



# A Review On: Concise Concepts of Artificial Intelligence

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## ABSTRACT:

Artificial Intelligence (AI) focuses in producing intelligent modelling, which helps in imagining knowledge, cracking problems and decision making. Recently, AI plays an important role in various fields of pharmacy like drug discovery, drug delivery formulation development, polypharmacology, hospital pharmacy, etc. In drug discovery and drug delivery formulation development, various Artificial Neural Networks (ANNs) like Deep Neural Networks (DNNs) or Recurrent Neural Networks (RNNs) are being employed. Several implementations of drug discovery have currently been analysed and supported the power of the technology in quantitative structure-property relationship (QSPR) or quantitative structure-activity relationship (QSAR). In addition, de novo design promotes the invention of significantly newer drug molecules with regard to desired/optimal qualities. In the current review article, the uses of AI in pharmacy, especially in drug discovery, drug delivery formulation development, polypharmacology and hospital pharmacy are discussed.

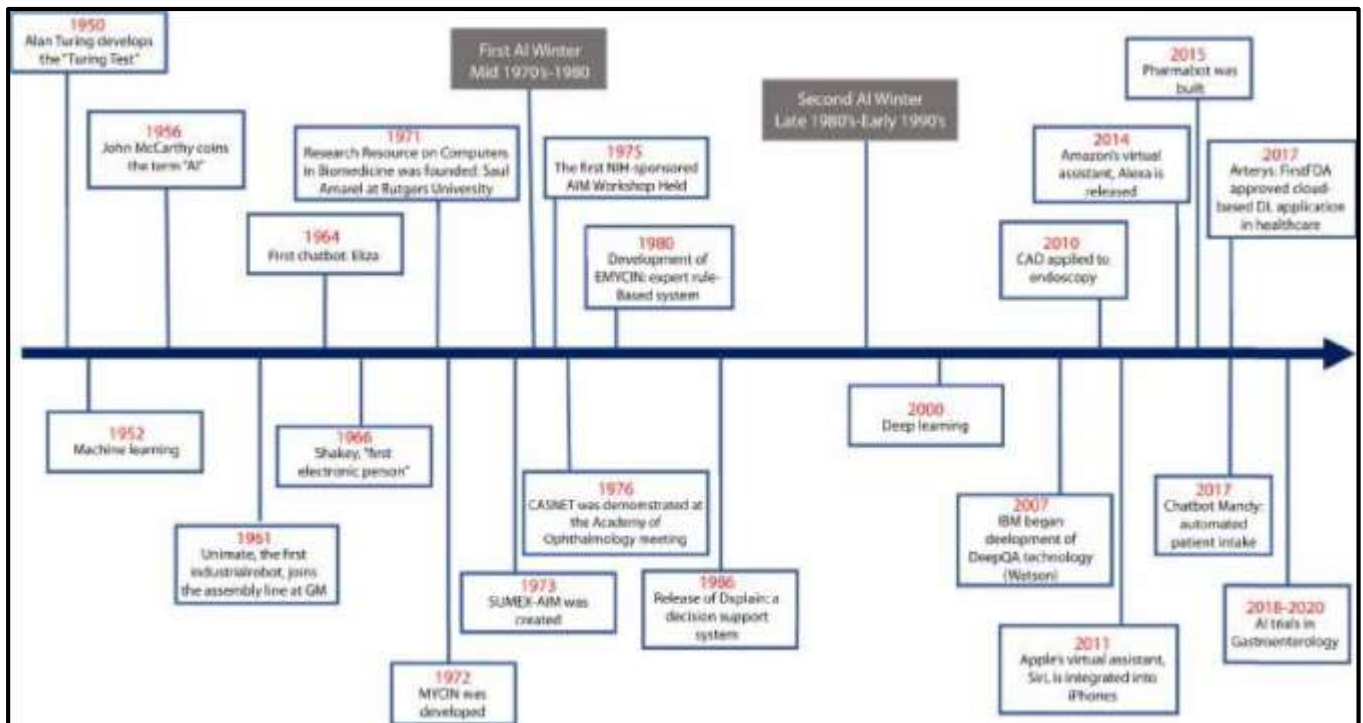
**Keywords:** Artificial intelligence, Drug discovery, Drug delivery research, Hospital pharmacy.

