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A SYSTEMATIC REVIEW ON : ROLE OF ARTIFICIAL INTELLIGENCE IN PHARMACY

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Abstract:- Role Of Artificial Intelligence In Pharmacy
Abstract Artificial intelligence use in pharmaceutical technology has increased over the years, and the use of technology can save time and money while providing a better understanding of the relationships between different formulations and processes parameters. Artificial intelligence is a branch of the computer science that deals with the problem-solving by the aid of symbolized programming. It has greatly evolved in to a science of problems-solving with the hug applications in business, health care, and engineering. The article is describes the drugs discovery ,tools of AI, manufacturing execution systems automated control processes systems ,AI to predict new treatment, development of novel peptides from natural foods, treatment and management of rare diseases, drug adherence and dosage ,challenges to adoption of AI in pharma. Keywords: Drug Discovery, tools of AI, MES, ACPS, treatment and management of rare diseases, drug adherence and dosage, challenges to adoption of AI in pharma.

The term artificial intelligence broadly refers to applications of technology to perform tasks that resemble human cognitive function and is generally defined as "[t]he capability of a machine to imitate intelligent human behavior."6 AI typically involves "[t]he theory and development of computer systems able.

KEYWORDS: Development, Use and Application, History, Investment, Material and Mathod**,** Scope for Further Research, Recent Adoptions, Advantage**.**

INTRODUCTION:-

ROLE OF ARTIFICIAL INTELLIGENCE:-

Artificial Intelligence enhances the speed, precision and effectiveness of human efforts. In financial institutions, AI techniques can be used to identify which transactions are likely to be fraudulent, adopt fast and accurate credit scoring, as well as automate manually intense data management tasks.

Fig- 01

WHEN WAS AI INTRODUCED ?

- In 1956, the beginning of AI can be traced to classical philosopher's attempts to describe human thinking as a symbolic system.
- But the field of AI wasn't formally founded until 1956, at a conference at Dartmouth College, in Hanover, New Hampshire, where the term AI was coined.

(AI) is a branch of computer science that deals with the problem –solving by the aid of symbolic programming .it has greatly evolved into a science of problem- solving with huge application in business, health care, engineering [1]. The main objective of this artificial intelligence to identify useful information processing problems and give an abstract account of how to solve them. Such an account is called as methodand it corresponds to a theorem in mathematics. Artificial intelligence as a field that deals with the design and application f algorithms for analysis of learning from and interpreting data. Artificial intelligence en compasses many branches of statistical and machine learning, pattern recognition, and clustering, similarity-based methods [2]. AI is a flourishing technology which finds application in multiple aspects of life and industry. In Recent times the pharmaceutical industry discovers novel and innovative ways to use this powerful technology to help solve some of the biggest problems facing pharma today. Artificial intelligence in Pharma refers to the use of automated algorithms to perform tasks which traditionally rely on human intelligence. Over the last five years, the use of artificial intelligence in the pharma and biotech industry has redefined how scientists develop new drugs, tackle disease, and more [3]. HISTORY Allen Newell ,Herbert A Simon was developed the Logic Theorist .it was born in 1956 that Dartmouth college had organized the famous conference [4], It has been forecasted that the revenue from AI market will be increasing by as much as ten-fold between the years 2017 and 2022. Natural language processing market, which has several applications including text prediction, and speech and voice recognition has been said to achieve a growth of 28.5% in the year 2017. Worldwide revenue from big data and business analytics was US$ 122 billion in the year 2015 and it is being expected that the figures will rise to more than US$ 200 billion by the year 2020 [5]. Artificial intelligence has a rocky history spanning back to the 1950s. For a long time it was seen as a field for dreamers, but that started to change in 1997 when IBM‟s Deep Blue computer was able to defeat chess champion Garry Kasparov. By 2011, IBM‟s new Watson supercomputer was able to win the US$1m prize in the US game-show Jeopardy. Since then, Watson has expanded into healthcare and drug discovery, including a partnership with Pfizer in 2016 to accelerate drug discovery in immuno-oncology. In December 2016 IBM in collaboration.

