network like YouTube Netflix etc. These kinds of application work by the use of AI. Many sources like it and other sector work basically on the development of AI. It can help in many aspects like artillery, guns and defense sector that help in welfare of the nation.AI work on the aspect to security purpose of the nation and society. Now days in field of research aspect have been change and it became convenient and very effective.AI have very fast aspect on every field of work. It may be pharmacy, medical health, auto mobile sector, marketing strategy or in field of it also changed and totally boomed out. It decreases the work load and harassing culture of industries. In field of pharmacy, it also helps very much and also specialized it and boomed out total outcomes, in pharmacy. It is used in many aspects like it help in drug distribution, the drug distribution become convenient because it stores out the all data of patient with pharmacy and medical professional. In field of research, it helps by providing support by providing convenient help in research it reduces time of research activities and reduce time and cost effectiveness. Due to AI the research and drug discovery standard also change out and therapeutic also change out. In process of drug research by the help of AI total working scenario changes. In the pharmacy industry the working pattern change it helps out the total efficacy stander of working condition and their response. By the use of AI, the toxicity condition changes out specially in condition of chemotherapy drugs and highly toxic drugs. In other medical specially for elder age patient by the use of AI application they get boon and support from the AI application like wheel chair and other supporter devices application. AI also use in many aspects like epidemic study prediction the epidemic and any disease spreading study, so it is used to prevent the spreading of disease. It basically used to gather out different data and information from the different source that help in to tackle out this response also.

1.0 INTRODUCTION

1.1 Artificial Intelligence (AI)

AI first mentioned in year 1956 at a compounding confine. The well-known scientist John McCarthy from the Dartmouth university brought the leading mathematics and science subject in one panel of AI. It is a stream of science and technology that consisted with computer which helps in developments of many aspects like machines and learning of machines, it performs many convenient tasks that is too much helpful for working of human, and it helps in development of human artificial intelligence. The knowledge is to be further processed on the event of the conjugation of each chance of knowing and learning of any character of intelligent may be in the main aspect to be mainly detailed about the machine is to be stimulated by it. At the time when machine do any specific work like it speak convenient English and solve out any algebraic sums and equation. Now days AI has been evolved from academic field to overall field it is said to be an allrounder in use, now it uses in field like social and economical and voice activated in main working technology including speak and speech recognising, medico diagnostic, and mostly now days it uses in automatic vehicle assisting. [1] It is a stream of cs to learn about what is totally and explicitly to be programmed is known as Machine Learning (ML).[2]

Machine Learning (ML) is a kind of Artificial Intelligence which will totally transform the recent era i.e., 21st century. Going progress in the underlaying algorithms and architecture and increasing the amounts of data collection that helps in computing out to increase the competition through out in the field of computer competition throughout the field. These may take about the data to run a vehicle, translation of languages, throughout beyond to human ability to perform at compound level panel games like as GO. In this work we study about the basic fundamentals of machine learning and algorithms and to learn out their optimisation. We also summarise out the tender of Machine Learning in field of medicine. [3]

Artificial Intelligence (AI) is a truly ground breaking computer science achievement that will become a critical component of all modern software in the future years and decades. This is both a danger and an opportunity. Both defensive and offensive cyber operations will benefit from AI. In addition, new cyber-attack methods will be developed to exploit AI's specific flaws. Finally, AI's demand for enormous volumes of training data will amplify the value of data,

altering how we must think about data protection. Prudent global governance will be required to ensure that this era-defining technology brings about widespread safety and prosperity. [4]

Artificial Intelligence is defined as the intelligence agent-that is may be any kind of apps, devices agent which may be proceed surrounding requirement surrounding and requirement according to it, may proceed or intake good amount of time to proceed its objective. In the pharmacy profession AI basically changes out the whole scenario of profession practice, that means in now days any advancement or development can only be possible due to appearance or activity of AI in pharmacy. In the production of pharmacy product, we basically need to run out the industries and, these industries basically run due to the role of ai that generally generated by us, due to the role of AI the production rate now days increases and the working condition also changes, that also influence the life of general people because the price of product is reducing due to vast production in general time. Due to the role of AI in research activities work become smooth and convenient and it take less time, as compared to previous technique, recent example- the research of COVID-19 vaccine become so smooth and very less time consuming due to in role of AI in research activities days there are many research activities are going on like: -HIV virus antidote, cancer drug research, research on the permanent medication of diabetes mellitus, it may be possible in recent days due to in role of AI. In clinical practice of pharmacy, the distribution of drug become convenient due to the use of AI now the pharmacist can keep more knowledge and record of their patient, it prevents in misusing of drugs and helps in distribution of proper distribution of drugs that helps in to provide good therapeutic response and also help in overdosing and side effect of drugs. Artificial Intelligence (AI) had been helping fast in these recent years in concept of software system algorithms, hardware use and development, and its use and utilization in a very aspects number of fields. In this review, we collect the recent researches use and development of applications of AI in biomedicine, pharmacy and medical science including disease test and diagnostical, living assistances, biomedicals data monitoring, and biomedicals researches and development. [5]

The main target of this work is to get knowledge and all information of new scientific development and growth, to keep the knowledge of the availability of technologies, to increase the value of the development and wonderful possibilities of AI in biomedicines and pharmacy, and to give researchers and scientist in connected grounds with motivation. It may be declared that, fair like AI itself, the applications of AI in biomedicines and pharmacy are till now in its very newer and un researched stage. New advanced research and development, progress and innovations will stay to impulse the edge and grow the possibility and option of AI application,

with wild growths are planned in the nearby coming days. AI is fundamentally linked through algorithms. An artificial neural network (ANN) is a theoretical outline for implementing AI algorithms. It is a copy of the human brain and linked fibres of neurons with biased statement path between them. Single neuron may respond to several incentives from neighbouring neurons, and the entire fibres may change its state in response to various environmental input. Health care is totally information-centre containing many data- creating subdomains, such as, medical treatment, pharmacy. Management health care institution with many specialists of clinically practices. Major kind of knowledge are gathered at every aspect of health care and to give unique information, how to practice store and sell of drug at different canters of pharmacy.AI research, imaging, Algorithm have been the best acknowledgement about the kinds of research and advancement over the last years. Computers and AI advances are very ultra-fast computing networking make artificial intelligence (AI) largely advancing in the current society forecasting weather, identifying faces in mobile phone, sensing fraud, and interpreting genomics. AI's upcoming days share in medical practices will be an unrequited question. Machines basically computer learns to identify design not legible using biostatistics by processing and using huge datasets (big data) by algorithms. [6]

Artificial Intelligence has always inspired bizarre visions, such as AI destroying us, saving us, or radically transforming us into a new era. Erik Larson reveals the huge disparity among the real and true science and technology fundamental Artificial Intelligence and the theatrical privileges rises for it. Artificial Intelligence investigators and scientist have long associated AI cognitive approaches through those of human intelligence. However, this is a grave error. Uniform cutting-edge AI does not link to human intelligence. Modern Artificial Intelligence is founded on inductive reasoning: computers use numerical connections to determine which results are mostly chances to correct, letting software to identify an exact look in a copy, for Ex -. Though, hominoid cognitive is totally opposite. Men not relate facts arrange; we educated guesses based on our comments about that we previously distinguish around the earth. We have no idea in what way to programme this type of problems, referred to as abduction. Nonetheless, it is at the core of maximum people's thinking. Larson believes that all of the Artificial Intelligence propaganda is wicked knowledge and evil for knowledge. A philosophy of discovery flourishes on the exploration of beginners somewhat than overpraising present approaches. Inductive AI resolve endure to progress at thin works, but in order toward type actual development, we necessity recklessness innovative conversation then study toward worth the solitary correct intellect we know that is our self. [7]

As hostile performers pursue habits toward feat the knowledge's specific flaws, Artificial Intelligence determination non solitary supplement present offensive and defensive plans, but will too exposed novel facades in the brawl for cyber safety. Data poisoning is a revolutionary assault method that antagonistic actors may employ. Because AI learns from data, antagonistic artistes might manipulate the information usual used to Pullman the Artificial Intelligence toward fix whatever they want. Another potential attack method could be "adversarial examples." Adversarial examples are similar to optical illusions in that they involve changing an AI's contribution information in a method that would be untraceable to a humanoid nevertheless is intended to reason the AI to misleading the contribution in an exact way. In one extensively circulated in one frequently hypothesised scenario, a break symbol might be faintly changed to cause an autonomous car's AI system to misleading it as a produce symbol, with possibly fatal consequences. [8]

Artificial Intelligence is quickly evolving in today's society, with new technological breakthroughs being released every day. Small activities, such as facial recognition, car driving, and other modest responsibilities, are designed into today's computer systems. The major goal of artificial intelligence, on the other hand, is toward make progressive then additional complicated structures that can exceed persons in any type. This comprises additional difficult skills like chess and completing equations. As a result, AI's long-term goal is too faultless altogether people doings then offer healthier answers toward issues than humans may do. Lasting an automatic scheme that performs entirely humanoid duties, from driving carriages to operating computerised commercial units, resolve present various obstacles. Additional importantly, in stopping the creation of deadly weapons that cause significant damage to persons when employed in a war. By way of an effect, the growth of wonderful AI that improves itself, activating an intellect blast, would far beyond humanoid intelligent potential. The creation of a wonderful AI will be the most significant creation in humanoid history. As a result, the development of additional modern technology consumes aided in the abolition of wars, the proper combating of diseases, and the development of appropriate prophylactic measures. In addition, advanced technology would be extremely beneficial in the fight against poverty. [9]

1.2 Artificial Intelligence Devices [10]

1. Mobile phone
2. Electric cars and drones.

3. Social sites and apps like: -fb, twitter, Instagram.

4. Multimedia, video and music streaming app like: - YouTube, Netflix, Spotify

5. Online gaming like: - pubg.

6. Online advertising sites and apps

7. Maps and navigation like: - google map.

8. Finance and economics.

9. Search apps and engine like: - google, Bing

10. Alexa, Siri type google assistant voice assistant app

11. Different apps and instrument use buy the help of AI in research and innovation sector.

1.3 AI basically used for Pharmacy industries

1. In drug detection and development

2. In Clinical research

3. In diagnosis of disease

4. In New medicine

5. Analysis and forecast

6. Information study AI in pharma raises to use of automatic algorithms to make responsibilities which usually depend on people intelligence.[11]

2.0 AI FOR LIVING ASSISTANT

AI applications and advantages are used as consistent smart robotic systems in the field of supported living for the elderly and immobile patients, flagging the path for developments in lifespan excellence for patients and crippled or elderly people. Recently, a list of smart home-based activities and gears for individuals through harm of independence (PLA) was released. As well as intellectual answer replicas founded on radiocommunication device networks, information mining, then AI. NNs may remain skilled to detect human facial expressions as commands using certain image-processing processes. Furthermore, HMIs founded on makeover look study enable public through impairments to switch wheelchairs and robot support cars deprived of the use of a control or sensor committed to the frame parts for diagnosis and treatment and diagnosis attached to body and diagnosis attached to body for the treatment of different stages of treatment and diagnosis linked to the body. [12] Artificial Intelligence (AI) aspires to mimic human thinking processes. Many types of healthcare data may be exploited by AI (structured and unstructured). Machine Learning algorithms for organized information, such by way of the old care path mechanism and neuronal network, and

the current profound knowledge, as fit as normal linguistic distribution for formless data, are well-known AI techniques. Cancer, neurology, and cardiology are three major illness areas where AI is used. The following three obsess or bases are used to do an AI review on cardiovascular stroke.

1) Cause of disease why and what are the reason to cause the disease?
2) Process of study of obsession of causing of disease.
3) It is totally about the process of treatment by the help of different AI tools like IBM Watson which work on AI.