## Introduction:

According to father of artificial intelligence John McCarthy, who coined the term “Artificial intelligence” in 1956, said that “It is the combination of science and engineering to make intelligent devices for human welfare.” Artificial intelligence is an intellect that is much smarter than the best human brain in practically every field, including computer science and linguistic logic. It is a modern method of

machines which will do muscle work and illustrate complex questions in a “intellectual” manner. AI plays a very important role to exhibit intelligent behaviour, to learn, demonstrate and give advice to the user.<sup>1</sup>

## History of Artificial Intelligence:



**Fig. No. 1 History of Artificial Intelligence**

### 1. The 1950s to 1970s:

Early AI was focused on the development of machines that had the ability to make inferences or decisions that previously only a human could make. The first industrial robot arm (Unimate; Unimation, Danbury, Conn, USA) joined the assembly line at General Motors in 1961 and performed automated die casting. Unimate was able to follow step-by-step commands. A few years later (1964), Eliza was introduced by Joseph Weizenbaum. In 1966, Shakey, “the first electronic person,” was developed. Created at Stanford Research Institute, this was the first mobile robot to be able to interpret instructions. This was an important milestone in robotics and AI.

## 2. The 1970s to 2000s:

Most of this time period is referred to as the “AI winter,” signifying a period of reduced funding and interest and subsequently fewer significant developments. Many acknowledge 2 major winters: the first in the late 1970s, driven by the perceived limitations of AI, and the second in the late 1980s extending to the early 1990s, driven by the excessive cost in developing and maintaining expert digital information databases. Despite the lack of general interest during this time period, collaboration among pioneers in the field of AI continued. This fostered the development of The Research Resource on Computers in Biomedicine by Saul Amarel in 1971 at Rutgers University.

The Stanford University Medical Experimental–Artificial Intelligence in Medicine, a time-shared computer system, was created in 1973 and enhanced networking capabilities among clinical and biomedical researchers from several institutions. Largely as a result of these collaborations, the first National Institutes of Health–sponsored AIM workshop was held at Rutgers University in 1975. These events represent the initial collaborations among the pioneers in AIM. One of the first prototypes to demonstrate feasibility of applying AI to medicine was the development of a consultation program for glaucoma using the CASNET model.

## 3. From 2000 to 2020: Seminal Advancements in AI:

In 2007, IBM created an open-domain question–answering system, named Watson that competed with human participants and won first place on the television game show *Jeopardy!* in 2011. In contrast to traditional systems that used either forward reasoning (following rules from data to conclusions), backward reasoning (following rules from conclusions to data), or hand-crafted if-then rules, this technology, called Deep QA, used natural language processing and various searches to analyze data over unstructured content to generate probable answers. This system was more readily available for use, easier to maintain and more cost effective. In 2017, IBM Watson used to successfully identify new RNA-binding proteins that were altered in amyotrophic lateral sclerosis.<sup>2,3,4,5</sup>

### Definition:

Artificial intelligence (AI) is an integration of computer science and physiology. Intelligence in simple language is the computational part of the ability to achieve goals in the world. Intelligence is the ability to think to imagine creating memorizing and understanding, recognizing patterns, making choices adapting to change and learn from experience.

Artificial intelligence concerned with making computers behave like humans more human like fashion and in much less time than a human takes so is called as Artificial Intelligence.

### **Advantages of Artificial Intelligence (AI):**

The benefits of artificial intelligence are incredible, what this area can offer us, is to evolve definitively and move on to the history of artificial robots. Following are the main advantages of Artificial Intelligence (AI).

- Finished task faster than a human
- Stressful and complex work completed easily
- Difficult work done in short period
- Various functions can done at a time
- Success ratio is high
- Less errors in task and defects also
- More efficiency in short time
- Less space, less size
- Calculation of long term and complex situation

### **Disadvantages of Artificial Intelligence (AI):**

Some of the main disadvantages of Artificial Intelligence (AI) in our daily lives are as follows:

- Programme Some time it can be misused leading to mass scale destruction,
- Mismatch sometime done opposite to the command,
- Human jobs affected,
- Unemployment problem increased,
- Creativity is depend upon programmer,
- Lacks the human touch,
- Younger generation becomes lazy,
- Require a lot of time and money, and
- Technological dependency increased.<sup>6</sup>

### **Types of Artificial Intelligence:**

Artificial Intelligence can be divided in various types, there are mainly two types of main categorization which are based on capabilities and based on functionally of AI.

**AI Type-1: Based on Capabilities:****1. Weak AI or Narrow AI:**

- Narrow AI is a type of AI which is able to perform a dedicated task with intelligence. The most common and currently available AI is Narrow AI in the world of Artificial Intelligence.
- Narrow AI cannot perform beyond its field or limitations, as it is only trained for one specific task. Hence it is also termed as weak AI. Narrow AI can fail in unpredictable ways if it goes beyond its limits.
- Apple Series is a good example of Narrow AI, but it operates with a limited pre-defined range of functions.

**2. General AI:**

- General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.
- The idea behind the general AI to make such a system which could be smarter and think like a human by its own.
- Currently, there is no such system exist which could come under general AI and can perform any task as perfect as a human.
- The worldwide researchers are now focused on developing machines with General AI.