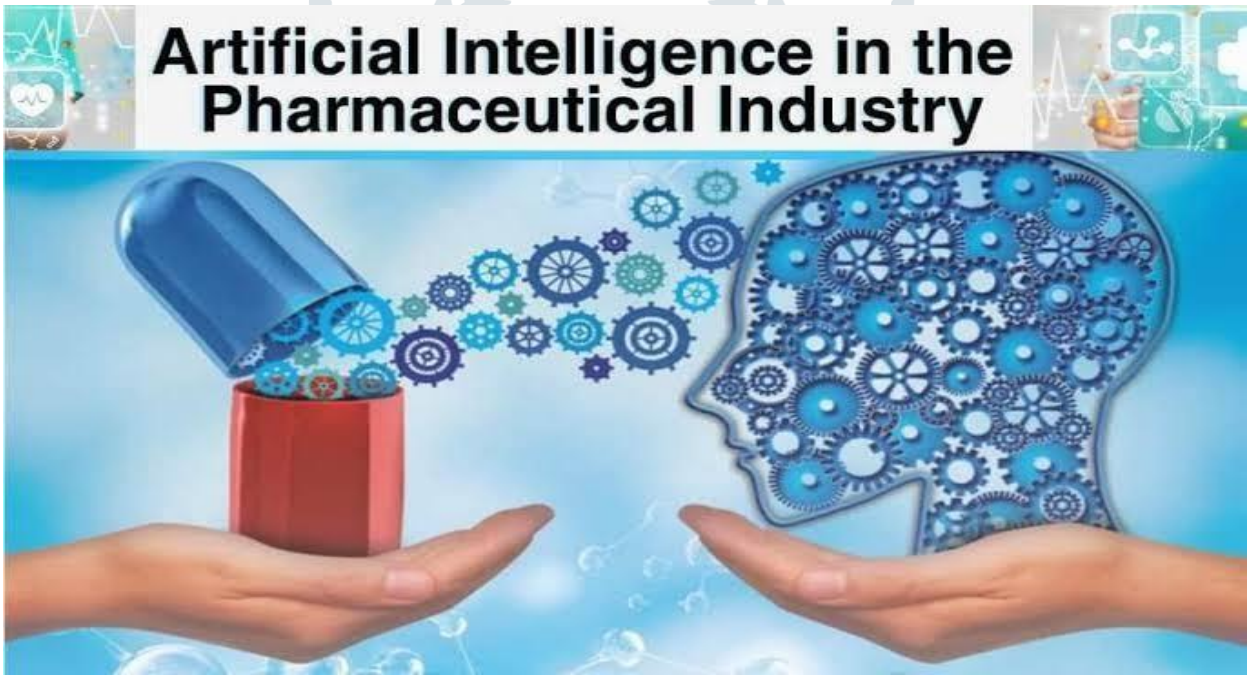

Fig - 02

Material And Method:- The larvae of Spodoptera littoralis were reared in groups of 10 animals on an artificial diet (SEHNAL et al., 1976) under long day conditions (LD 17:7) (light on at 9 a.m. Light off at 2 a.m.) at 29°C.

Experiments were carried out on 6^{th} (final) instar larvae. In all groups, insects differed from each other by 6 hr from their ecdysis to the last instar.

The juvenile hormone analogue (JHA) ethyl 11- methoxy-3,7,11-trimethyl-2,4- dodecadienoate-ZR- 515 (Zöecon Corp.) was dissolved in acetone and applied topically at a constant dose of 10 µg per specimen. Applications were performed on last instar larvae of different ages, both neck-ligated and normal larvae. One µl of acetone was applied to control animals. Every 24 hr larvae were weighed and observations made on dorsal vessel exposure and pupal cuticle formation.

The Cochin estuarine system extends between latitude 9°40' to 10°12'N and longitude 76°10' to 76°30'E. It is connected to the Arabian Sea by a permanent bar mouth at Cochin and two seasonal openings, during peak monsoon season, al Andhakaranazhi and north Paravoor. The expansive backwaters are generally shallow, with the exception of two deep navigation channels maintained at atleast 12 m depth that lead into the harbour. Two major rivers discharge freshwater into the estuarine system, the Periyar flowing into the northern part and the Pumpa flowing into the southern part. Other smaller rivers flowing into the estuary are Achankoil, Manimala, Meenachil and Muvatupuzha.

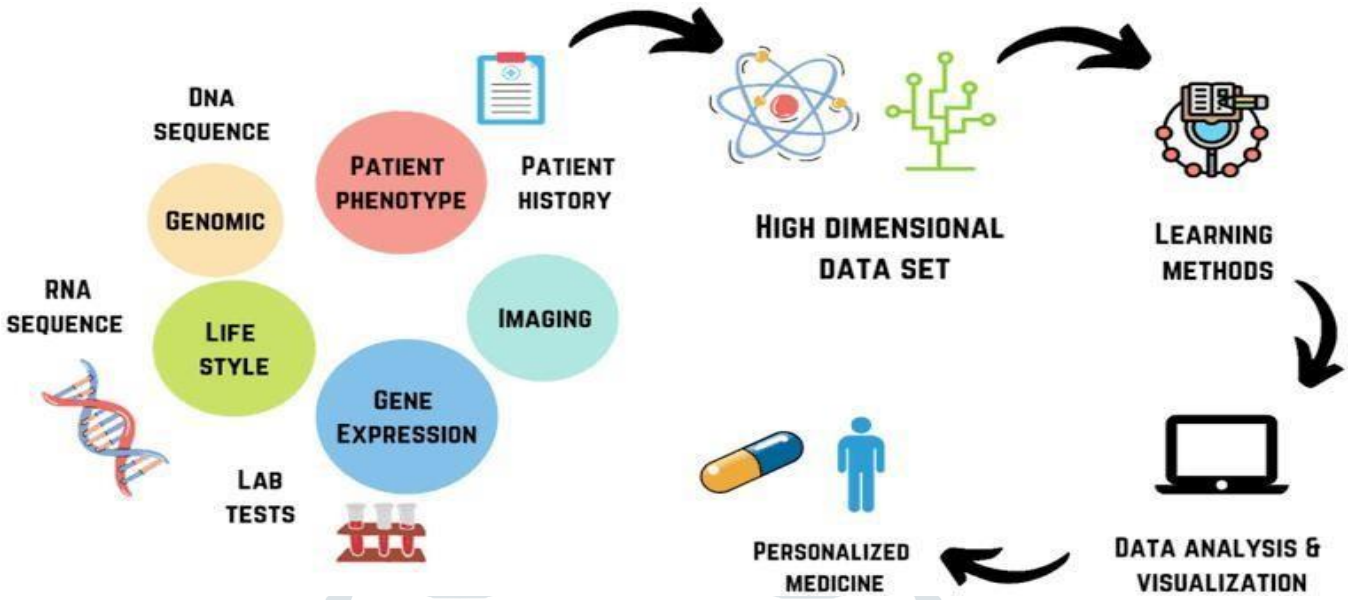

Fig- 03

A large number of industrial establishments are located along the banks of the River Periyar, and include coconut retting yards and fish processing units. The Cochin estuarine system is, thus, subjected to emissions and discharges of effluents from manufacturing industries, harbour operations, urban waste from the Cochin City and land runoff.

