



BACHELOR IN OCCUPATIONAL SAFETY AND HEALTH

COMPUTING TECHNOLOGIES

-LGSE 3023-

ASSIGNMENT 01:

ARTIFICIAL INTELLIGENCE IN MEDICINE



PREPARED BY: MONISHYA A/P SUMARAN

MATRIX NO: BOSH 2307-8083

PREPARED FOR: MR. HAIDHAR ATHIR BIN MOHD PUAT

SUBMISSION DATE: 11TH AUGUST 2023

TABLE OF CONTENTS

Contents

TABLE OF CONTENTS	2
LIST OF FIGURES AND TABLES	3
ABSTRACT	4
CHAPTER 1.0	5
INTRODUCTION	5
1.1 HISTORY OF ARTIFICIAL INTELLIGENCE	5
CHAPTER 2.0	7
LITERATURE REVIEW.....	7
2.1 HISTORY OF ARTIFICIAL INTELLIGENCE IN MEDICINE.....	7
2.2 TYPES OF ARTIFICIAL INTELLIGENCE RELATED TO HEALTHCARE.....	9
2.3 RECENT IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE FIELD	10
2.4 BENEFITS OF ARTIFICIAL INTELLIGENCE IN MEDICINE	11
CHAPTER 3.0	13
DISCUSSION/ UNDERSTANDING	13
CHAPTER 4.0	14
CONCLUSION	14

LIST OF FIGURES AND TABLES

ABSTRACT

This research is about the importance and benefits of Artificial Intelligence in Medicine. Due to the complexity and expansion of data in the healthcare sector, artificial intelligence (AI) will be applied more and more. Various AI technologies are presently used by payers, healthcare providers, and life sciences companies. Following will be about the history of Artificial Intelligence and AI in medicine, types of AI related to healthcare, implementation. The purpose of this research is also to discuss about the scientific literature and provide an opinion on the benefits of established artificial intelligence applications in clinical practice on physicians, medical education, bioethics and healthcare institutions,

CHAPTER 1.0

INTRODUCTION

Artificial intelligence (AI) may immediately conjure up images of self-driving cars, robots, ChatGPT or other AI chatbots, or even images created in a laboratory. But it's also essential to look beyond AI's results and understand how the technology works as well as its ramifications for both the now and the future.

Artificial intelligence is a concept that has been around for a while and evolved. In the 1950s, researchers defined AI as a field of study in order to develop machines that could mimic human intelligence and do activities that previously required human cognitive ability.

There are many ways AI that could assist in various fields. One of the fields that has major benefits through Artificial Intelligence is medical field.

1.1 HISTORY OF ARTIFICIAL INTELLIGENCE

The idea of "a machine that thinks" initially surfaced in ancient Greece. But with respect to some of the topics mentioned in this article, major events and turning points in the development of artificial intelligence since the birth of electronic computing include the following:

⇓ 1950:

Publishing Alan Turing developed computing technology and artificial intelligence. Turing proposes in the paper to address the question of "Can machines think?" and introduces the Turing Test to determine whether a computer can exhibit the same intelligence (or the results of the same intelligence) as a person.

⇓ 1956:

John McCarthy coined the term "artificial intelligence" during the first AI conference held at Dartmouth College. (McCarthy later invented the language known as Lisp.) Later that year, Allen Newell, J.C. Shaw, and Herbert Simon create the Logic Theorist, the first ever operational AI program.

⇓ 1967:

Frank Rosenblatt's Mark 1 Perceptron was the first device based on a neural network that "learned" through making mistakes. Just one year later, Marvin Minsky and Seymour Papert publish Perceptrons. It immediately establishes itself as a classic work on neural networks and serves, at least momentarily, as a justification against more research into neural networks.

⇓ 1980:

Neural networks that self-train via a backpropagation technique are extensively used in AI applications.

⇓ 2015:

Convolutional neural networks, a particular sort of deep neural network, are used by the Minwa supercomputer from Baidu to detect and classify photos more accurately than the average person.

⇓ 2016:

DeepMind's AlphaGo software beats current Go world champion Lee Sodol in a five-game match. Given the vast number of potential outcomes as the game develops (more than 14.5 trillion) the victory is noteworthy. Later, it was reported that Google had paid \$400 million for DeepMind.

⇓ 2023:

The prevalence of large language models, or LLMs, like ChatGPT has the potential to drastically change how well AI performs.

These new generative AI techniques enable pre-training of deep-learning models on massive amounts of unlabeled raw data.