3.0 TYPES OF AI

IBM's Deep Blue, the mechanism that excellently defeated chess game Grandmaster Garry Kasparov in 1997, is a famous sample of a sensitive AI machines. These devices container individual be considered aimed at responding toward an incomplete and fixed usual or mixture of contributions automatically and directly. They are the primary AI-stated structure machineries and hence take actual partial capabilities because they do not include or attach in memory-based processes. As a result, previous experiences and exposure may not be handled to shape the mechanism's upcoming behaviours and activities, i.e., these machineries cannot gain knowledge.

(1) **First Classification**: The primary grouping is based on AI and AI-handled machines' resemblance to hominoid minds, as well as their aptitude to "reason " and "feel" like human body. These AI or AI-stepped schemes are divided into 4 categories: Reactive machines, limited-memory machines, theory of mind, and self-aware AI are all examples. These are briefly explained:

(a) **Reactive machinery**: IBM's Profound Blue, the mechanism that superbly defeated chess game Grandmaster Garry Kasparov in 1997, is a prevalent sample of a responsive AI machinery. Such devices can only respond to a restricted usual or mixture of contributions automatically. They lack thinking-assets processes and were the primary AI-assists scheme machinery, hence their capabilities are limited. As a result, preceding knowledges are irrelevant. As a result, preceding knowledges cannot be used as contributions to guide the mechanism's upcoming behaviours, implying that these machineries are incapable of "learning."

7

(b) **Limited memory machine**: Limited-memory machines are machineries that, in adding to having the characteristics of virtuously sensitive machineries, can to learn after prior information to influence future judgments. Nearly all contemporary AI submissions fit into this category, from catboats and computer-generated supporters to self-driving cars. [14]

(c) **Theory of mind**: The theory of mind AI is the subsequent stander of AI process, and different the preceding 2 methods of AI, it is still regarded an idea or an effort in growth. AI schemes that use theory of mind may improve comprehend the objects by which they interact by determining their mental states and all kinds of emotion, opinion and thinking.

(d) **Self-aware AI**: This is the last step of AI improvement, and it is the final aspects, of all AI innovation. It now exists only in theory. Self-aware AI refers to artificial intelligence structures that take matured to the opinion that they are self-aware, similar to the human being's brain.

(2) **The Second classification**: The second classification is based on information, with three subcategories: (a) Artificial Narrow Intelligence (ANI), (b) Artificial General Intelligence (AGI), and (c) Artificial Superintelligence (ASI).

(a) **Artificial Narrow Intelligence** (ANI): This class of AI encompasses all Artificial Intelligence currently in use. These devices' operation is entirely dependent on way they are planned to perform. As a result, their powers are restricted. These systems fall into the responsive and limited-knowledge. Artificial Intelligence subcategories outlined in the initial AI categories. ANI, often called as 'Weak' AI, is what we see in the world now, according to Jalal.

(b)**Artificial General Intelligence** (AGI) is an AI mediator's ability toward know, observe, understood, and purpose totally similar a human being. ANI is about specific problem solving, whereas AGI is about a machine's ability to do general intelligent behaviours. AGI (artificial general intelligence) is a term that refers to machines that have human-like intelligence.[15]

(c) **Artificial Superintelligence** (ASI): Artificial Superintelligence development is the pinnacle of AI development. If AGI becomes a reality, it will alter our method of lifespan. The basic goal of ASI is to create an appliance that can think more intelligently than a human. The Terminator, starring Arnold Schwarzenegger, is a prime example of ASI.[16]

4.0 ADVANTAGES OF AI IN PHARMACY

1) **Disease Prevention**: Pharmacy businesses can utilise Artificial Intelligence to develop actions and diagnoses for both shared and unusual illnesses such as Alzheimer's and Parkinson's. Because the ROI and chances are actual little relative to the period and price it receipts to create and search pharmacy for treating occasional illness pharmacy corporations do not devote their effort, periods, and possessions like: - money to developing and searching remedies for rare illness. Closely 95 out of a hundred of unusual diseases, rendering to Global Genes, absence FDA-approved drugs or treatment. The scenario is fast shifting for improved therapy thanks to AI and ML's inventive and new research abilities.

2) **Epidemic Prediction**: Many pharma businesses and healthcare providers are already using AI and machine learning to monitor and anticipate epidemic outbreaks and their potential to spread around the world. These technologies use information gathered from a variety of sources and data on the internet to investigate the impact of a variety of ecological, environmental, and organic issues on the healthiness of people in a variety of geographical and geographic particular place, and to attempt to attach the spots among these issues and preceding widespread epidemics. These AI/ML replicas are particularly effective in developing frugalities and countries that absence the infrastructure and monetary resources to contract with widespread outbreaks like COVID. The AI-based Malaria Outbake is a good example and use of this technology.

3) **Remote Monitoring**: Remote monitoring is a game-changer trendy in the pharmacy and health system industries. Numerous pharmacy businesses have now advanced AI-equipped wearables that may directly screen patient role with life-dangerous conditions. Tencent Holdings, for example, has teamed up with Meropid to grow Artificial Intelligence skill that may directly control sick person with Parkinson's sickness, cutting the period it takes to do a motorized purpose assessment from thirty minutes to 3 minutes. It is feasible to manage the opening and shutting actions of a patient's hands and other activities from a remote place by combining AI technology with smartphone apps. [17] The digital mobile camera will detention and recognise the hand movement after detecting and discovering it, which will aid in determining the harshness of the indications (Parkinson's). The incidence and magnitude of the drive will define the harshness notch of the affected role status, allows doctor and medical practitioners to remotely modify medications and drug doses as needed.

If the situation worsens and a therapy upgrade is required, the AI will notify the doctor and schedule a diagnosis. Remote installations as similar these reduce the necessity for patients to drive back and forth toward the hospital's office, redeemable them time and money.

4) **Marketing Development**: Given that the pharmacy manufacturing is a sales-based and based industry, AI may be a useful and beneficial equipment in pharmacy market. Pharma firms may use AI to investigate, design, and develop unique marketing tactics and techniques that will result in increased revenue, collection, and brand awareness. AI may aid in the mapping of a customer's desire and journey, allowing businesses to identify and determine which marketing tactic drove visits to their place (lead conversing) and eventually strapped those companies to buy and buy out from them. In this situation, pharmacy businesses can concentrate their efforts and be more consultative on the marketing methods and techniques that result in the highest conversion rates and increased revenues and earnings. Artificial intelligence (AI) systems can look back at previous marketing efforts and surveys Combine the findings to see which campaigns and organisations have been the most successful. This forces businesses and organisations to rethink their present marketing tactics, saving time and money in the process. Further these kinds of Artificial Intelligence systems can calculate the achievement or disappointment degree of advertising movements and strategies with great precision. Even though AI is rapidly challenging. Most pharmacy businesses' current IT infrastructure is founded on outdated technologies these are not Artificial Intelligence-ready.

Furthermore, the incorporation and acceptance of AI requires industrial knowledge and skills, which are presently in short supply. However, by following these steps, AI adoption in the pharmacy industry can be made simple. [18]

• Cooperating with moot organizations that specialise in Artificial Intelligence Research and development to track pharma businesses' Artificial Intelligence acceptance towards the society.
• Collaborating with corporations that specialise in Artificial Intelligence-steps drug detection to gain access to expert help, progressive instruments, and manufacturing knowledge.

Trained Research and development and industrial sides in the proper usage and implementation of AI apparatuses and methodologies for maximum productivity and efficacy. Several pharmacological therapy-focused programmes have recently been reported. They can help with Medication interaction, treatment monitor, and medicine formulation process are all important considerations. There are numerous aspects of pharmaceuticals where Artificial Intelligence could have an assay, and the learner is urged to think about these potentials since they maybe

one day develop a realism in pharmacy profession. There are many sectors of pharmacy where Artificial Intelligence may have an effect, and the reader is encouraged to consider these potentials because they whitethorn one day will be a reality in pharmacy profession [19].

5.0 APPLICATION OF AI IN PHARMACY

In Pharmacy profession the AI works in very aspects to tackle out different aspects like the process of drug discovery, quality assurance, quality control and different processes of drug discovery and many processes of Pharmaceutical production.
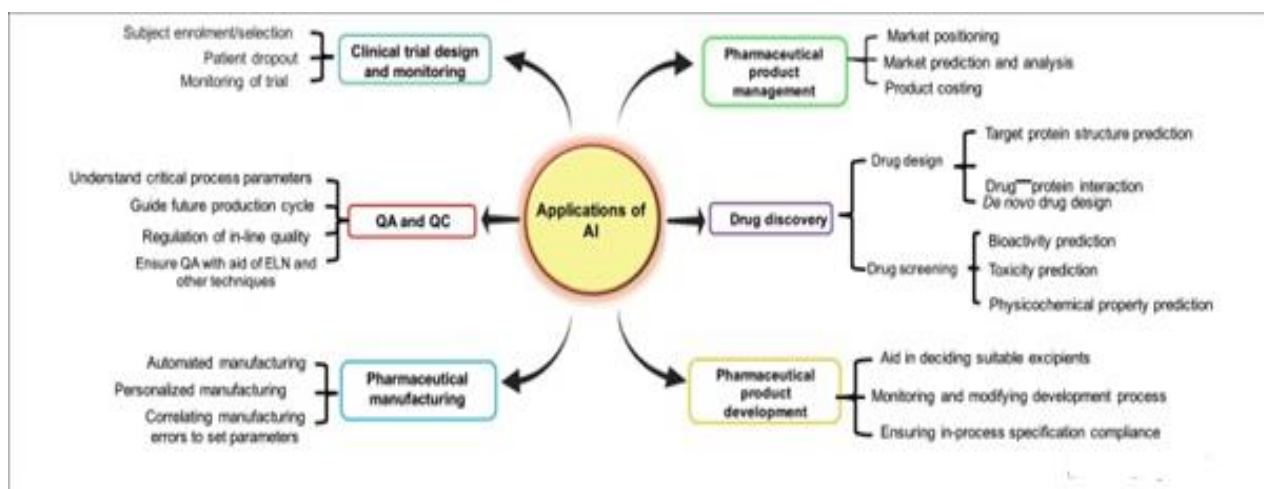

Fig 1: - Application of AI in Pharmacy

Application of Artificial Intelligence in the Pharmacy industries:

1.**Research developments** -In the field of research and research and development in pharmacy in very assertive role to help out the overall performance to develop out in all aspect to generate out more therapeutic product in very less effect time and cost.

2. **Drug development** -It is very major field to develop out a drug that may develop in very less time, before the use of AI all the process was going out manually, it may consume more time and show very less effect and accuracy was also very low so, it used to increase the chances of accuracy and therapeuticising.[20]

3**. Diagnosis** –In the diagnosis of many diseases and many experiments and much procedure we take out the help of AI which help out in accurate diagnosis in very less time with throughout total effective effect.

4. **Disease prevention-** AI aspect in disease prevention is related to prediction of new virus and microbes spreading that cause out many diseases, so AI help in somehow in prevention of disease by helping through out

5. **Epidemic prediction** –It is subjected to predict out about the epidemic occurrence or to the chances l to cause out any epidemic out comes, so AI basically may help in to predict out the rate or chances of spreading of any disease, in which pattern in is spreading, about infection ratio, death numbers, etc.

6. **Remote monitoring** -It is a kind of monitoring in which we say about the use of monitoring device by help of AI, to monitor out or control out the any application and device which help them to function, for ex-use of remote control in electronic wheel chair, use of AI in electronic pacemaker, BP measuring and other devices.

7. **Manufacturing**. –In manufacturing of pharmacy product like- tablet, capsule, IV, and other formulation during the formulation of these products, we have to properly monitoring of manufacturing unit to proper monitoring we need the help of AI to proper monitoring of these all devices. [21]

8. **Marketing** -in the aspect of marketing the use of AI is like a boon to collect out the all data related to customer and other sources of markets like-organisation, demand, total bill sheet information of marketing; it so much helps in to approach out proper customer.