- This section is meant for giving the details of all the materials and methods used and if necessary the details of the specific techniques.
- Reason for providing all the necessary details is to enable any competent worker to repeat our experiment.
- The experimental materials such as animals, plants, and microorganisms should be identified specifying the genus, species and strain.
- The source of materials i.e., the place of collection or purchase should be given.

History of AI:- Maturation of AI (1943-1952)

Year **1943**-The first work which is now recognized as Al was done by Warren McCulloch and Walter pits in **1943**.They proposed model of artificial neurons.

Year **1949**-Donald Hebb demonstrate an updating rule for modifying the connection strength between neurons. His rule is now called Hebbian learning.

Year **1950**-The Alan Turing who was an English mathematician and pioneered machine learning in **1950**. Alan Turing publishes

“Computing machinery and intelligence “In which he proposed at a test. The test can check the machine ability to exhibit intelligent behavior equivalent to human intelligence, called a Turing test.

The birth of Al (1952-1956)

- Year **1955**-An Allen Newell and Herbert A. Simon created the first artificial intelligence program which was named as “Logic
- theorist”. This program had proved 38 of 52 mathematics theorems, and find new and more elegant proofs for some theorems.

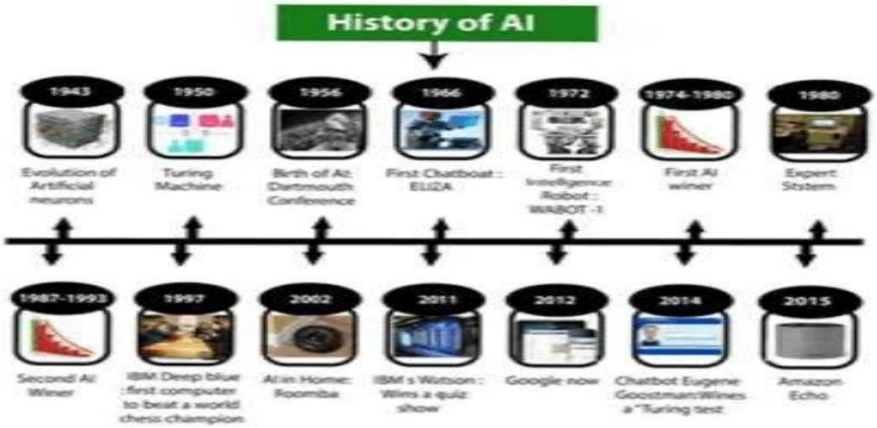

Fig-04

Year **1956**-The word Al first adopted by American computer scientist John McCarthy at Dartmouth conference. For the first time, Al coined

as an academic field [1,2]. The golden years-early enthusiasm **(1956-1974)** year **1966**-The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in **1966**, which was named as ELIZA.

Year **1972**-The first intelligent humanoid robot was built in Japan which was named as WABOT-1. The first Al winter **(1974-1980)**

The duration between years **1974** to **1980** was the first Al winter duration. Al winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for Al researches.

During Al winter, an interest of publicity on Al was decreased [3]. A boom of Al **(1980- 1987)** Year **1980**-After Al winter duration, Al came back with "Expert system ". Expert system was programed that emulate the decision making ability of human expert.

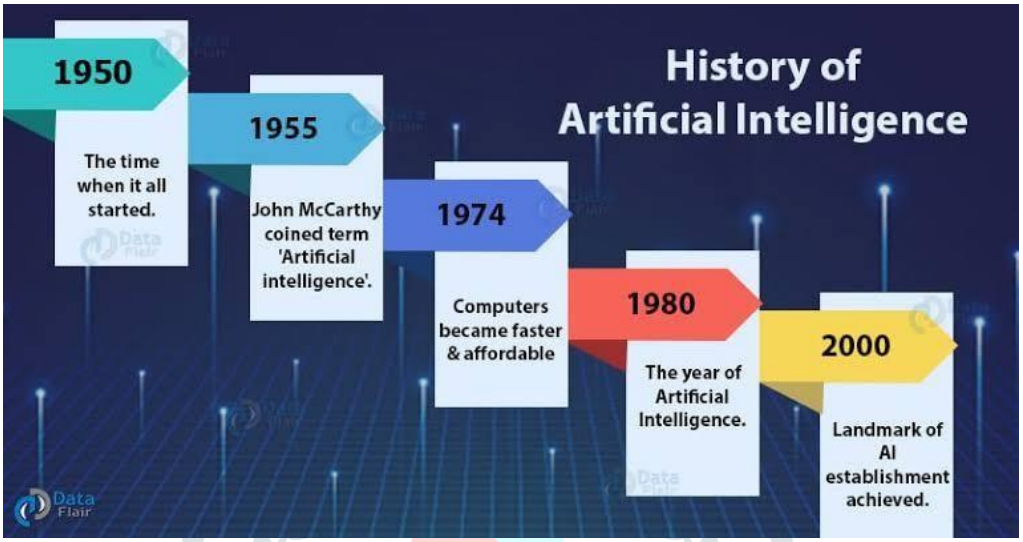

Fig -05

In the year **1980**, the first national conference of the American association of Al was held at Stanford University.

The second Al winter (**1987-1993)** The duration between the years **1987** to **1993** was the second Al winter duration. Again, investors and government stopped in funding for Al research as due to high cost but not efficient result. The expert system such as XCON was very cost effective.

The emergence of intelligent agents **(1993-2011)** Year **1997**-In this year, IBM deep blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.

Year **2002**-for the first time, AI entered the home in the form of Roomba, a vacuum cleaner. | Year **2006** Al came in the Business world till the year **2006**. Companies like Facebook, Twitter, and Netflix also started using Al [4,5] Deep learning, big data and artificial general intelligence (**2011**-present) Year **2011**-In the year **2011**, IBM's Watson won jeopardy, a quiz show, where it had to solve the complex questions as well as riddles. Watson had proved that it could understand natural language and can solve tricky questions quickly.