CHAPTER 2.0

LITERATURE REVIEW

2.1 HISTORY OF ARTIFICIAL INTELLIGENCE IN MEDICINE

Based on the website of ScienceDirect which was published in 2020, it is proved that even though AI was invented in the 1950s, certain limitations in the initial states were prohibited from widespread applications to medicine. Eventually, it has been overcome. Now, Artificial Intelligence has the tendency of analyzing complicated algorithms, risk assessment models and improving diagnostic reliability and etc.

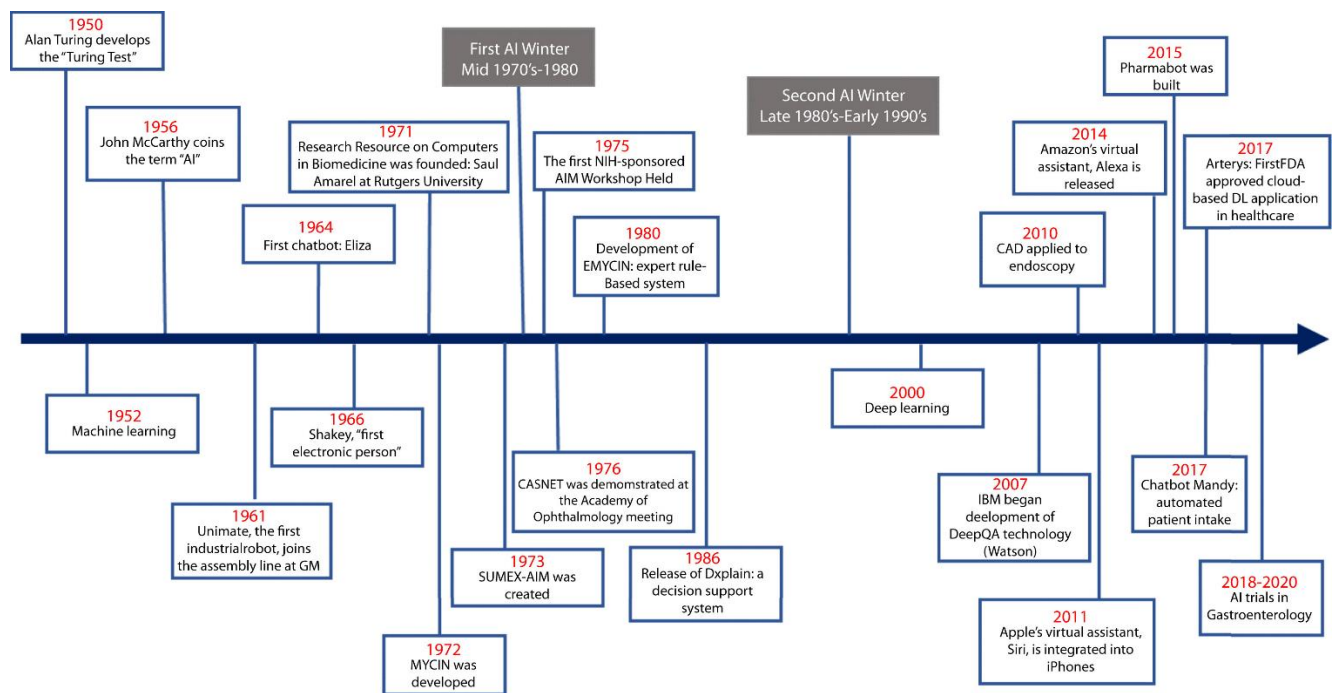


Figure 1 Timeline of the development and use of a.i in medicine

During the 1950s to 1970s, Early AI sought to build machines that could make decisions or perform tasks that had previously been limited to humans. The first industrial robot arm was introduced to the assembly line for automated die casting by General Motors in 1961 (Unimate; Unimation, Danbury, Conn, USA). Unimate was able to follow directions precisely. A few years later, in 1964, Joseph Weizenbaum released Eliza for the first time. Using pattern matching and replacement techniques with natural language processing, Eliza was able to replicate human conversation, laying the groundwork for future chatterbots.

"The first electronic person," Shakey, was invented in 1966. The first mobile robot to be able to understand commands was created at the Stanford Research Institute. Instead of just following one-step instructions, Shakey was able to comprehend more complex instructions and carry out the required tasks. For robots and AI, this represented a key turning point.

The Medical Literature Analysis and Retrieval System and the web-based search engine PubMed, both developed by the National Library of Medicine in the 1960s, were essential digital tools for the subsequent acceleration of biomedicine. Clinical informatics databases and medical record systems were first developed at this time era, laying the foundation for later AIM advancements.

Whereas, in the 1970s to the 2000s, AI was known as the AI Winter due to the decreased funding and interest of developments. There are two types of winters. The first one is in the late 70s and the second would be in the late 80s.