9. **Rare diseases and personalized medicine** -some rare disease like Alzheimer and other disease like mental disability, the RMP take out the help of AI to diagnose out individually basis and to prescribe out any specific medicine for the treatment of these kind of disease the personalized kind of medication is required which monitor out by the uses of AI.

10. **Processing biomedical with clinical information** - For any kind of clinical research or invention of new kind of drug or see out their therapies effect and other abilities or to evaluate out the generic drug, then bioequivalence data is required and monitoring of biomedical and other clinical data is may be possible to assessed by the help of AI in the medical aspects.

11. **Identifying clinical trial candidates**- In clinical trial process there are many aspects is to be observed, over all the main observation is done to the all the candidate, who is taking participation in the clinical trial procedure, we have to see the all activities of the volunteer that they are responding or not, if responding then, what are the sign is it positive or negative, as per our desire if not then we go for the development and manage out our drawback.

We can say that in know days AI become in the pharmacy's sector and we need to much implementation of AI in this sector.[22]

6.0 AI IN HOSPITAL PHARMACY

There are numerous tenders of Artificial Intelligence in hospital pharmaceutics-standard well-being maintenance systems, including establishing quantity procedures for every patient selecting the most appropriate and obtainable management routes, and determining diagnosis policy.[23]

I) **Medical record maintenance**: Preserving patient medicinal archives is a difficult task. The AI system makes data collecting, storage, normalization, and tracing much easier. The Google very deep Mind well-being scheme (created by Google) aids with the rapid excavation of medicinal record. As a result, this project is beneficial to better and faster health treatment. This project assists the Moor fields Eye Hospital NHS in improving eyes treatments.

ii) **Treatment planning design**: With the help to treatments plan design software, you may create effective treatment programmes technology. When a patient's condition becomes critical and selecting an appropriate treatments planning becomes very difficultly, an Artificial Intelligence system is required for maintain switch of the condition. All earlier information and report, as well as clinically expertise, are taken into account when designing a treatment plan based on the technology's recommendations. IBM Watson has launched a programme to assist doctor.

iii) **Assisting with repetitive work**: Artificial Intelligence skill can help with few consecutive works, like these evaluating X-ray scanning, radiography, ECHO, and ECG to determine disease diagnosis and recognise. Medical Sieve (an IBM algorithm) is a "cognitive assistant" with strong analytical and reasoning abilities. By mixing deep learning with medical data, a medical start-up is required to enhance patient condition. Each bodily part has its own unique computer software that is used in specific medical states. Deep learning may be used to analyse practically any sort of imaging data, including X-rays, CT scans, ECHOs, and ECGs.[24]

iv) **Medical help and assistance with medication**: In recent years, AI technology has been recognised as effective in health support services and pharmacy assistance. Molly (a virtual nurse created by a start-up) is greeted with a friendly voice and a friendly visage. Its goal is to assist patients in making treatment decisions. Its goal is to assist patients in guiding their treatment and to provide assistance for chronic conditions in between medical visits. AI Cure is a smartphone webcam programme that watches sick person to helps them switch their diseases. [25]

v) **AI aids people in the health-care system**: It has the ability to collect and compare data from social awareness algorithms. The large amount of data stored in the healthcare system includes the individuals' medical histories, treatment histories, habits, and lifestyles. [26]

7.0 AI APPROACHES IN POLY PHARMACOLOGY

AI methods for the new type's progressive understanding of compulsive processes in numerous illnesses at their complex foundation, the 'single-diseases-many-approaches' paradigm now governs over the 'one-disease-one-targets' approach. Polypharmacology refers to the situation of a single disease having several targets. PubChem, KEGG, ChEMBL, ZINC, STITCH, Ligand Expo, PDB, Drug bank, Super target, Compulsory DB, and other databases are available for obtaining a variety of significant and valuable information's linked to crystalline structures, chemicals property, biologicals property, atoms pathway, binding affinity, diseases concerns, medicine target, and so on. AI can also help with the construction of records for polypharmacological compounds and agents.[27]

8.0 TOOLS OF AI IN PHARMACY

Robot pharmacy: - By the target of growing patient safeness, UCSF Medicinal Centers uses robot skill for medication formulation and diagnosis. Conferring near them, the system has accurately equipped 3,50,000 pharmacy dosing. The robotic has shown to be significantly superior to human being in terms of both sizes and skill. The capabilities of robotic technology include the manufacturing of oral and injectable pharmacy's, including deadly chemotherapy agents. This has allowed UCSF pharmacists and nurses to focus on straight sick person attention also collaboration by doctors, allowing them toward use their expertise.

MEDi Robot: - MEDi stands for medicine and engineering designing intelligence in short. AI instruments Tanya Beran, senior professor of Public Health Disciplines in the University of Calgary in Alberta, oversaw to initiative that resulted by the creation of the pain management robot. Afterwards employed in hospices where child screamed by medicine professional, she had to notion. Although the robot may not thinkable, planning, or reasons, it can be made to appear to have AI. [28] The robot initially establishes a relationship with the child before telling them what to imagine throughout a medicinal treatment.[29]

Erica robot: - Erica is a novel upkeep robots created in Japan by Hiroshi Ishiguro, an Osaka University professor.) The Progressive Communications Investigate Institution International,

Kyoto University, and the Japan Sciences and Technologies Activity collaborated on to the project (ATR). It speaks Japanese and has a face that is a mix of European and Asian features. [30]. It enjoys cartoon films, wishes to go to Southeast Asia, and wishes to have a life partner with whom it can converse. The robot cannot move on its own, but it has been designed to understand and respond to inquiries by human being-related makeover expression. Ishiguro combined the feature of thirty beauty ladies to create Erica, the "most beautiful and intellectual" android so Ishiguro and used to change out the beauty of robots by taking the rear of nose, lips and other beauty parts of approx. 30 women and beautician.

Tug robot: - Tug robot is intended to go over the hospice on their own, delivering medications, meals, specimens, and materials, as well as hauling heavy loads like linen and rubbish. It comes in two configurations: secure and tenable cart, as well as a conversation improper stage for carrying rack, bin, and cart. The interchange platform is used to convey 75 transfer goods that can be loaded on multiple racks, whilst the stationary carts are used by to deliver pharmacy's, sensitive products, and laboratory specimens. The TUG can provide a variety of cart and rack, makes it a too much versatile and useful resources. [31,32]

Technology of AI are increasing to applied healthcare for the, healthcare settings like related terms of patient flow, medical data, which rise volume and capabilities, to current health care system to run in meaningful system.AI used to prevent drug resistance, for the patient, especially the mental retardation patient, approx. of all patient 30% of total patient show the side effect, so AI in pharmacy use to prevent side effect and provide proper therapeutic effect. Now days the use of AI in pharmacy leads to vast development of therapeutic response of drug and the outcomes of the result, by the use of AI in pharmacy it leads out the major problems like: -side effects adverse effect, miss use, that helps in decrease the death ratio of patient. [33] AI in now days become one of the most important problem-solving techniques by add of intelligence. By the advancement of large information, information and Artificial Intelligence like: - pharmacy robot, use for improving the safeness of patients, robotic an technologies use for the training and delivery of drug basically these kinds of robots may use in chemotherapy (toxic) drugs.AI intelligence use in discovery of new drugs, it takes very less time as compare to traditional laboratory method, so that helps in good therapeutic and cost-effective production. Manufacturing executive system (MES)-use of AI like: - robots, computers etc. to monitor out to control out the production unit and to get out the total minute to minute information like data and information related to different sources and parts of industries. [34]

It emphasises the usage by Artificial Intelligence in a variety of pharmacy industries sectors, includes medicine innovation and developments, medicine repurpose, boosting pharmacy productivities, and clinicals trial, amongst other; as like as minimises humans work loading while also reaching target a very shortly amount of period It also inform the connections among AI tool and methodologies, as well as ongoing difficulties and solutions, as well as the upcoming of Artificial Intelligence in the pharmacy business. E-VAI is an analytic and decision-making therapeutic response to a patient, like the personalized their medication and other clinical data for future development of the drug. Application of AI a) clinical trial design and to monitor it, b) in the role of qa and qc in manufacturing of products, c) drug discovery by use of AI, d) pharmacy development and development of their product.[35]

Artificially Intelligences (AI) is a model that assists in the creation of information, the solving of problems, and the making of specific decisions. Recently, AI has been playing a important part in many aspects of pharmacy, including medicine discoveries, drug delivery format development, poly pharmacology, hospital pharmacy, and so on. Many Artificial Neural Networks (ANNs) such as Deep Neural Networks (DNNs) and Recurrent Neural Networks (RNNs) are used in drugs discoveries and formulation developments. Numerous medicine detection discoveries have been lately reviewed, by the control of knowledge in measurable structural-properties relationships (QSPR) or quantitative structure-activity relationship (QSAR) has recently been accumulated (QSAR). Furthermore, de novo creation design encourages the development of significantly fresher medication compounds than desired/optimal makings. The applications of AI in, particularly in the areas of drug detection, medication distribution preparation developments, poly pharmacologies, and hospitals pharmacies, particularly in the areas of drug detection, medication distribution formulations developments, poly pharmacologies, and hospitals pharmacies [36].

In to pharmacy research with development, artificial intelligence and machine learning have proven to be quite beneficial. Because of its generative nature, prediction skills, and regular abilities effective in result, AI/ML attributes are creating to the pharmacy industry. Since the last 15–20 years, ML has been employed in drug discovery. Due to an effective result in the clinical trial process, the COVID-19 pandemic may also control the use of AI/ML in clinical trials. As we progress into a world where AI/ML is being integrated into R&D, we will see the development of new pharmacy evolution, which will aid in the production of more cost-effective and therapeutic products. AI/ML methods have the ability in pharmacy research and development, artificial intelligence and machine learning have proven to be quite beneficial.

Because of its generative nature, prediction skills, and regular abilities effective in result, AI/ML attributes are creating to the pharmacy industry. Since the last 15–20 years, ML has been employed in drug discovery. Due to an effective result in the clinical trial process, the COVID-19 pandemic may also control the use of AI/ML in clinical trials. As we progress into a world where AI/ML is being integrated into R&D, we will see the development of new pharmacy evolution, which will aid in the production of more cost-effective and therapeutic products. AI/ML methods have the ability to Methods have the potential to improve drug growth chances by delivering important developments in many areas of Research and development, including: new targets documentation, sympathetic of targeting-diseases relatives, medication contender selections, proteins structures prediction, molecule compounding plan and optimizations sympathetic of diseases mechanism, and growth. [37]

9.0 AI APPLIED IN TOP PHARMACY COMPANIES

- Pfizer: specialises in immunological oncology.
- Roche: Diabetics maculating edema . [38]
- Decoding cancer pathologies image with Novartis.
- Johnson Johnson: skin scanner, strokes-relating demise MSD and Merck put a special prominence on diabetes tumours inhibition.
- Sanofis recognises novel usages for nearly half of it medical asset fragment meant for hereditary illness through medication repurposing.
- GlaxoSmithKline has an artificial intelligence unit for drug detection and an in-silico medicine finding team.
- Amgen: GNS well-being maintenance therapeutic study accuracy medicine
  Gilead Sciences: medication discovery from several perspectives. [39]

The drive of conduction artificial intelligence-based information detection techniques was considered as following: ,[40]

1) Artificial intelligence abilities , Sessa et al, AI in Pharmacoepidemiology Frontiers in Pharmacology ,To forecast clinical reply succeeding pharmacologic conduct.

2) Towards forecast the required dose specified the patient role quality and chances.

3) Toward forecast the existence/harshness of adversative medicine responses.

4) Towards forecast judgment principal to a medicine remedy.

5) Toward analyse medicine use and their activities.

6) To analyse the tendency score and appetite.

7) To analyse drug-addled extents of time in hospice.

8) Toward foresee obedience to pharmacologic diagnosis and evolution.

9) Toward enhance action routine of the patients.