Year 2012 – Google has launched an Android app feature "Google now ", which was able to provide information to the user as a

prediction.

Year 2014 — In the year **2014**, Chatbot "Eugene Goostman" won a competition in the infamous "Turing test".

Year 2018 — The "Project Debater" from IBM debated on complex topics with two master debaters and also performed extremely well.
Google has demonstrated an AI program "Duplex" which a virtual assistant was and which has hairdresser appointment on call, and lady on other side didn't notice that she was talking with the machine [6] (Figure 1).

Figure 1: History of AI. TYPES OF AI

There are 4 types of artificial intelligence: Reactive machines.
Limited memory. Theory of mind. Self-awareness.
AI was first applied in

In 1960's researchers emphasized developing algorithms to solve mathematical problems and geometrical theorems.

In the late **1960**'s computers scientists worked on machine vision learning and developing machine learning in robots, were built.

Al in field of Pharmacy:-
It is one of the top technologies shaping the future of pharmacy.

- Pharma industries has been developing cure & treatment for centuries. Traditionally the design & manufacturing of drug requires several years, lengthy clinical trials & huge costs.
- With the rise of 21st century technologies, this has been changing.
- In future we will see completely different drug designs, manufacture & clinical trials.

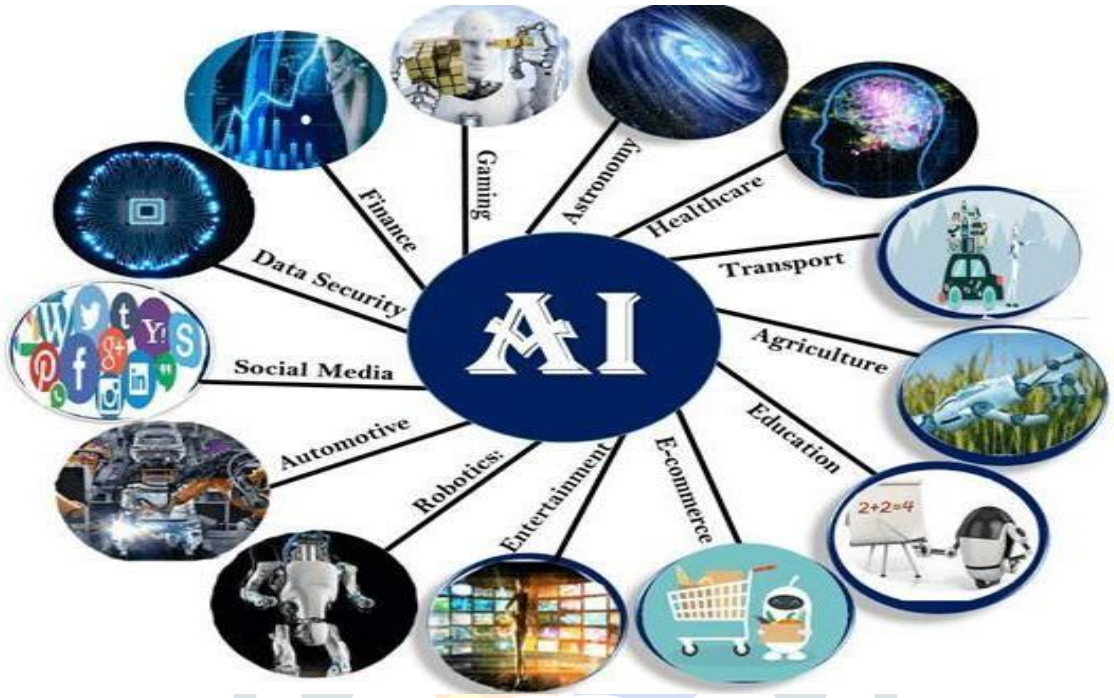

Fig-06

By AI In Pharma Is A Good Idea ?
AI solutions can successfully identify disease patterns in large datasets and help understand which drug compositions would be best suited for treating different diseases

A mid-career AI Engineer with 4-9 years of experience earns an average salary of ₹17 Lakhs per year, while an experienced AI Engineer with 10-20 years of experience earns an average salary of ₹40 Lakhs per year.

Fig-07

AI helps to apply machine learning to this data and rapidly increases the discovery of new molecules. It can research and cross-reference

published scientific materials with alternative resources, including clinical trial results, to develop drugs and discover new effective treatment methods for rare diseases.

Imagine A Future Where:-

AI will redefine the future of pharmaceuticals by fine-tuning the process of candidate selection in clinical trials. It will ensure that the most suitable candidates are chosen for trials by performing a detailed analysis of data and filtering the candidate pool.

In the workplace, artificial intelligence can boost efficiency and increase humans' capacity to perform certain tasks. AI frees humans to do work they are better equipped for, such as creative and empathic tasks, by taking over repetitive or dangerous tasks.

AI Can help increase the success rate of drugs while bringing down the cost of operations. AI will redefine the future of pharmaceuticals by fine-tuning the process of candidate selection in clinical trials.

Counterfeiting drugs become almost impossible.

Block-chain technology secures the entire distribution channel.

Local pharmacists 30 prints personalised drugs in any shape & desired dosage.