The University of Massachusetts first presented the DXplain decision-support system in 1986. The differential diagnosis generated by this program is based on the symptoms you entered. It also serves as an electronic medical textbook with in-depth descriptions of diseases and supporting references. DXplain was able to describe information on around 500 different ailments when it was originally made available. More than 2400 ailments have since been added to the list since then. In addition to the aforementioned technological developments, the late 1990s saw a rebirth of interest in machine learning (ML), particularly in the medical industry, which helped prepare the way for the current era of AIM.

And finally, In 2011, Watson, an IBM open-domain question-answering system, outperformed human competitors on the Jeopardy! television game show. This system, known as DeepQA, analyzed data over unstructured text and produced plausible answers using natural language processing and other searches. This is in contrast to conventional systems, which either employed manual if-then rule creation, backward reasoning, or forward reasoning. This technology was easier to use, cheaper, and more widely available. Data from a patient's electronic medical record and other electronic sources can be retrieved using DeepQA technology to give evidence-based medicine solutions. It thus opened up new possibilities for evidence-based clinical decision-making. Bakkar et al. in 2017 used IBM Watson to discover new RNA-binding proteins that were altered in amyotrophic lateral sclerosis

This impetus, coupled with improvements in computer hardware and software, made digitalized medicine more widely available, and AIM swiftly grew. Although chatbots were initially created for impersonal communication (Eliza), NLP has transformed them into practical conversation-based user interfaces. This technology was utilized to develop Apple's Siri in 2011 and Amazon's Alexa in 2014, respectively. Pharmabot was created in 2015 to

educate young patients and their parents about medicine, while Mandy was designed in 2017 as an automated patient intake process for a primary care clinic. Some of the Artificial Intelligence that are being used in medicine are in gastroenterology and Endoscopy.

2.2 TYPES OF ARTIFICIAL INTELLIGENCE RELATED TO HEALTHCARE

In actuality, artificial intelligence is comprised of a wide variety of technologies. The specific procedures and jobs that these technologies support vary widely, despite the fact that most of them are directly applicable to the healthcare sector. As Thomas Davenport stated in the PubMed Central of Future Healthcare journal in 2019, there are a few types of ai related to healthcare which are:

2.2.1 : MACHINE LEARNING (ML) – NEURAL NETWORKS AND DEEP LEARNING(DP)

Machine learning is a statistical technique for 'learning' through 'teaching' models with data and fitting models to data. Machine learning is one of the most widely used forms of AI.

The most well-known use of conventional machine learning in the healthcare sector is precision medicine, which chooses which therapeutic approaches are most likely to be successful for a patient based on a range of patient attributes and the environment of the therapy. The great majority of applications in machine learning and precision medicine demand supervised learning, which necessitates a training dataset with a known end variable (like the beginning of disease).

Deep learning, which uses neural network models with several levels of features or variables to predict outcomes, is one of the more difficult types of machine learning. To identify possibly malignant tumors in radiological imaging, deep learning is frequently used in the medical industry. In order to uncover clinically significant patterns in imaging data that go beyond what the human eye can see, deep learning is being used more and more in the field of radiomics. In cancer picture analysis, deep learning and radiomics are most frequently used.

2.2.2 NATURAL LANGUAGE PROCESSING

AI researchers have been attempting to comprehend how human language functions since the 1950s. Speech recognition, text analysis, translation, and other language-related applications fall under the umbrella of the field of NLP. Semantic NLP and statistical NLP are the two basic approaches. Recent advancements in recognition accuracy have been made

possible by statistical NLP, which is based on machine learning and more especially deep learning neural networks. You need a substantial "corpus" or body of language to learn it.

The main uses of NLP in the healthcare industry are the creation, understanding, and classification of clinical documentation and published research. Conversational AI, reports (such those on radiological exams), analysis of unstructured clinical notes on patients, and patient interaction recording are all capabilities of NLP systems.

2.2.3 PHYSICAL ROBOTS

Physical robots are already well-known, with more than 200,000 industrial robot installations occurring each year worldwide. They perform preset tasks including lifting, moving, welding, or assembling items in locations like factories and warehouses, as well as transporting supplies in medical facilities. More recently, robots have become easier to teach by having them carry out a desired task, and they have increased their capacity to work cooperatively with people. The incorporation of various AI capabilities into their "brains," which are actually their operating systems, is another reason why they are growing smarter. It would seem logical that as artificial intelligence develops across different fields, physical robots would eventually incorporate the same improvements in intelligence.

Surgical robots give surgeons "superpowers," enhancing their vision, capacity to make precise, minimally invasive incisions, close wounds, and other surgical procedures. They were first approved in the USA in 2000. However, significant choices are still made by human surgeons. Gynecologic surgery, prostate surgery, and head and neck surgery are among the common surgical procedures performed with robotic surgery.