10) Toward classify sub population additional at danger of medicine inefficaciousness besides their misuse, then

11) Towards prediction of drug-drug relations. [41]

Pharma's next competitive advantage in life sciences is artificial intelligence (AI). 'Automation becomes the conclusion of Industrialization' with the use of Artificial Intelligence and Robots, driven by the need to increase productivity, produce consistently excellent products, and eliminate hazardous and heavy duties from the workforce. PAT, CFD, and pharmacy automation in R&D are the current inclinations of AI in pharmacy, which provide complete knowledge about approaches that have previously been employed in health care, like as nebulizer projects, medicine fascination & disbanding, and illness targeting. [42] Many pills and treatments contain harmful and severe adverse effects. People stopped buying these drugs as a result. As a result of the AI's prediction and determination that certain combinations of pharmacy and drugs will work for individuals, fewer people and patients will be required to cease using these very poisonous prescriptions. Consumers will be more confident in purchasing pharmacy since they will know they are safe and have no negative side effects. Furthermore, AI will aid in the development of new medicine combinations that will increase pharmacy efficiency, therapeutic effectiveness, and cost. [43]

10.0 USE OF AI IN VARIOUS FIELDS

10.1 Use of AI in Research and Development

Pharmaceutical corporations everywhere in different countries stay using progressive and well-developed ML procedures and Artificial Intelligence based and power-driven tool to make successful the drugs development and   discoveries processes and activities. They are very fast and highly intelligent tools and devices and designed are created to identify patterns and design to big dataset, so hence, these may to use to predict and resolve out challenging related within difficult biologically networking and association. This ability is brilliant for learning the forms kind numerous diseases and knowing with drug arrangements will be good and suitable for treatment and diagnosis of specific traits and variants of a particular disease. [44]

As per recent studies so successes, the medicinal R&D models are not able to help the patient's health because of a sequence of faults and defects innate in the R&D model itself. Now a newer group of intelligence, incorporating human and artificial intelligence (AI) may come out of these problems. Because AI may show a major part in this newer over all intelligence, it is needed that person who concerned in healthcare should have a general knowledge of how this AI intelligence will work. AI is increasingly day by day to use in drug discovery and research out to aid by the simulated broadcast of a huge number of compounds with molecules in order to assess these structure and designs of new compound to instance, a powerful neutrally networks capable of identifying the binding poses of three additional chemicals and molecules of interest as well as the ability to bind a proteins targeting were used by anticipate the possessing of potential novels ligand. Known ligands, as well as numerous additional chemicals and molecules with known poses, non-binding conformations, and polymer, were used by the training process. In vitro and in vivo tests and system were used to verify the percentage and possibilities of the novel compounds expected to bind to the protein target. [45]

10.2 Use of AI in Medical Health Care

AI had been effectively applying by images analyses and diagnosis in radiologists, pathologies, and dermatologist, very helpful in speeding up diagnostic activates, and providing effective accurateness to medicinal professional and medical experts. When diagnostic and research and effective rate never be reaches up to 100%, by combining and adding machines like Ai with doctors and physicians consistently boosts overall performance and results. Rational databases are enhancing health repetition to contributing naturally languages processed by study out the speedily increasing scientifically literatures by organize ages of varied electronically medicinal recording. In these and added way, Artificial Intelligence can improve by caring route of chronically diseased patient, propose accuracy therapy of multifaceted illness, decrease medicinal mistakes, with enhance focus conscription in clinicals trial.[46]

AI can help clinical practisers like doctor, nurses, pharmacist to improve the outcome of patients. By help of AI by the role of data science, by calibrations of model of AI we can develop condition of patient. AI related main limitation is to medication use process are also discovered.AI in recent time in the medical sector become one of the most supportable help and source which help in increasing the overall outcomes and also help full for the wellbeing of patient and sick person. Many diseases treatment may be possible due to the effect and in role of AI in medical health profession. [47]

Technology progress in health care profession will demonstrate the causing (symptoms) of disease, for example covid-19(corona virus) pandemic, to determine the spredation it cause up to 3to4 months, but we can say that it may take up to few days by use of AI, so basically, we can use AI in to pre prediction of any pandemic, that will be very help full for human generation.[48] Main diseases extents with practice Artificial Intelligence tool contain cancers, neurologist and cariologies. [49]

Ai review on cardiovascular stroke is basically done via three obsess or bases are following:

1) Conduction of disease how it conducts to the body, means how it causes?

2) Obsession of disease that is about the cause of disease.

3) It is about the process of treatment by the help of AI, its pioneer discussion was concluding on the AI systems like the IBM Waston.

One of the first research AI approaches for medical development was IBM Baston. [50] Doctors may collect, process, analyse, and determine massive amounts of patient healthcare data and information using innovative and effective Machine Learning technologies. Healthcare providers and workers all around the world are adopting ML and AI to securely store with protect sensitive and vital patients' information in the clouds, a centralised storing system, or a cloud chain network like GOOGLE. Electronic medical records (EMRs) are used for this. [51]

Doctors and medical professionals can use these records as needed to understood the influence by a certain hereditary characteristic on a patient role well-being or in what way a specific or any medicine may treated and discussed any patient's health problem. Machine Learning organizations can used by information from EMR to produce actual forecasts for analysis and provide the best action options for patient. [52]

Because machine learning skills can process and evaluate large amount of information quick, these may speed up the treatment processing, potentially saving million of life. If AI is utilised unethically, it has the potential to exacerbate current health-care inequities, especially if it is not deployed effectively. It is critical to harness AI's positive potential in a decent and morally acceptable manner. This article examines the major challenges surrounding AI ethics.

Pathology and treatment, as well as the use of AI in patient welfare, are all areas where pharmacy may assist. The possible hazards associated with the application of Artificial Intelligence and ADM inside the pathology's workflows were examined, as well as issues linked to moral project of pathology's Artificial intelligence study. In to context of pathology

and treatment, three fundamental aspects of ethical AI are described: openness, accountability, and governance. [53]

Artificial Intelligence to forecast new treatments verge is tackling major issues in drug discovery by employing automated data collection and analysis. In other words, they're using an algorithm to map out hundreds of genes involved in brain illnesses such as Alzheimer's, Parkinson's, and ALS. Verge believes that collecting and analysing gene data will have a positive impact on the drug discovery phase, beginning with preclinical trials. Starting in the preclinical phase, Verge hopes to utilise AI to track the effects of various pharmacological treatments on the human brain.[54]

As a result, drug companies can acquire a better image of a medicine's impact on human cells sooner. Verge, in example, employs artificial intelligence to track the effects of various medicines on the humanoid brains, within a focused on the preclinically stage. [55] Contempt numerous preceding sessions of "enthusiastic optimise" around the methodologies deploy, Artificial intelligence was dominant to Biomedical and Health Informatics (BMHI), by arena investigation in what way to appreciate brainy rational in skill jobwise by the practise of health care, emerging exact model, technologies, then software program tool to help humanoid expert in biomedicines.[56]These are starting to had an influence in medicine on 3 level: for clinician, primarily through rapidly, precise copy interpretations; to healthiness system, through improved workflows by the potentials for reduce medicinal error; then fourthly patient, to permitting the to procedure their individual information to indorse healthiness. [57]

10.3 Use of AI in Cancer Treatment

Multiparametric imaging is a type of medical imaging that uses two or more characteristics to distinguish between healthy and sick tissue. T2-weighte MRIs, diffusions-weights MRIs, with active contrasting-enhance MRIs are some of the characteristics used in multipara metric magnetic resonance imaging (MRI). [58]

AI for detecting new occurrences of breast cancer and providing appropriate treatment- We recognized females by mammographic mystic chest malignancies by evaluating the recognized record from Jan 2017 to Sep 2019 and analysing these mammographic by Artificial Intelligence package that generated a spite notch (range zero to hundred greater than ten measured good). The AI report's hot areas were compared against US and MRI data to see if the AI software correctly identified the tumours. The clinic pathologic characteristics of AI-identified tumours

were analysed and compared to those of cancers that were not detected, and the results will be very useful in cancer detection and therapy. [59]

In many countries, mammography is a commonly used breast cancer screening method that is helpful in plummeting chest cancer-linked death [60]. Though, the compassion situation is limit, and mammographic mystic chest tumours account for nine – thirty percent of all breast cancers [61]. Since the 1990s, traditional computer-aided detection (CAD) methods designed for involuntary discovery then cataloguing of chest grazes in mammographic have been developed, which indicate localised parts of augmented thickness then tiny calcification. However, owing toward the enormous numbers of true-false finding, CAD system fail by showing important increases in showing efficacy or price-effective effect. [62]

Though mammographic is the lone imagery examination that has been shown to reduce breast cancer mortality, there has been debate over the possible risks of screening, such as untrue confident memories and biopsy. The massive mainstream to ten to fifteen percent of females who are requested to reappearance after an indecisive showing mammography have another mammograms or ultrasounds. Many of these abnormalities are confirmed to be benign after subsequent imaging scans, with only 10–20 percent requiring a needle biopsy for further investigation. Only 20–40 percent of these result in a cancer diagnosis. Clearly, nearby is an emergency need for alter the equilibrium of repetitive chest cancer broadcast from advantage to harmanes. [63]

There are lots of interest in using AI algorithms in radiologist, which are mostly dependent on picture information that may be effortlessly treated besides analysed by computer.[64] Previous research has originated that Artificial Intelligence algorithm may had very sympathy then specific aimed at to detect of chest cancer. [65] Additionally, Artificial intelligence algorithm improve radiology' cancers discovery rate then achieve high performances levels than radiologist deprived of Artificial Intelligence help through lowering the degree of true-false and right-false interpretation. Furthermore, AI algorithms greatly lowered radiologists' workload without compromising their performance, and they showed promise in eliminating the requirement for dual understanding. [66]

Given the Artificial intelligence algorithm are founded on imagination biomarker acquired from important copy information somewhat than old-style human beings-design structures of chest cancers, we hypothesise these tumour signals that are often hidden by the naked eyes can be detected by Artificial Intelligence algorithm.[67] Though, lone rare research has looked at

AI algorithms' efficacy in detecting mammographically occult breast tumours. One study compared the specificity of medical and Artificial Intelligence assessment at the mammographic levels to assess the effectiveness of an AI algorithm in reducing false-negative interpretation, nonetheless the option of true-false assessment in the Artificial Intelligence algorithms (that is tall spite notch made in the mistaken areas) were non occupied hooked on accounts.[68]

The purpose of these works was to determine the clinically and pathologically pattern of mammographic mystic chest cancer that may be determined used by Artificial Intelligence software program, as well as to assess the additional worth of an Artificial Intelligence-based analysis secondary software program in the discovery of mammographic ally mystic chest cancer by the good locality. [69]

For the clarification of numerous imagination modals, such as radiographic, CT, or MR, deep learning (DL)-based methods has been presented. DL algorithms have been used to evaluate anomalies such as lungs modeless, pulmonarias tuberculised, cisticolas fibrosing, pneumonoconiosis, and the placement of superficially placed dominant catheters on trunk radiographs. Aimed at a variety of no-emergency and developing scientific indication, breast radiographs is the greatest frequently done radiologically testes. The aim for this education is to determine the correctness of a bottomless knowledge algorithm to detecting abnormality on monotonous forward trunk radiographics (CXR), as well as the stability and change in findings over time. [70]

10.4 Use of AI Tools in Pharmacy for Co-Morbidities Patient

The WHO has designated the Deltas version of SARS-CoV-2 as a variation of concerns (VOC), then COVID-19-related infection in patient by co-morbidity had tinted the necessity of lingering illness treatment, such as diabetes, hypertension, and cardiovascular disease. Community pharmacy can be updated utilising AI tools in such dire situations. For example, in clinical settings, FDA-approve Artificial Intelligence tool as like as DreaMed AdvisorPro (which analyses bloods sugar and insulin heart information) and the guardians, connecting systems (which predicts bloods sugar changing) have been reported to improve the accurateness of circulatory danger forecast amongst patient through heart related diseases. They are susceptible to mucormycotic and other COVID-19-related problems. Artificial intelligence (AI) and deep learning are making inroads into clinical practise. [71]

10.5 Use of AI in Distribution of Drugs

A survey done by government of Estonia, in which they find that, every patient has their own online medical history records with their doctors and pharmacist. This kind of information share by the use of AI like mobile phone or app based on mobile phone, they contain a unique prescription which shared to every hospital of country, so they can share it to any doctor and pharmacist, so patient can generate their prescription at any pharmacy by using the unique id Influence by pharmacist. By way of Artificial intelligence impacts routines, basic, with repeated jobs, pharmacist' period then effort may be diverted by nuanced clinic task which provide directly, therapeutic, and humanitarian parietal caring. Slow jobs, like as regular visiting, patient and drug care scrutiny, then information reading, may be offloaded using AI structures. Artificial Intelligence technologies may work to the back level, providing info in a visual digestible then moderately explainable format by the right time to assist pharmacists improve patient care outcomes. Supports the patient's overall well-being [72].