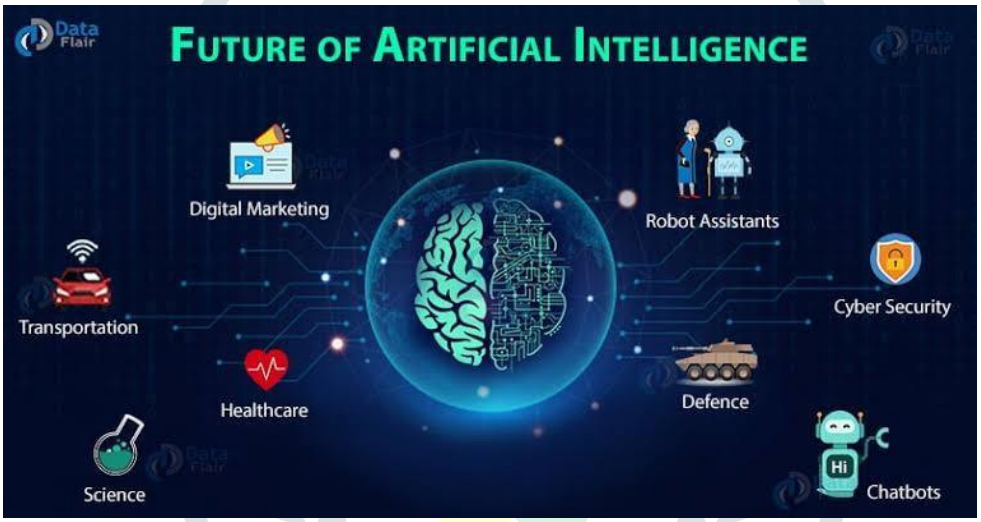

Fig-08

Investment In AI:-

Last year, Verdict Al asked businesses how vital artificial intelligence will be in their respective industries and over 70% of them thought it would be very important. From the same group, only 11% of businesses have not considered investing in Al technology

Furthermore, according to Narrative Science, 61% of companies investing in innovative strategies are using Al to identify opportunities that they would have otherwise missed. For pharmaceutical businesses that thrive on innovation, this is an important statistic to understand.

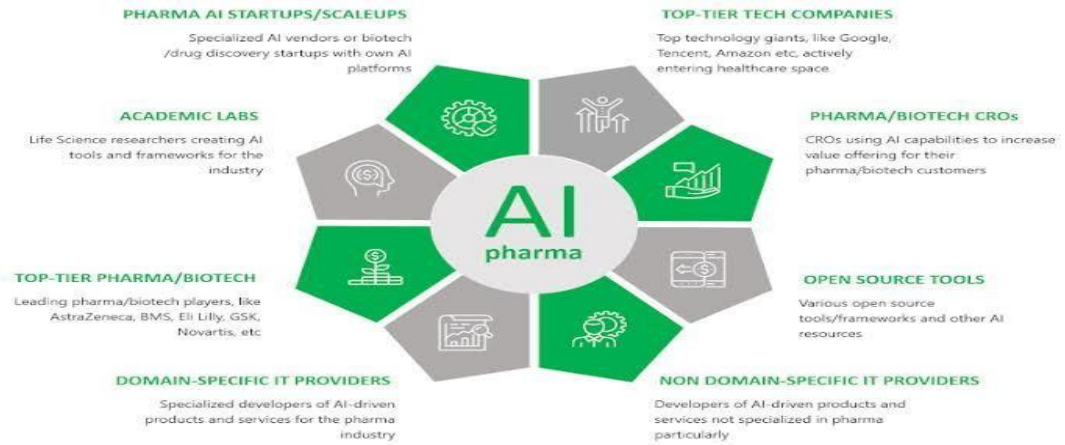

Fig-09

Pharma giant Pfizer said on its website that "in reality employing AI is less like building a mechanical overlord than it is like training a super-intern." Still, Pfizer, Merck, AstraZeneca, Sanofi, Amgen and many more inked new deals with AI-driven companies in the first half of 2022 alone.17-Nov-2022

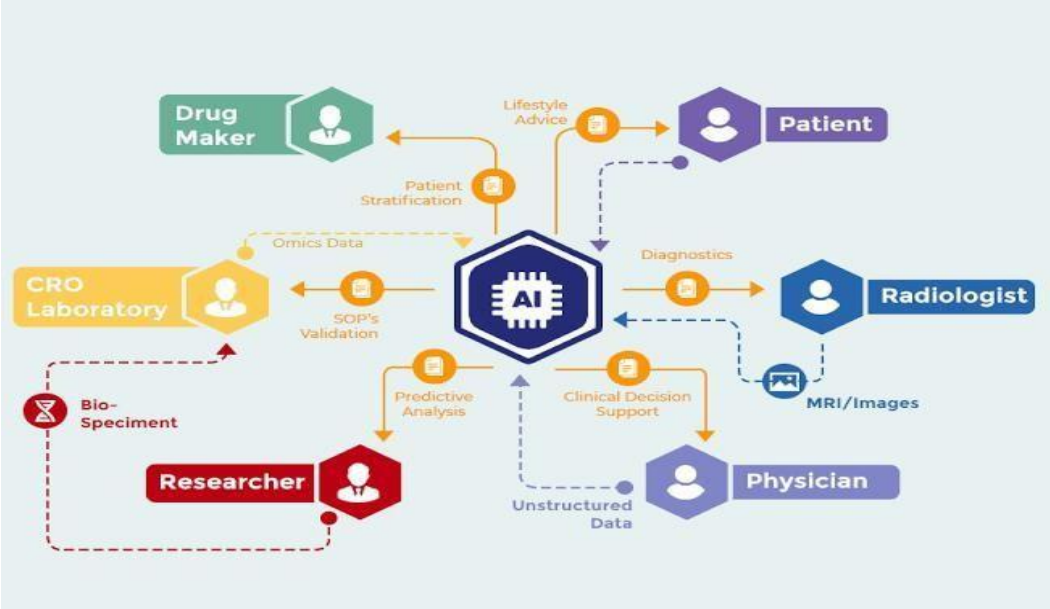

Fig-10

Artificial Intelligence in Healthcare – AI Applications and Uses:-

1. Accurate Cancer Diagnosis.
2. Early Diagnosis of Fatal Blood Diseases.
3. Customer Service Chatbots.
4. Virtual Health Assistants.
5. Treatment of Rare Diseases.
6. Targeted Treatment.
7. Automation of Redundant ,
8. Healthcare Tasks.
9. Management of Medical Records.