2.3 RECENT IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE FIELD

According to the perspective article from the frontiers written on 5th February 2020, there are several applications of ai in medicine which are:

2.3.1 GASTROENTEROLOGY

Numerous applications of AI in clinical settings are advantageous for the discipline of gastroenterology. Gastroenterologists have utilized convolutional neural networks and other deep learning models to analyze images from endoscopy and ultrasound and discover abnormal structures like colonic polyps. Artificial neural networks have also been used to forecast outcomes for gastrointestinal bleeding, esophageal cancer survival, inflammatory

bowel disease, metastasis in colorectal cancer, and esophageal squamous cell carcinoma. These diseases include atrophic gastritis and gastroesophageal reflux disease.



Figure 2 ai in gastroenterology

2.3.2 PULMONARY MEDICINE

In the realm of pulmonary medicine, the interpretation of pulmonary function tests is reportedly a promising area for the development of AI applications. According to a recent study, AI-based software provides a more accurate interpretation and serves as a decision support tool when it comes to interpreting the results of pulmonary function tests. The fact that the study's pulmonologists had much lower rates of accurate diagnosis than the national norm was one of the study's many points of criticism.

2.3.3 CANCER'S COMPUTATIONAL DIAGNOSIS IN HISTOPATHOLOGY

The FDA has granted Paige.ai breakthrough status for an AI-based application that uses computational histopathology to reliably diagnose cancer, freeing up pathologists' time to focus on important slides.

2.4 BENEFITS OF ARTIFICIAL INTELLIGENCE IN MEDICINE

There are many pros that are found in the use of AI in medicine. Upon the research of IBM and an article posted on FutureLearn on 2nd May 2023, it is proven that Artificial Intelligence are prone to help us in huge ways.

2.4.1 THE TENDENCY TO ANALYSE DATA AND BETTER DIAGNOSIS

Medical records and other data related to healthcare may be analyzed by AI technology far more faster and frequently with more accuracy than by humans. As a result, the diagnosing procedure can be significantly accelerated and medical professionals' jobs can be accomplished more successfully.

2.4.2 THE COST OF CARE IS DECREASED

There are numerous ways that AI could lessen costs in the healthcare industry. Some of the most promising potential include reducing pharmaceutical errors, providing personalized virtual health assistance, reducing fraud, and providing more efficient administrative and clinical processes.

2.4.3 DEVELOPING DOCTOR-PATIENT INVOLVEMENT

Inquiries from patients continue far after normal work hours. AI can help prepare round-the-clock care by using chatbots that can answer fundamental questions and give patients information while their provider's office is closed. In order to help clinicians become aware of health changes that need additional care, AI may also be used to prioritize queries and flag data for close examination.

CHAPTER 3.0

DISCUSSION/ UNDERSTANDING

Based on the findings and research of the above, I agree that Artificial Intelligence gives a very huge positive impact to the medical field.

AI is expanding into the field of public health and will have a remarkable impact on all facets of primary care. Primary care givers will be better equipped to recognize patients who need extra attention and deliver individualized regimens for each individual with the aid of AI-enabled computer programs. AI can be used by primary care doctors to take notes, evaluate patient conversations, and upload necessary data into EHR systems. These programs will gather and examine patient information and give primary care doctors knowledge of the patients' medical necessity.

Despite the fact that this application is still in its infancy, Harvard's School of Public Health asserts that using AI to make diagnoses may lead to up to a 50% reduction in treatment costs and a 40% improvement in patient outcomes.

The largest challenge for AI in many healthcare industries is not evaluating whether the technologies will be capable enough to be useful, but rather ensuring their adoption in everyday clinical practice. To be widely used, AI systems must be approved by regulatory bodies, integrated with EHR systems, sufficiently standardized so that similar products perform similarly, taught to clinicians, paid for by public or private payer organizations, and improved over time in the field. It will take far longer than it takes for technology to improve, but these issues will eventually be handled. Therefore, we forecast a limited application of AI in clinical practice by the year 5 and a more extensive use by the year 10.

CHAPTER 4.0

CONCLUSION

To conclude, the use of Artificial Intelligence in clinical practice, along with other cutting-edge fields like precision medicine, genomics, and teleconsultation, is a promising area of study and development that is growing speedily. While scientific research should continue to be rigorous and transparent in developing new solutions to enhance contemporary healthcare, health policy should now focus on tackling the ethical and practical difficulties associated with this pillar of the evolution of medicine. It is believed that Artificial Intelligence have more pros than its con.

.