Machine learning and artificial intelligence are the forthcoming of each area. They may be used to slightly area aimed at improved or more effectual performances. Together of they may be employed to a retailing pharma store to solve variety of problem. The ML forecast perfectly may aid in the prediction to a patient's disease as well as the patient's medication. Artificial Intelligence system may be use to mechanize processes, which would save time and money in the project of medicine distribution system. However, there were certain drawbacks, such as the forecast of the association between devising parameters and response. [73]

This is too connected for treatment results then unexpected events. On-demand dose adjustment or drug release rates, targeted releasing, and drug stability are all critical factors to consider when constructing various types of intelligent drug releasing systems.

Due to AI the research and drug discovery standard also change out and therapeutic also change out. In process of drug research by the help of AI total working scenario changes. In the pharmacy industry the working pattern change it helps out the total efficacy stander of working condition and their response. By the use of AI, the toxicity condition changes out specially in condition of chemotherapy drugs and highly toxic drugs. In other medical specially for elder age patient by the use of AI application they get boon and support from the AI application like wheel chair and other supporter devices application.AI also use in many aspects like epidemic study prediction the epidemic and any disease spreading study, so it is used to prevent the

spreading of disease. It basically used to gather out different data and information from the different source that help in to tackle out this response also.[74]

AI had been effectively applying by images analyses and diagnosis in radiologists, pathologies, and dermatologist, very helpful in speeding up diagnostic activates, and providing effective accurateness to medicinal professional and medical experts. When diagnostic and research and effective rate never be reaches up to 100%, by combining and adding machines like Ai with doctors and physicians consistently boosts overall performance and results. Rational databases are enhancing health repetition to contributing naturally languages processed by study out the speedily increasing scientifically literatures by organize ages of varied electronically medicinal recording. In these and added way, Artificial Intelligence can improve by caring route of chronically diseased patient, propose accuracy therapy of multifaceted illness, decrease medicinal mistakes, with enhance focus conscription in clinicals trials. As a result, drug companies can acquire a better image of a medicine's impact on human cells sooner. Verge, in example, employs artificial intelligence to track the effects of various medicines on the humanoid brains, within a focused on the preclinically stage. Contempt numerous preceding sessions of "enthusiastic optimise" around the methodologies deploys.

10.6 AI in Drug Discovery and Clinical Trail

In now days the pharmacy industry discovers new ways and techniques to help and solve some of the greatest or bigger problem facing in pharma profession. AI in pharma profession allow use of advanced automated algorithms to continue task of with old, traditional related to human intelligence.
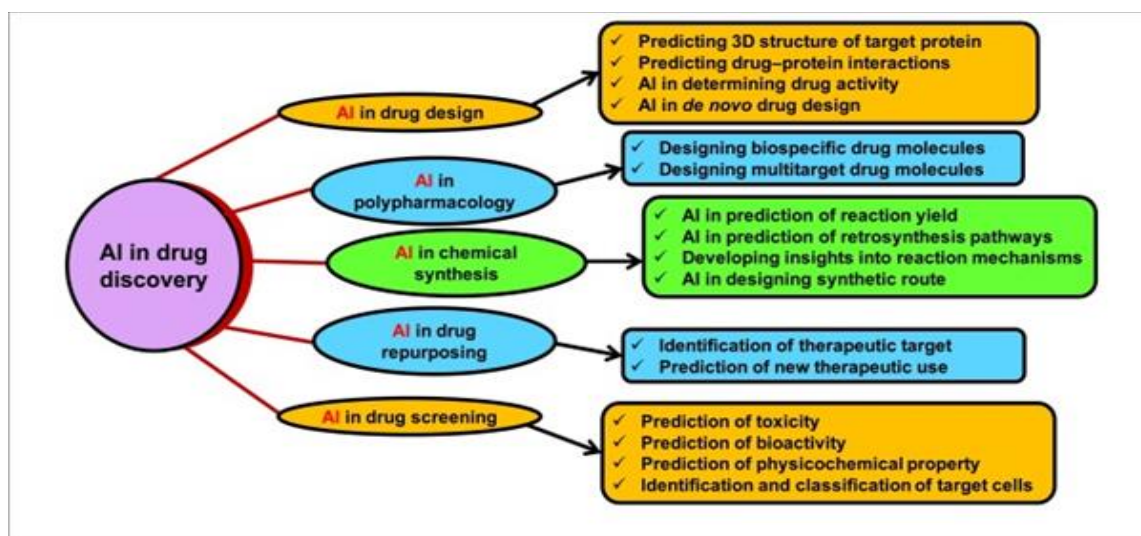

Fig no.-2 AI in drug discovery

25

AI in drug discovery-computer are far faster to old-style humanoid examination then workshop experiments in discovery novel information set, by the of air new and more therapeutic effect drug can be reported soon. Drug discovery in pharma company use to aspect conjugative with software companies to implement the most costly and expensive process of drug discovery. Artificial intelligence (AI) has the possible to recover the research and development and medication development procedure. AI can handle it all, after scheming, developing, then classifying novel particles or compounds to targets-basses medicine authentication, evaluation, then discovery. Only 13.8 percent of medications make it through clinical testing, according to MIT research.[75]

A pharmacy corporation must wage wherever amid US$ 161 crores and US$ 2ooo crores aimed at a medicine to become finished the entire procedure and study of a scientific experimental and receive FDA and other regulatory body approval in order to pass or emerge out of this clinical study. There are numerous reasons why some pharmacy corporations are approving AI toward recover the achievement rate of novel medications to develop more cheap and advanced medications with great therapeutic efficacy while also lowering overall activity costs. AI has improved computer-assisted drug development. This could help to improve molecule and compound discovery and development by allowing for more imaginative searches of related substances. However, such effect breeds significant philosophical, technological, and structural requirements, as well as scepticism regarding their long-term improvement. Machine learning, particularly deep learning, is used in many scientific fields, and advancement in computation computer hardware and package, among other things, altogether contribute toward this global expansion. Target-driven drug discovery is a traditional and old strategy in which a recognized targets is use to shade for minor and minor compounds that cooperate by it or alter its purpose in cubicles. [76]

- The methods effort effectively aimed at drug able marks by a distinct construction and welled-understand cell connections.
- Though, owing to the difficulty of cell connections then a absence of understanding of complicated physiological pathway, these strategies were harshly constrained. Through finding innovative relationships then concluding the useful value of distinct mechanisms of a biologically pathways, Artificial Intelligence can overcome these problems.
- Complex algorithms and machine learning are employed by AI to extract useful information from enormous datasets. For example, a datasets of Ribose Nucleic Acid

sequences may be cast-off to discover genetic factor which expressions associates by a specific biological situation.

- Artificial Intelligence may too be use to find compound that might predicament to 'undug able target,' or protein with unknown structure. Iterative simulations of multiple compounds' interactions by minor portions of a proteins can easily identify a prognostic collection of chemicals in a short amount of time. [77]

Table 1: Difference between traditional and AI based drug discovery

TRADITIONAL DRUG DISCOVERY	AI BASESD DRUG DISCCOVERY
• Target-based	• Data based
• Work good for easy drug achieving target they had a maturely developed construction then which interaction within cells are known to be studied as per target decided.	• Complex able algorithms artificial intelligence and machine learning can extract out meaning full information from a large data sate that is to be used.
• Externally limited owing toward the difficulty of cells connections and a absence of considerate of how cell level pathway interact.	• Find chemicals that could bind to a "undruggable target," such as a protein whose structure is unknown.

10.7 AI Methods to Drug Development

The drug discovery process starts with the result obtain by many resources like as tall quantity screening modelling, portion broadcast modelling, computationally demonstrating, then previously reported data. Aspect of drug discovery offers a schematic outline of the medicine detection technique. The mechanical characterisation of medicine particles can be studied straight or circuitously via computers-assisting project methodologies during the drug discovery process, and then organic synthesis of drug molecules takes place. In primary tests, produced medicine atoms before composed medicine mixtures are exposed to tall amount broadcast, after which they are countering-screening and assessed for bio availabilities in subordinate analyses, as well as fruitful construction action association (SAR) analyses.[78]

The steps of medicine development alternate between initiation and inference. As a result, the substitutable inductive–deductive series finally principals to the optimal principal molecules.

The mechanization of key shares of the inductive–deductive series decreases unpredictability and inaccuracy, increasing the competence of the medicine expansion process. Using deep learning software, such as "NVIDIA DGX-1," biochemical and pharmacy companies' study then originate various rights by way of well genetic information-bases scientific discipline knowledge. Humans are unable to process all available data in order to develop systematic research. AI supercomputers can receive and evaluate data for the identification of figures in photographs of various standards.[79]

11.0 BENEFITS OF AI IN DRUG DISCOVERY

The claim of Artificial Intelligence to medicine detection have the probable to transform the present drug discovery period gauge and possibility.

1. For medicine detection, Artificial Intelligence fixes not trust on prearranged marks. As a result, there is no subjective bias or prior information in this drug development process.

2. AI uses the maximum new developments in ecology and computation to make leading-edge medicine finding algorithm. Artificial Intelligence has the potential to equal the in concert arena in medicine research, with toward quick increases trendy computing capacity then lower dispensation prices.

3. In a pharmacological screen, AI has a stronger prediction power for defining relevant interactions. As a result, by carefully setting the parameters of the test in issue, the risk of false positives can be decreased.

4. Maximum highly, Artificial Intelligence has the ability to shift medicine broadcast after the pew toward a simulated laboratory, where findings may be produced more quickly and intriguing targets can be screened without requiring extensive experimental input or personnel hours.

12.0 PROCESS OF DRUG DISCOVERY

Step 1: Identifying and validating the target

Step 2: Identifying and validating hits

Step 3: From a hit to a lead confirmation

Problem solving is one of AI's primary functions. It obtains and collects data using information and inputs provided by humans and sensors. -1) Drug discovery- Through the assistance of

Artificial Intelligence, investigators and discovery can choice and detain an insufficient clinical actual applicants or applications available of numbers of compounds using computers-aid medicine enterprise computer software in a fraction of the period and cost, while the old-style method can take up to 14 to 15 years. Boost in clinical trials and research, AI in diagnosis and analysis.

The enormous chemical space, which contains more than 1060 compounds, inspires the discovery of numerous medicinal particles. The absence of new skill, happening the additional hands, hinders drug development, creation it a long and expensive activity that may be spoke by applying Artificial Intelligence.[81] Artificial Intelligence may distinguish success and principal compound, letting aimed at earlier authentication of the therapeutic target and structural design optimization. In this diagram, many AI uses in drug discovery are shown.