**3. Super AI:**

- Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AI.
- Some key characteristics of strong AI include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.
- Super AI is still a hypothetical concept of Artificial Intelligence. Development of such systems in real is still world changing task.

## AI Type-2: Based on Functionality:

### 1. Reactive Machines

- Purely reactive machines are the most basic types of Artificial Intelligence.
- Such AI systems do not store memories or past experiences for future actions.
- These machines only focus on current scenarios and react on it as per possible bestaction.

### 2. Limited Memory

- Limited memory machines can store past experiences or some data for a short period of time.
- These machines can use stored data for a limited time period only.
- Self-driving cars are one of the best examples of Limited Memory systems.

### 3. Theory of Mind

- Theory of Mind AI should understand the human emotions, people, beliefs, and be able to interact socially like humans.
- These types of AI machines are still not developed, but researchers are making lots of efforts and improvement for developing such AI machines.

### 4. Self-Awareness

- Self-awareness AI is the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, sentiments, and self-awareness.
- These machines will be smarter than human mind. Self-Awareness AI does not exist in reality still and it is a hypothetical concept.<sup>7</sup>

## Why Is Artificial Intelligence Important?

Artificial Intelligence (AI) is a large-scale computer science industry that builds intelligent machines capable of accomplishing tasks that are typically human intelligence. The ability of a controlled person or intelligent person is to perform functions that usually associated with the intellectual (Clustering, 2019). Artificial Intelligence (AI) This concept is also used for the creation of structures of human mental mechanisms such as the capacity to comprehend, explore meaning, generalize, or benefit from previous experiences. Since the optical computer's invention in the 1940s, it has seen that machines can configure to conduct very complicated tasks Proof for mathematical theorems or chess with considerable skill may be found.

However, the computer processing speed and memory power are continually improving; no systems are yet accessible that can equal human dexterity across broader realms or activities involving a great deal of everyday expertise. In the other side, specific algorithms have reached the output standards of human experts and specialists in conducting such particular functions, such that in this narrow context.

From the past few decades, the involvement of artificial intelligence in students learning process is grown speedily and the future of students' learning virtually connected with these technologies. Presently, artificial intelligence is increasing the tools for student learning every day, i.e. spell checkers, text prediction applications, language translators, audio to text, and text to audio. Artificial Intelligence comprised of computing systems that can perform human-like tasks such as correction, learning, extracting, evaluating, and self-adapting. Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in a similar manner the intelligent humans think.

AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis, of developing intelligent software and systems.<sup>8</sup>

### **Goals of Artificial Intelligence:**

The traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and manipulate objects AI also draws upon computer science, psychology, linguistics, philosophy, and many other fields. AI can be achieved by reading the behavior of humans and using the results to develop intelligent systems. For example, they learn, make decisions and act in certain situations. Observing humans while problem-solving in simple tasks and using its results to develop intelligent systems.

- **Logic, problem-solving:** Early researchers developed algorithms that simulate humans' step by step reasoning when solving puzzles or making logical deductions The search for more efficient problem-solving algorithms is a high priority.
- **Knowledge representation:** Knowledge representation and knowledge engineering are central to AI research. Many of the problems that machines are expected to solve.
- **Planning:** Intelligent agents must be able to set goals and achieve them. They need a way to envision the future - a representation of the state of the world and make predictions about how their actions will change it.

- **Learning:** Machine learning, a fundamental concept of AI research since the field's inception, is the study of computer algorithms that automatically improve through experience.. After seeing several examples of things from several categories, classification is used to determine which category something falls into.
- **Social Intelligence:** Effective computing is the study and development of systems that can detect, interpret, process, and simulate human. While the origins of the field can be traced to early philosophical inquiries into emotion, the more modern branch of computer science originated from Rosalind Picard's 1995 paper on “effective computing”.
- **Creativity:** A sub-field of AI addresses creativity theoretically (philosophical, psychological perspective) and practically (the specific implementation of systems that produce novel and useful outputs). Some related areas of computational research include artificial intuition and artificial thinking.
- **General Intelligence:** Many researchers think that their work will eventually result in a machine with artificial general intelligence, combining all the skills described above and exceeding human capacity in most or all of these areas. Some believe that such a project may require anthropomorphic features such as artificial consciousness or an artificial brain.<sup>9</sup>

## AI Tools:

### 1. Robot pharmacy:

The objective of improving the safety of patients, UCSF Medical Center uses robotic technology for the preparation and tracking of medications. According to them, the technology has prepared 3, 50, 000 medication doses without any error. The robot has proved to be far better than humans both in size as well as its ability to deliver accurate medications. The abilities of the robotic technology include preparation of oral as well as injectable medicines which include chemotherapy drugs that are toxic. This has given freedom to the pharmacists and nurses of UCSF so that they can utilize their expertise by focusing on direct patient care and working with the physicians