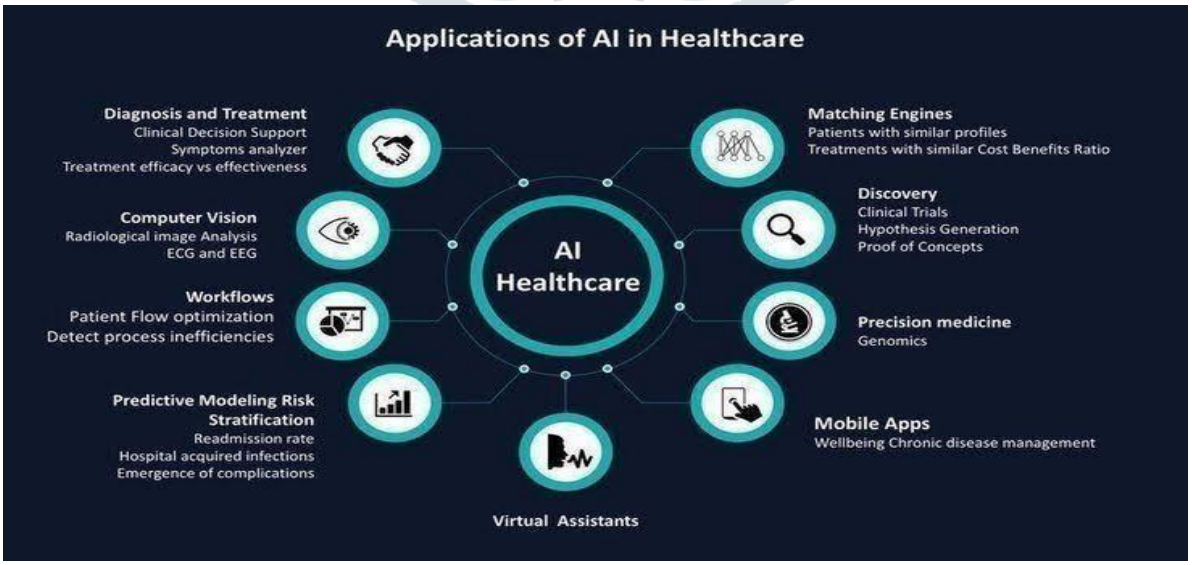

Fig-11

Steps Of Uses Of AI:-

1. .Accurate Cancer Diagnosis.
2. .Early Diagnosis of Fatal Blood Diseases.
3. .Customer Service Chatbots.
4. .Virtual Health Assistants.
5. .Treatment of Rare Diseases.
6. .Targeted Treatment.
7. .Automation of Redundant Healthcare Tasks.
8. .Management of Medical Records.

Application Of Artificial Intelligence:-

AI helps to apply machine learning to this data and rapidly increases the discovery of new molecules. It can research and cross-reference published scientific materials with alternative resources, including clinical trial results, to develop drugs and discover new effective treatment methods for rare diseases.

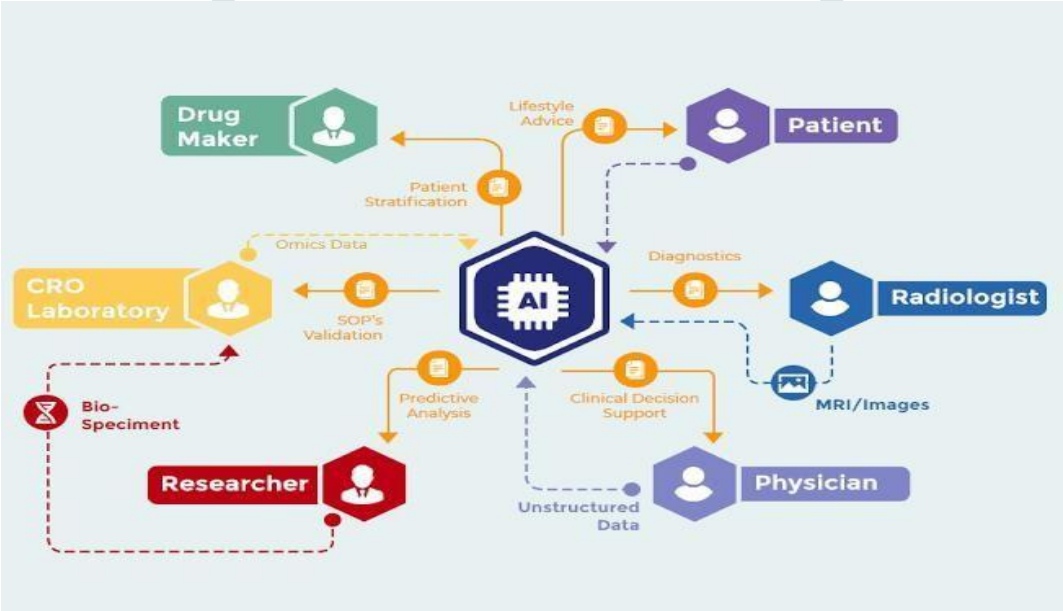

Fig-12

Application of artificial intelligence in the pharmaceutical industries:

1. Research development.
2. Drug development.
3. Diagnosis.
4. Disease prevention.
5. Epidemic prediction.
6. Remote monitoring.
7. Manufacturing.
8. Marketing.
9. Rare diseases and personalized medicine.
10. Processing biomedical and clinical data.
11. Identifying clinical trial candidates.