Several tools founded on the nets that procedure central construction of Artificial Intelligence schemes has been advanced. The Worldwide Commercial Mechanism (IBM) Watson supercomputer is one example of an AI-based utility (IBM, New York, USA). That were created toward aid trendy the study of a affected persons medicinal data and the situation association by a large file, culminating in the recommendation of cancer treatment techniques. This technique can potentially be used to detect diseases quickly. Its capacity to identify breast cancer in approximately 60 seconds demonstrates this. [82]

13.0 PREDICTION OF BIOACTIVITY

The empathy of medicine particles aimed at the board proteins or receptors controls the effectiveness. Medicine particles does not interrelate by before take an empathy aimed at the embattled proteins determination non remain talented to deliver a beneficial answer. It's too conceivable that produced therapeutic compounds interrelate through unwanted protein before receptor, resultant trendy poisonousness in rare cases. To forecast medication–board connections, medication board compulsory empathy (DTBA) is crucial. AI-based approaches can measure a medication's compulsory empathy through look on the traits or comparations among the medication then the situation board.

Toward control the futuristic courses, features-base interaction recognises the chemicals medieties of the medication then the mark. Trendy a similarity-bases interactions, on the other hand, the resemblance of the medication then the board is occupied hooked on version, then it is anticipated that comparable pharmacy determination interrelates by the similar boards. A drug's discovery and development can take more than a decade then cost an average of $2.8

billion. Level still, 9 out of 10 medicinal particles flop Stage II medical studies then are rejected by regulators. Nearest-Neighbour classifies, RF, dangerous knowledge machineries, SVMs, then bottomless neuronal nets (DNNs) are utilised aimed at VS and can forecast in vivo action then poisonousness.[83]

Numerous bio pharmacies firms, including Bayer, Roche, and Pfizer, consume partnered through IT businesses toward establish a podium for drug development in areas including immuno-oncology and cardiovascular illnesses. Below are the features of VS near to Artificial Intelligence had been used. By depicting the distributions of molecules and their attributes, the virtual chemical space provides a topographical chart of particles. The goal of the chemical space illustration is to gather positional information about molecules inside the planetary in order toward exploration aimed at bio actives mixtures, and therefore computer-generated showing (VS) aids in the selection of relevant molecules for further testing. PubChem, ChemBank, DrugBank, and ChemDB are examples of open access chemical environments.[84]

14.0 PREDICTION OF TOXICITY

To avoid hazardous effects, it is critical to forecast the toxicity of any therapeutic molecule. Preliminary investigations by means of cellular-base into vitro examines are often performed, shadowed by bodily educations to regulate a mixture's poisonousness, raising the price of medication research. LimTox, pkCSM, admetSAR, and Toxtree remain approximately of the net-bases solutions it may assist cut costs. Advanced AI-based algorithms explore for similarities between substances or predict a compound's toxicity based on input features. The design of drug delivery systems has some drawbacks, such as the inability to forecast the link between formulation parameters and reactions.

This is also connected to treatment outcomes and unexpected events. On-demand dose adjustment or drug release rates, targeted releasing, and drug stability are all key elements in the design of many types of intelligent drug releasing systems. [85]

15.0 USE OF AI INPHARMACY INDUSTRY

AI is now days used in the pharmacy industry in four types sources. The first is in the valuation of the harshness of disease and the guess of what kind of treatment will be successful effecting for each patient, even erstwhile to its direction, second, it is cast-off to stop or resolve difficulties during treatment. Its third key routine is as an assistive technology to during diagnosis treatment or surgery on patients. Fourth it is castoff to regulate the motives behind

the use of certain instruments or chemicals through diagnosis, and to generate or generate novel uses for instruments or chemicals to advance safety and efficacy. The pharmacy manufacturing is scheduled the advantage of a main change owing toward the conjunction then booming of great novel numerical information bases, calculation influence toward classifies clinical expressive designs trendy the information applying competent AI and ML algorithm, then administrators' approval this variation toward exposed awake siloes schemes then permit competence in pharmacy drug progress. [86]

For increased production, improved efficiency, and speedier generation of life-saving pharmaceuticals pharmacy businesses can perform or integrate AI in the manufacturing and manufacturing process. All parts of the manufacturing process, including the following, can be managed and improved by AI:

- Qualities controls
- Predict ivies maintenances
- Wastes management
- Designing optimizations
- Process automations

Because Artificial Intelligence may manage inefficient and traditional production procedures and steps, it can assist and support pharmacy businesses in bringing innovative pharmaceuticals to market as quickly as possible and at a lower cost. Separately after greatly cumulative their ROI through reducing humanoid interference in the production procedure and operations, Artificial Intelligence may to help to minimise slightly potential for humanoid mistake. From medication detection then growth toward industrial and advertising, AI may be used in practically every element of the pharmacy sector Pharma businesses may brand altogether commercial activities effectual, lucrative, and hassles-free by using and adopting AI solutions in essential workflows. The best aspect is that AI systems may remain a strong instrument trendy the pharmacy industries investigate then growth department because they remain intended toward give healthier results by way of the study after fresh information then knowledge. [87]

In the pharmacy sector, artificial intelligence is used to achieve the procedure of scientific experimental folders; the situation controls completely scientific trial databases then maintains, organises, then stores the information into a record. Artificial Intelligence remains too utilised toward minimise the price of producing novel pharmaceuticals. They too aid clinical research services in making better decisions, managing databases, and generating more income. In the

pharmacy business, Artificial Intelligence is being utilised to aid medication discovery and development. Many companies are already working in this industry, including Google. Pfizer was the first company to apply AI in the pharmacy industry. To summarise, AI's potential in the pharmacy sector appears to be very promising.

As more pharma businesses use AI and machine learning technologies, these advanced technologies will become more democratized, making them additional nearby to minor then general-size pharmacy company. Hussain and co-workers at the Universities of Cincinnati use neuronal nets toward mimic pharmacy formulation and created them (OH, USA). They demonstrated the into vitro issue features of a variety of medicines distributed in media made after numerous hydrophilizing polymer in several investigations. In every case, neuronal nets by only unseen coating remained originate toward perform rather well into medicine announcement forecast. [88]

Workers into the pharmacy firm KRKA dd (Smerjeskas, Slovenias) then University of Ljubljana (Slovenian) use neuronal nets to predict the degree of medicine announcement then toward optimise by means of 2 and 3 dimensionally responses superficial examination in a additional new education connecting the preparation of diclofenac's Na after a medium tablets prepare by acetyl alcohol. Tablets with immediate release: Two studies were conducted in this area barely three years ago. Turkoglu with colleagues were from the Marmara university of nation Turkey with also Cincinnati university employed neuronal nets and figures to simulate hydrochlorothiazide pill formulation.

In order to enhance tablet strength or pick the appropriate lubricant, the network was utilised for create 3-D plot for musings timing, density pressures, and devastating strengths, or drugs releasing, massing timing, with comprisable pressures. Despite the fact that trends were noticed, no ideal formulations were provided. The patterns resembled those produced by statistical techniques. The best formulation was discovered to be determined by the limits placed on the constituent amounts employed in the formulation and the relative significance given to the production parameter. Only by sacrificing disintegration time could a higher tablets asset then little crumbliness be achieved. Lactose was the favoured diluent in all situations, and fluidized bed granulating was the recommended granulating technique.[89]

Using technology improvements, the pharmacy industry can speed innovation. Artificial intelligence, the growth of computers scheme accomplished of responsibility doings normally needful humanoid intellect, as like as graphic insight, language credit, executive, and linguistic

conversion, is one recent technical accomplishment that comes to mind. According to IBM, the Health system area consumes over one hundred sixty-one billion GB total information by way of 2011. By so much information accessible in this field, artificial intelligence can be extremely useful into evaluating the information then giving conclusions that aid policymaking while redeemable humanoid exertion, period, then currency, and so potentially saving life.

Epidemic breakout forecast; utilising ML/AL researchers may examine to past of the outbreaks, analyse communal television action, then forecast anywhere then at what time epidemics will occur through a high degree of accuracy. There are countless others, in addition to the ones named above: Personalizing the therapy Contribution into the growth of new tools for patients, physicians, and others. Clinical trial research: using social media and medical visits to find trial candidates using predictive analytics.

Artificial Intelligence (AI) technologies are currently generating a lot of buzz then conjecture around their more influential competences, as well as anxieties that computers resolve rapidly be taking responsibility of maximum loads. However, it is no factual that artificial intelligence resolves rapidly substitute hominoid competence. In its place, if we try to accomplish valuable imbursement, meet the triple goal, to develop knowledge healthiness schemes in the near future, pharmacist knowhow determination takes toward supplemented by Artificial Intelligence in way to lead for better medicine-uses decision with outcome. The challenges to leading pharmaceutical officer with many pharmacies' leader by the figure out in what way to use AI technology to uncover novel pattern in well-being information they are useful in practise. May Artificial Intelligence help to enhance persistent knowledges then well-being results, improve people well-being, lower cost, then healthier notify pharmacist and extra healthcare provider.[90]

16.0 ARTIFICIAL INTELLIGENCE'S FUTURE POTENTIAL

• Artificial Intelligence in science and research.

• Data analysis with AI.

• Transportation AI

• AI in the home

• Artificial Intelligence in health care

Artificial Intelligence in science and researches

Into the scientific community, Artificial Intelligence is making significant progress. Artificial intelligence can analyse enormous amounts of data more quickly than human thinking. This makes it ideal for studies using large amounts of data from multiple sources. In this discipline, AI is already making strides.

Cybersecurity and AI

Another industry that benefits from Artificial Intelligence is cyber security. The threat of hackers is getting more severe as businesses move their data to IT networks and the cloud.

Data analysis with AI

AI and machine learning may help a lot with data analysis. Artificial Intelligence algorithm are capable to improv within repetition, increasing their accuracy and precision in the process. Data analysts can use AI to assist them in handling and analysing massive datasets.

Transportation AI

For decades, AI has been used in the transportation industry. Autopilot has been used to control planes in the air since 1912. A plane's trajectory is controlled by an autopilot system, although it isn't limited to planes. Autopilot is also used by ships and spacecraft to help them retain their position.

In-home AI

In the guise of Smart Home Assistants, Artificial Intelligence had founded a specialised space into the public houses. Amazons Echoes and Google's Homes very prevalent social house device that allow we to complete a variety of activities with only your voice.

Artificial Intelligence in health care

In the medicinal field for benefiting from to the technologies. Medical researchers and professionals' benefit from AI in a variety of ways. [91]

17.0 CONCLUSION

Artificial Intelligence is situated into the core of a novel undertaking for grow computationally intellect modelling. The underlying assumption is the intellect (humanoid may be other ones) may be signified by sign constructions then representative procedures that may be automatic in to a numerical processer. There is substantial disagreement over whether such a properly automatic processer should may be a attention or simply pretend ace, nonetheless Artificial Intelligence investigators do not need to delay to the outcome of that discussion, or aimed at the imaginary computers that might perfect completely of humanoid intellect. Solving issues, establishing references, learning, and interpreting language are all examples of intelligent human behaviour.AI algorithms can beat human experts in relatively limited fields, such as recognising diseases of soybean plants, because they have previously been coded as computer programmes. The current AI problem is to find ways to represent the common-sense information with knowledge that allows people toward transmit available everyday errands similar property an extensive discussion before steering an eventful throughfare. While AI in the pharmacy business is a blessing, we must remain overly reliant on pharmaceuticals in order for pharmacy industries to grow and thrive. Artificial Intelligence assisted systems might recover the quality of our lives to a great extent, as we have discussed in the article the wide opportunity available for Artificial Intelligence-assisted systems. On the one hand, it is boon for society if used in enhancement or could be a curse if it reaches wrong hands. We have discussed the future of AI in fields of Finance, HealthCare, Education and Military applications, where it could affect both the ways either positive or negative. In health care artificial intelligence has many potentials to aspect like to treat out and diagnose out many diseases and in different field like research also get potential out and also increase out the chances of successes.