### 2. MEDI Robot:

MEDI is a short form for medicine and engineering designing intelligence. The pain management robot was developed as part of a project led by Tanya Beran, professor of Community Health Sciences at the University of Calgary in Alberta. She got the idea after working in hospitals where children scream during medical procedures. The robot first builds a rapport with the children and then tells them what to expect during a medical procedure, although the robot cannot think, plan, or reason, it can be programmed such that it shows to have AI.<sup>10, 11</sup>



## Applications of Artificial Intelligence in the Pharmaceutical Industry:

- R&D. Pharma companies around the world are leveraging advanced ML algorithms and AI-powered tools to streamline the drug discovery process.
- Drug Development.
- Diagnosis.
- Disease Prevention.
- Epidemic prediction.
- Remote Monitoring.
- Manufacturing.
- Marketing<sup>12</sup>

## Future of Artificial Intelligence:

Artificial Intelligence (AI) is a revolutionary field of computer science, which is ready to become the main component of various emerging technologies like big data, robotics, and IoT. It will continue to act as a technological innovator in the coming years.

We are using AI technology in our daily lives either unknowingly or knowingly, and somewhere it has become a part of our life. It has taken several years and lots of hard work & contributions of various people to take AI at this stage. Being so revolutionary technology, AI also deals with many controversies about its future and impact on Human beings. It may be dangerous, but also a great opportunity. AI will be deployed to enhance both defensive and offensive cyber operations. Additionally, new means of cyber-attack will be invented to take advantage of particular vulnerabilities of AI technology.<sup>13</sup>

## Role of AI in Pharmacy:

### 1. AI in Hospital Pharmacy:

There are several applications of AI in hospital pharmacy based health care system in organizing dosage forms for individualized patients, selection of the suitable or available administration routes or treatment policies.

- Maintaining of Medical Records:** Maintenance of the medical records of patients is complicated task. The collection, storage normalizing, tracing of data are made easy by implementing the AI system. Google Deep Mind health project (developed by Google) assists to excavate the medical records in short span of time. Hence, this project is a useful one for better and faster health care. The Moor fields Eye hospital NHS is assisted by this project for improvement of eye treatment.

**b. Treatment Plan Designing:** the designing of effective treatment plans is possible with the help of AI technology. When any critical condition of patient arises and selection of suitable treatment plan becomes difficult, then the AI system is necessary to control the situation. All the previous data and reports, clinical expertise, etc., are considered in the designing of treatment plan as suggested by this technology. A program is launched by IBM Watson to help oncologists.

## 2. AI Approaches for Drug Discovery:

The drug discovery procedure begins from the available results attained from different resources like high throughput screening modelling, fragment screening modelling, computational modelling. In drug discovery procedure, the structural characterization of drug molecules can directly or indirectly be analyzed by computer-assisted design approaches and after this, organic synthesis of drug molecules is done. The synthesized drug molecules or collected drug compounds are subjected to high throughput screening in primary assay and then, these are counter screened and evaluated for their bioavailability in secondary assays along with successful structure activity relationship (SAR) analysis.<sup>14</sup>

Chemical and pharmaceutical manufacturers examine and derive numerous patents as well as genomic data-based scientific science information by applying the deep learning software, e.g., “NVIDIA DGX-1”. Human beings cannot operate total available information for the advancement of scientific research. AI supercomputers are able to receive and examine the information for identification the association in-between the compounds to offer newer drug molecules.

## 3. AI Approaches for Development of Drug Delivery Systems

The designing of drug delivery systems is related to some disadvantages like prediction of the relationship amongst the formulation factors and responses. This is also related to the therapeutic outcomes and the unpredicted occurrences.

In the designing of different kinds of intelligent drug releasing systems, the on-demand dose adjustment or the rates of drug releasing, targeted releasing and drug stability are the important factors. Concerning the self- monitoring systems for releasing of drugs, the suitable algorithms are useful for controlling the quantity as well as the period of drug releasing. Therefore, AI approaches are useful for the prediction of the drug dosing efficacy and drug delivery potential of the drug delivery dosage forms.<sup>15, 16, 17, 18</sup>

**Conclusion:**

The main purpose of this article is to give a general view of AI applications used to enhance the education domain. For example, finding a solution to complex problems required a lot of time if students try to solve them without using any tool or technology. Therefore, advancement in technology considers the learning perspectives of students to provide them with a way to learn and conduct research fast and reliable using state of the art technologies. Universities and higher education departments are required to keep an eye on technologies and expert systems. Now days to provide quality education with the help of the latest tool and technologies to enhance the learning outcomes of their students only possible with the help of artificial intelligence.

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