ADVANTAGES OF AI IN HEALTHCARE

AI-equipped technology can analyse data much faster than any human, including clinical studies, medical records and genetic information that can help medical professionals come to a diagnosis. AI can automate many routine tasks, such as maintaining records, data entry and scan analysis.

Benefits.....
Improved accessibility. ... Sharing Information Is Simple. ... Early diagnosis. ...
Increased speed and reduced costs. ...
Improved Care For Patients. ...
Efficient and unique assistance in surgery. ... Enhanced human abilities and mental health support.

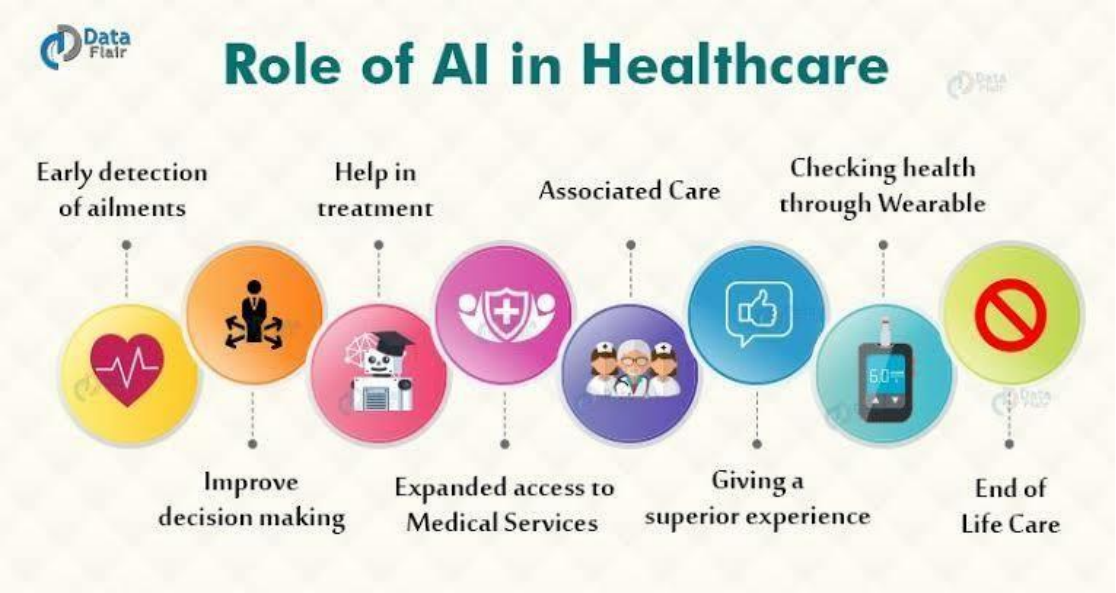

Fig-13

Scope For Further Research:-
Predicted Market Growth of AI in Healthcare
AI in Diagnostic Care: By 2027, the global market for AI technologies in diagnostics is anticipated to reach $3.0 billion. From 2020 to 2027, it is expected to expand at a 32.3percent compound annual growth rate (CAGR).

Fig-14

AI will be used for the management of chronic diseases.

Global drug development and pharmaceutical companies are expected to invest more in AI to facilitate the research and discovery of chronic diseases and terminal illnesses. In the US, chronic diseases constitute one of the major reasons for death.

What is the scope of artificial intelligence in medicine?
Artificially intelligent computer systems are used extensively in medical sciences. Common applications include diagnosing patients, end-to-end drug discovery and development, improving communication between physician and patient, transcribing medical documents, such as prescriptions, and remotely treating patients.

AI in science and research.

- AI in cyber security.
- AI in data analysis.
- AI in transport.
- AI in home.
- AI in health care etc.

AI is making lots of progress in the scientific sector. Artificial intelligence can handle large quantities of data and processes it quicker than human minds. This makes it prefect for research .

Fig-15

Ai in cyber security

Cyber security is another field that's benefitting from AI. As organizations are transferring their data to IT networks and cloud, the threat of hackers is becoming more significant.

AI in data analysis

Data analysis can benefit largely from AI and ML. AI algorithms are capable of improving with iteration, and this way, their accuracy, and precision increase accordingly. AI can help data analysts with handling and processing large datasets.

AI in transport

The transport sector has been using AI for decades. Airplanes have been using autopilot to steer them in the air since 1912. An autopilot system controls the trajectory of a plane, but it isn't restricted to aircraft alone. Ships and spacecraft also use autopilot to help them maintain the correct course.

AI in home

AI has found a special place in people's homes in the form of Smart Home Assistants. Amazon Echo and Google Home are popularsmart home devices that let you perform various tasks with just voice commands.