REFERENCE

[1] Guoguang Rong , Arnaldo Mendez , Elie Bou Assi , Bo Zhao , Mohamad Sawan, Artificial Intelligence in Healthcare: Review and Prediction Case Studies, Chinese Academy of Engineering and Higher Education Press Limited Company. Elsevier, **2019**,VOLUME-6 ,ISSUE-3 Page no.-291-301, https://doi.org/10.1016/j.eng.2019.08.015

[2] Muhammad Faisal Nadeem , Nazish Matti , Shagufta Parveen, Sehrish Rafiq, Highlighting need for a mix of FDA-approved artificial intelligence tools and community pharmacy services, regulatory of pharmacy association service(RPAS),volume-18,issue-5,page no.-01-03,**2021**, https://doi.org/10.1016/j.sapharm.2021.07.018

[3] Chhavi Chauhan, and Rama R. Gullapalliyz, Ethics of AI in Pathology Current Paradigms and Emerging Issues,The American journal of pathology,**2021,volume-191,issue-10,page no.-1673-1683,**https://doi.org/10.1016/j.ajpath.2021.06.011

[4] Ann Aerts , Doreen Bogdan-Martin, Leveraging data and AI to deliver on the promise of digital health, International Journal of Medical Informatics Elsevier, **2021,** https://doi.org/10.1016/j.ijmedinf.2021.104456

[5] Fatema Mustansir Dawoodbhoy, Jack Delaney, Paulina Cecula , Jiakun Yu, Iain Peacock, Joseph Tan, Benita Cox, AI in patient flow: applications of artificial intelligence to improve patient flow in NHS acute mental health inpatient units, Heliyon by Elsevier,**2021,** https://doi.org/10.1016/j.heliyon.2021.e06993

[6] Ch.Krishnaveni ,Swarupa Arvapalli, J.V.C Sharma, Divya.K, artificial intelligence in pharma industry, International Journal of Innovative Pharmacy Sciences and Research,**2020,** DOI: 10.21276/IJIPSR.2019.07.10.506

[7] Manish Vyas, Sourav Thakur, Bushra Riyaz , Kuldeep K Bansal, Bhupendra Tomar, Vijay Mishra, Artificial Intelligence: The Beginning of a New Era in Pharmacy Profession, Asian Journal of Pharmaceutics,**2018,** https://www.researchgate.net/publication/327177266

[8] Colin G Walsh, Andrew J McLaughlin, Joseph R LeGrand, Scott D nelsion, Casey A Olsen, Nick Schutz,Thomas A Lasko, Demystifying artificial intelligence in pharmacy, American journal of health System Pharmacy, **2020,** https://doi.org/10.1093/ajhp/zxaa218

[9] Debleena Paulz, Gaurav Sanapz , Snehal Shenoyz , Dnyaneshwar Kalyane, Kiran Kalia and Rakesh K. Tekade, Artificial intelligence in drug discovery and development, Elsevier Ltd, **2021**,https://doi.org/10.1016/j.drudis.2020.10.010

[10] Sudipta Das, Rimi Dey , Amit Kumar Nayak, Artificial Intelligence in Pharmacy, Indian Journal of Pharmacy Education and Research, **2021,** DOI: 10.5530/ijper.55.2.68

[11] nick Schutz, casey A. Olsen, Andrew J. McLaughlin, Whitley M.Yi, Scott D. Nelson, Asha L. Kalichira, Andrew H. Smith, Katherine A. Miller, Trinh Le, Bruce W. Chaffee, CDR Kendra Worthy Woodbury, Hardik Patel, ASHP Statement on the Use of Artificial Intelligence in Pharmacy, ashp report, **2020,** DOI 10.1093/ajhp/zxaa249

[12] Sheela Kolluri, Jianchang Lin , Rachael Liu, Yanwei Zhang and Wenwen Zhang, Machine Learning and Artifcial Intelligence in Pharmacy Research and Development, The AAPS Journal ,**2021,** https://doi.org/10.1208/s12248-021-00644-3

[13] Veer Patel, Manan Shah, A comprehensive study on artificial intelligence and machine learning in drug discovery and drug development, Chinese Medical Association Published by Elsevier B.V,**2021,** https://doi.org/10.1016/j.imed.2021.10.001

[14] NagaRavi Kiran T , Suresh Kumar N, Lakshmi GVN, Naseema S, Bhargav SB, Mohiddien SM, Artificial Intelligence in Pharmacy, Scholars Research Library, **2021volume-13, issue-5,**(http: //scholarsresearchlibrary. com/archive. html)

[15] Margaret Gamalo, artificial intelligence permeates into mainstream statistics in pharmacy product development at a laggard pace, Journal of Biopharmacy Statistics,**2021,** https://doi.org/10.1080/10543406.2021.1868425

[16] Maurizio Sessa, Abdul Rauf Khan, David Liang , Morten Andersen and Murat Kulahci, Artificial Intelligence in Pharmacoepidemiology: A Systematic Review. Overview of Knowledge Discovery Techniques in Artificial Intelligence, Frontiers in Pharmacology,**2020,** doi: 10.3389/fphar.2020.01028

[17] Tamanna Sharma, Abhinav Mankoo and Vivek Sood, Artificial intelligence in advanced pharmacy, International Journal of Science and Research Archive, **2021,** https://doi.org/10.30574/ijsra.2021.2.1.0301

[18] Nisha V kalayil, Shona S D'souza, Showkhiya Y khan, Pallavi paul, artificial intelligence in pharmacy drug design, Asian journal of pharmacy and clinical research,**2022,** http://dx.doi.org/10.22159/ajpcr.2022v15i4.43890

[19] Akshara Kumar, Shivaprasad Gadag, Usha Yogendra Nayak, The Beginning of a New Era: Artificial Intelligence in Healthcare, advanced pharmacy bulletin,**2021,** doi: 10.34172/apb.2021.049

[20] Zaheer Allam , Gourav Dey and David S. Jones, Artificial Intelligence (AI) Provided Early Detection of the Coronavirus (COVID-19) in China and Will Influence Future Urban Health Policy Internationally, research gate publication,**2020,** DOI: 10.3390/ai1020009

[21] C.M. Galmarini, M. Lucius Artificial intelligence: a disruptive tool for a smarter medicine**,** European Review for Medical and Pharmacological Sciences **, 2020,** DOI: 10.26355/eurrev_202007_21915

[22] Fei Jiang, Yong Jiang, Hui Zhi, Yi Dong, Hao Li, Sufeng Ma, Yilong Wang, Qiang Dong, Haipeng Shen, Yongjun Wang, Artificial intelligence in healthcare: past, present and future, Stroke and Vascular Neurology, 2017,doi:10.1136/svn-2017-00010

[23] D. DouglasMiller &Eric W.Brown, Artificial Intelligence in Medical Practice: The Question to the Answer, The American Journal of Medicine, Volume 131, Issue 2,Page no.-129-133, 2018, https://doi.org/10.1016/j.amjmed.2017.10.035

[24] Y. Rabhi, M. Mrabet, F. Fnaiech,A facial expression controlled wheelchair for people with disabilitiesComput Methods Programs Biomed,2018, volume-165 ,page no.- 89-105, https://doi.org/10.1016/j.cmpb.2018.08.013

[25] K. Dahmani, A. Tahiri, O. Habbert, Y. Elmeftouhi,An intelligent model of home support for people with loss of autonomy: a novel approach,Proceedings of 2016 International Conference on Control, Decision and Information Technologies,**2016,** page no- 182-185 10.1109/CoDIT.2016.7593557

[26]AndrewTenpas,EricDietrich,Simplifying medical decision-making for clinical pharmacists, **Research in Social and Administrative Pharmacy**,volume-18,issue-5,page no.- 112-123, 2020,https://doi.org/10.1016/j.sapharm.2021.07.026

[27] Alvin rajkomar,Jeffery dean,issac kohane, machine learning in medicine,the new American journal of medicine,**2019,**doi:10.11056/NEJPMra181425

[28] Hossein Hassani , Emmanuel Sirimal Silva , Stephane Unger , Maedeh TajMazinani and Stephen Mac Feely, Artificial Intelligence (AI) or Intelligence Augmentation (IA): What Is the Future?,MDPI, **2020,** page no.- 143–155; doi:10.3390/ai102000824.

[29]M T Strack,Artificial Intelligence Defined as a New Research Discipline: This Week in Tech History.,Forbes, 28 www.forbes.com/sites/gilpress/2016/08/28/artificial-intelligence-defined-as-a-newresearch-discipline-this-week-in-tech-history/#f2e02836dd15(accessed on 19 November 2019).

[30] Pan, Y. Heading toward artificial intelligence 2.0. Engineering 2016, 2, 409–413. [CrossRef] 26. Frank, M.R. The Evolution of AI Research and the Study of Its Social Implications 2019. Available online: https://medium.com/mit-media-lab/the-evolution-of-ai-research-and-the-study-of-itssocial-implications-4a9598b3d7db (accessed on 19 November 2019).

[31]. Jalal, T.D. Distinguishing between Narrow AI, General AI and Super AI 2018. Available online: https//medium.com/@tjajal/distinguishing-between-narrow-ai-general-ai-and-super-ai-a4bc44172e22 (accessed on 7 December 2019).

[32] Cha, J. The Differences Between Artificial Intelligence and Augmented Intelligence 2019. Available online: https: //appsilon.com/decision-making-support-systems-3-differences-between-ia-and-ai/?nabe=4634331497365504 (accessed on 8 December 2019).

[33] Erik J. Larson ,The Myth of Artificial Intelligence Why Computers Can't Think the Way we do,Harvard university press,2021, Main content: 288, https://doi.org/10.4159/9780674259935

[34] ROBERT FAYWALLACE TRENHOLM, **The Cyber Security Battlefield,center for international governance information, https://www.cigionline.org/articles/cyber-security-battlefield/?utm_source=google_ads&utm_medium=grant&gclid=EAIaIQobChMI076t69ep9wIVzJNmAh3DIAoNEAAYBCAAEgIlm_D_BwE**

[35] Ahmed Hosny, Chintan Parmar, John Quackenbush, Lawrence H. Schwartz & Hugo J. W. L. Aerts **Artificial intelligence in radiology**,Nature Reviews Cancer **,2018** https://www.nature.com/articles/s41568-018-0016-5

[36] Hee Jeong Kim, Hak Hee Kim, Ki Hwan Kim, Woo Jung Choi, Eun Young Chae, Hee Jung Shin, Joo Hee Cha, Woo Hyun Shim , Mammographically occult breast cancers detected

with AI-based diagnosis supporting software: clinical and histopathologic characteristics,European society of publisher,volume Article number: 57 (2022) Cite this article- 722,**2022**, https://insightsimaging.springeropen.com/articles/10.1186/s13244-022-01183-x

[37] Rodriguez-Ruiz A, Lang K, Gubern-Merida ,Stand-alone artificial intelligence for breast cancer detection in mammography: comparison with 101 radiologists. J Natl Cancer Inst,**2019** volume-111: page no.-916–922 ,https://doi.org/10.1093/jnci/djy222

[38]Wu N, Phang J, Park J et al , Deep neural networks improve radiologists' performance in breast cancer screening. IEEE Trans Med Imaging ,volume-39 issue-4: page no.-1184–1194,**2020**,**DOI:** 10.1109/TMI.2019.2945514

[39]Dembrower K, Wahlin E, Liu Y,ErikWåhlinMSce , PeterLindholm , MartinEklund FredrikStrand , Effect of artificial intelligence-based triaging of breast cancer screening mammograms on cancer detection and radiologist workload: a retrospective simulation study. Lancet Digit Health ,volume2, issue 9, September 2020, Pages e468-e474https://doi.org/10.1016/S2589-7500(20)30185-0

[40]Geras KJ, Mann RM, Moy L , Artificial intelligence for mammography and digital breast tomosynthesis: current concepts and future perspectives. Radiology rsna,volume-293, page no-246–259,2019 ,https://doi.org/10.1148/radiol.2019182627

[41] Aneesa S. Majid, Ellen Shaw de Paredes, Richard D. Doherty, Neil R. Sharma, Xavier Salvador, Missed Breast Carcinoma: Pitfalls and Pearls,radiography rsna,volume-23,issue-3 ,page no.-881-895; **2003**,https://doi.org/10.1148/rg.234025083

[42] Charles Wright , Mohamed, Navneeta Kaul, What are the applications of artificial intelligence in drug discovery & development?, PreScouter Research Support Service ,**2018,** https://pswordpress-production.s3.amazonaws.com/2018/08/Applications-of-AI-in-Drug-Discovery-and-Development-PreScouter.pdf

[43] James A. Nichols, Hsien W. Herbert Chan & Matthew A. B. Baker , **Machine learning: applications of artificial intelligence to imaging and diagnosis,Biophysical review, page no.-111-118,volume-14,issue-1,** **https://link.springer.com/article/10.1007/s12551-018-0449-9**

[**44**] Indrasen Poola, How Artificial Intelligence in Impacting Real Life Every day, International Journal of Advance Research and Development.,volume-2,issue-10,page no.-96-100,**2017,** https://www.researchgate.net/publication/321348028

[45] 14. Rouse M. 2017. IBM Watson Supercomputer.https://searchenterpriseai.techtarget.com/definition/IBM-Watson-supercomputer . Accessed 13 October 2020.

[46] Vyas M. Artificial intelligence: the beginning of a new era in pharmacy profession. Asian J. Pharm. 2018;issue-12: page no.72–76. https://doi.org/10.22377/ajp.v12i02.2317

[47] Ciallella H.L., Zhu H. Advancing computational toxicology in the big data era by artificial intelligence: data-driven and mechanism-driven modeling for chemical toxicity. Chem. Res. Toxicol. 2019;32:536–547.

[48] RÍacheBrazil ,ThePharmacyJournal,Dec,**2007**,doi27:312-5,319-22

[49] 10. Trynacit K. MEDi Robot to Comfort Patients in Stollery Children"s Hospital. Available from: http://www.cbc. ca/news/canada/edmonton/medi-robot-to-comfortpatients-in-stollery-children-shospital-1.3919867. [Last accessed on 2017 Jun 24].

[50] Eye for Pharma. Artificial intelligence- A Brave New World for Pharma. Available from: https://www.social.eyeforpharma.com/clinical/artificial-intelligence-brave-new-worldpharma.[Last accessed on 2017 Jun 24].

[51] McCurry J. Erica, „most intelligent" Android, Leads Japan"s Robot Revolution. Available from: http:// www.thehindu.com/todays-paper/tp-national/ Erica-%E2%80%98mostintelligent%E2%80%99-android-leads-Japan%E2%80%99s-robot-revolution/ article13974805.ece [Last accessed on 2017 Jun 24].

[52] Aethon. TUG robots. Available from: http://www.aethon. com/tug/tughealthcare/. [Last accessed on 2017 Jun.

[53]. Duch W., Swaminathan K., Meller J., Artificial Intelligence Approaches for Rational Drug Design and Discovery. Current Pharmacy Design, 2007;13: 00

[54] Siemens. SIMATCSSIMATCS IT for the Pharmacy Industry. Available from : https://www.industry.siemens.com/verticals/global/en/pharma-industries/products-and-40 REVIEW ARTICLE Swarupa Arvapalli et.al / IJIPSR / 7 (10), 2019, 37-50 Department of Pharmaceutics ISSN (online) 2347-2154 DOI: 10.21276/IJIPSR.2019.07.10.506 Available online: www.ijipsr.com October Issue 50 services/industrial-software/pages/manufacturing execution-system.aspx.[last accessed on 2017 Jun 24].

[55] Wan F., Zeng J. Deep learning with feature embedding for compound–protein interaction prediction. *bioRxiv.* 2016;2016

[56] . AlQuraishi M., End-to-end differentiable learning of protein structure. *Cell Syst.* **2019**; volume-8,issue-4,pageno.-:292–301. https://doi.org/10.1016/j.cels.2019.03.006

[57] Hutson M. AI protein-folding algorithms solve structures faster than ever. *Nature.* 2019;XX:YYY–ZZZ. DOI: 10.1038/d41586-019-01357-6

[58] . Avdagic Z. Artificial intelligence in prediction of secondary protein structure using CB513 database. Summit Transl. Bioinf. 2009;2009:1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3041573/

[59] Tian K. MingyuShao,˙YangWang, JihongGuan ,ShuigengZhou, Boosting compound-protein interaction prediction by deep learning. Methods. 201 ,6volume-;110:page-64–72, https://doi.org/10.1016/j.ymeth.2016.06.024

[60] Wang F. Computational screening for active compounds targeting protein sequences: methodology and experimental validation. *J. Chem. Inf. Model.* 2011 Volume-;51 issue-11,page no.-:2821–2828,https://doi.org/10.1021/ci200264h

[61] Allen Flynn, Using artificial intelligence in health-system pharmacy practice: Finding new patterns that matter*,*American Journal of Health-System Pharmacy, Volume 76, Issue 9, 1 May **2019**, Pages 622–627, https://doi.org/10.1093/ajhp/zxz018

[62]ViEric J. Topolmla L.Patel, MarioStefanelli , Michael R.Berthold RiccardoBellazzi AmeenAbu-Hanna, The coming of age of artificial intelligence in medicine, Artificia Intelligence in Medicine,Volume 46, Issue 1, May 2009, Pages 5-17 https://doi.org/10.1016/j.artmed.2008.07.017,

[63] William W. Stead, Clinical Implications and Challenges of Artificial Intelligence and Deep Learning,jama,2018,volume-145,issue-**7**_____JAMA. 2018;320(11):1107-1108. doi:10.1001/jama.2018.11029

[64]casimir A. Kulikowski, Beginnings of Artificial Intelligence in Medicine (AIM): Computational Artifice Assisting Scientific Inquiry and Clinical Art – with Reflections on Present AIM Challenges, Yearb Med Inform, 2019; volume&issue-28(01): page no.- 249-256 DOI: 10.1055/s-0039-1677895

[65] Eric J. Topol, High-performance medicine: the convergence of human and artificial intelligence, Nature Medicine, volume 25, pages44–56, (2019) **https://www.nature.com/articles/s41591-018-0300-7**

[66] Ramandeep Singh,Mannudeep K. Kalra,Chayanin Nitiwarangkul,John A. Patti,Fatemeh Homayounieh,Atul Padole,Pooja Rao,Preetham Putha,Victorine V. Muse,Amita Sharma,Subba R. Digumarthy, Deep learning in chest radiography: Detection of findings and presence of change, plos one,October 4, 2018,https://doi.org/10.1371/journal.pone.0204155

[67] Winston PH Artificial intelligence. 3rd ed. Reading, MA: Addison-Wesley Pub. Co.; 1992.

[68] Banko M, Brill E. Scaling to very very large corpora for natural language disambiguation. Paper presented at Proceedings of 39th Annual Meeting of the Association for Computational Linguistics; July 2001; Toulouse, France.

[69] Halevy A, Norvig P, Pereira F. The unreasonable effectiveness of data. IEEE Intell Syst. 2009;24(2):8-12.

[70] Kannel WB, Doyle JT, McNamara PM, et al. Precursors of sudden coronary death. Factors related to the incidence of sudden death. Circulation. 1975;51(4):606-613.

[71] Dasta JF, Application of artificial intelligence to pharmacy and medicine,European pmc, , 01 Apr 1992, volume and issue-27(4) pages:312-5, 319-22,PMID: 10183640https://europepmc.org/article/med/10183640

[72] Praveen Kumar Donepudi, AI and Machine Learning in Retail Pharmacy: Systematic Review of Related Literature, ABC Journal of Advanced Research,volume&issue- 7(2), pages-109-112. doi: 10.18034/abcjar.v7i2.51

[73] Ferrero E, Dunham I, Sanseau P. In silico prediction of novel therapeutic targets using gene-disease association data. J Transl Med. 2017;15(1):182.

[74]Muller AT, Hiss JA, Schneider G. Recurrent Neural Network Model for Constructive Peptide Design. J ChemInf Model. 2018;58(2):472-9.

[75]. Olivecrona M, Blaschke T, Engkvist O, Chen H. Molecular de-novo design through deep reinforcement learning. J Cheminform. 2017;9(1):48.

[76] Ertl P, Schuffenhauer A. Estimation of synthetic accessibility score of druglike molecules based on molecular complexity and fragment contributions. J Cheminform. 2009;1(1):8.

[77]. Kadurin A, Nikolenko S, Khrabrov K, Aliper A, Zhavoronkov A. druGAN: An advanced generative adversarial autoencoder model for de novo generation of new molecules with desired molecular properties in silico. Mol Pharm. 2017;14(9):3098-104.

[78]Yildirim O, Gottwald M, Schüler P, Michel MC. Opportunities and challenges for drug development: public–private partnerships, adaptive designs and big data. Front Pharmacol. 2016;7:461.

[79] Shah N, Patel N, Patel KR. A sequential review on intelligent drug delivery system. J Pharm Sci Biosci Res. 2013;3(5):158-62.

[80] Medarevic DP, Kleinebudde P, Djuris J, Djuric Z, Ibric S. Combined application of mixture experimental design and artificial neural networks in the solid dispersion development. Drug DevInd Pharm. 2016;42(3):389-402.

[81]. Barmpalexis P, Koutsidis I, Karavas E, Louk D. Development of PVP/PEG mixtures as appropriate carriers for the preparation of drug solid dispersions by melt mixing technique and optimization of dissolution using artificial neural networks. Eur J Pharm Biopharm. 2013;85(3):1219-31.

[82] Kumar KJ, Panpalia GM, Priyadarshini S. Application of artificial neural networks in optimizing the fatty alcohol concentration in the formulation of an O/W emulsion. Acta Pharm. 2011;61(2):249-[83] Podlogar F, Šibanc R, Gašperlin M. Evolutionary artificial neural networks as tools for predicting the internal structure of microemulsions. J Pharm Pharmaceut Sci. 2008;11(1):67-76.

[84] Agatonovic-Kustrin S, Glass BD, Wisch MH, Alany RG. Prediction of a stable microemulsion formulation for the oral delivery of a combination of antitubercular drugs using ANN methodology. Pharm Res. 2003;20(11):1760-5.

[85] Petrovic J, Ibric S, Betz G, Duric Z. Optimization of matrix tablets controlled drug release using Elman dynamic neural networks and decision trees. Int J Pharm. 2012;428(1-2):57-67.

[86] Mandal U, Gowda V, Ghosh A, Bose A, Bhaumik U, Chatterjee B. Optimization of metformin HCl 500 mg sustained release matrix tablets using artificial neural network (ANN) based on multilayer perceptrons (MLP) model. Chem Pharm Bull. 2008;56(2):150-5.

[87]. Barmpalexis P, Kanaze FI, Kachrimanis K, Georgarakis E. Artificial neural networks in the optimization of a nimodipine controlled release tablet formulation. Eur J Pharm Biopharm. 2010;74(2):316-23.

[88] Zhang ZH, Wang Y, Wu WF, Zhao X, Sun XC, Wang HQ. Development of glipizide push-pull osmotic pump controlled release tablets by using expert system and artificial neural network. Yao Xue Xue Bao. 2012;47(12):1687-95.

[89] Patel A, Mehta T, Patel M, Patel K, Patel N. Design porosity osmotic tablet for delivering low and pH-dependent soluble drug using an artificial neural network. Curr Drug Deliv. 2012;9(5):459-67.

[90]. Vaithiyalingam S, Khan MA. Optimization and characterization of controlled release multi-particulate beads formulated with customized cellulose acetate butyrate dispersion. Int J Pharm. 2002;234(1-2):179-93.

[91] Sankalia MG, Mashru RC, Sankalia JM, Sutariya VB. Papain entrapment in alginate beads for stability improvement and site-specific delivery: physicochemical characterization and factorial optimization using neural network modeling. AAPS Pharm Sci Tech. 2005;6(2):E209-22.