Recent AI Adoptions :-

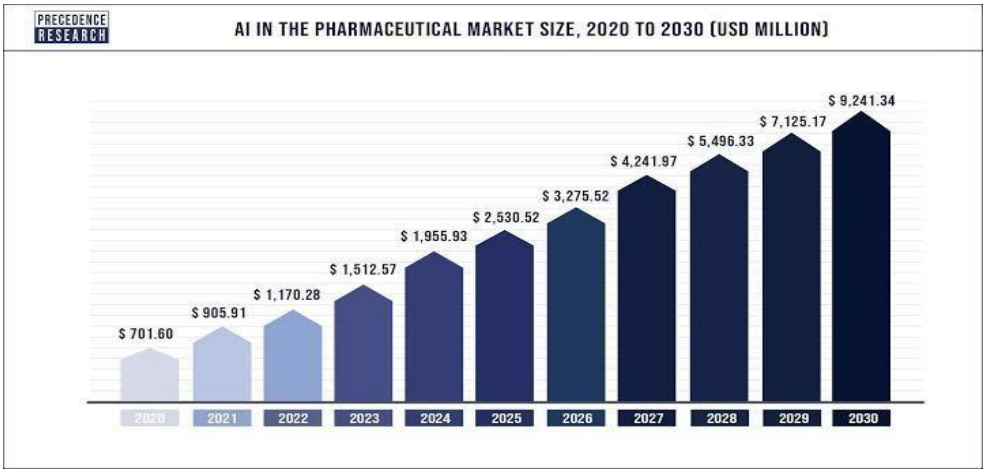

Fig-16

A) Process flow for reinforcement learning. The agent interacts with the environment and gains a reward accordingly based on its action. Through iterative learning, the agent learns and adopts a policy that aims to maximize its reward.

(B) Commonly used architecture for convolution neural networks (CNN). CNN, commonly used for image processing, as successive layers of convolutional and pooling layers are connected to a fully connected neural network. Convolutional layers filter the image based on high-level image features while the pooling layer compresses the image to reduce its size for ease of handling.

Rescan Advantage Associated With AI:-

1. Automates the processes.Artificial Intelligence allows robots to develop repetitive, routine and process optimization tasks automatically and without human intervention.

2. Enhance creative tasks. AI frees people from routine and repetitive tasks and allows them to spend more time on creative functions.

3. Provides precision.The application of AI is capable of providing greater precision than humans, for example in industrial environments, machines can make decisions that were previously made manually or monitored without AI.

4. Reduces human error. AI reduces failures caused by human limitations. In some production lines, AI is used to detect, by means of infrared sensors, small cracks or defects in parts that are undetectable by the human eye.

5. Reduces time spent on data analysis. It allows the analysis and exploitation of the data derived from production to be carried out in real time.

6. Predictive maintenance. It allows to carry out a maintenance of the industrial equipment based on the times and conditions of operation of the same, allowing to increase its performance and life cycle.

7. Improvement in decision making at both production and business levels. By having more information in a structured way, it allows each of the people in charge to make decisions in a faster and more efficient way.

8. Control and optimization of productive processes and production lines Through AI, more efficient, error-free processes are achieved, obtaining greater control over production lines in the company.

Result And Discussion :-

Artificial intelligence's impact on society is widely debated. Many argue that AI improves the quality of everyday life by doing routine and even complicated tasks better than humans can, making life simpler, safer, and more efficient.

The emergence of artificial intelligence (AI) in healthcare has been groundbreaking, reshaping the way we diagnose, treat and monitor patients. This technology is drastically improving healthcare research and outcomes by producing more accurate diagnoses and enabling more personalized treatments.

The primary aim of health-related AI applications is to analyze relationships between clinical techniques and patient outcomes. AI programs are applied to practices such as diagnostics, treatment protocol development, drug development, personalized medicine, and patient monitoring and care.

Fig-17

Conclusion And Future Perspective:-

AI is at the center of a new enterprise to build computational models of intelligence.
The main assumption is that intelligence (human or otherwise) can be represented in the terms of symbol structures and symbolic operations which can be programed in a digital computer.

There is much debates as to whether such an appropriately programmed computer would be a mind, or would merely simulate one, but AI researchers need not wait for the conclusion to that debate, nor for the hypothetical computer that could model all of human intelligence.

Aspects of human intelligent behavior, such as solving problems, making references, learning, and understanding language, have already been coded as computer programs, within very limited domains, such as identifying diseases of soybean plants, AI programs can outperform human experts.

Now the great challenge of AI is to find ways of representing the commonsense knowledge and experience that enables people to carry out every day activities such as holding a wide-ranging conversation, or finding their way along a busy street.

Fig-18

What Industries Will AI Change?

Can AI Make Art More Human? The Evolution of AI
AI's influence on technology is due in part because of how it impacts computing. Through AI, computers have the ability to harness massive amounts of data and use their learned intelligence to make optimal decisions and discoveries in fractions of the time that it would take humans.

AI has come a long way since 1951, when the first documented success of an AI computer program was written by Christopher Strachey, whose checkers program completed a whole game on the Ferranti Mark I computer at the University of Manchester.

Since then, AI has been used to help sequence RNA for vaccines and model human speech, technologies that rely on model- and algorithm-based machine learning and increasingly focus on perception, reasoning and generalization. With innovations like these, AI has re-taken center stage like never before and it won't cede the spotlight anytime soon.

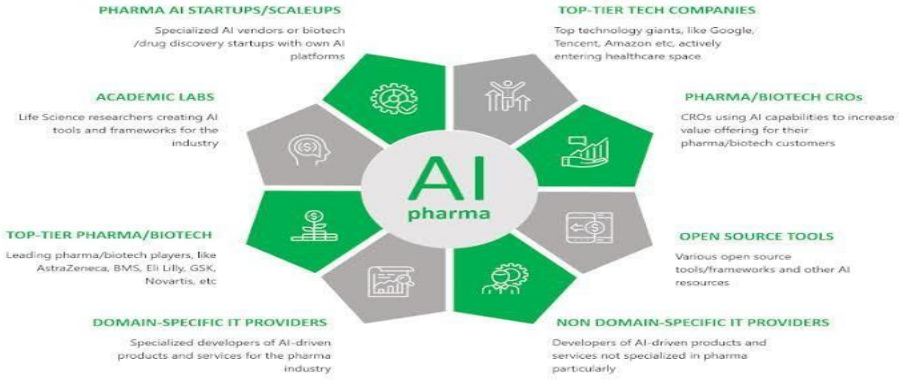

Fig-19

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