ARTIFICIAL INTELLIGENCE IN HEALTHCARE

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Summary. *The following article discusses the development, history, and importance of Artificial Intelligence in healthcare, in addition to an extra examination of some of the problems rising simultaneously. The history of Artificial Intelligence dates back to the middle of the 20th century, with its first appearance being a mystery for doctors as it was initially not well-trusted, where it was originally employed for treating blood-related illnesses and giving approximately accurate results. Modern-day A.I. is insanely powerful, similar to how most healthcare centers worldwide are dependent on it thanks to its multiplex and smart algorithms, some of which allow them to be capable of understanding medicine as well as some experts, if not better.*

Keywords: *medicine, algorithms, machine learning, diagnosis, doctor*

Introduction

Artificial Intelligence plays a pivotal role in modern medicine and general healthcare-related studies, such as chemical engineering and pharmaceutical studies. It enables doctors, medical practitioners, and physicians alike to get access to the precise solutions to even the most complex medicinal challenges without the need to consult other sources. Lest it gives misinformation or even dangerous malpractice-related knowledge, A.I. is gradually getting more innovatory and refined, despite it being a generally newly introduced aspect of medicine.

The fundamental cause of such high utilization of A.I. in healthcare is thanks to its high potential of improving patient outcomes, advance medical research and development as well as reducing healthcare costs. Moreover, many branches of medicine do not give exact conclusions or work properly without the assistance A.I. provides, for instance, machine learning, diagnosis and treatment applications, administrative applications, and many more. With careful oversight, A.I. can be a valuable tool in the medical industry.

History

The presence of Artificial Intelligence has always been a valuable asset of medicine throughout its history, with its roots dating back to the middle 1960s. At that time, A.I. was not only one of the newest introduced contrivances, but also the least tested and, most importantly, unknown of its abilities, as people were unconvinced of its use in such an important branch of industry as medicine, thus it was carefully organized and checked by engineers and programmers.

Early A.I. applications were only focused to assist clinicians with diagnosis and treatment recommendations. The world has seen A.I. first appearing in healthcare in 1972, with the MYCIN system being developed at Stanford University by a team led by Edward Shortliffe *(Fig 1)*. The program is buit upon an unique inference engine [1, p. 295], and it was used initially for treating blood-related infections, yet it would soon attempt to diagnose ill people based on described symptoms, despite initially the results being not as considerably accurate as the human-made conclusions [1, p. 14]. Many future A.I. developed in the same century will use some of the programming codes and data implemented in MYCIN.

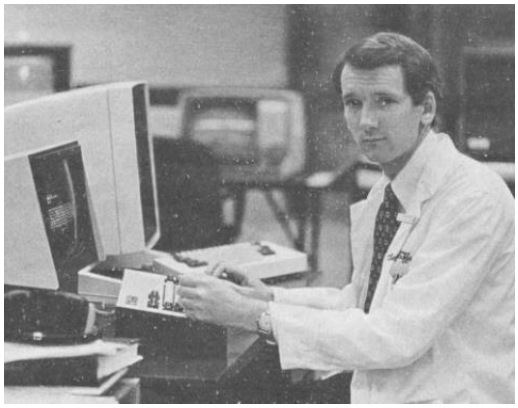

Figure 1. Edward Shortliffe [2]

During the late 1980s, people around the world have become more familiar with A.I. and it would be soon enough until we realize it has the capability to somewhat change healthcare entirely. Throughout the same period, some advanced and intricate Artificial Intelligence techniques were established, such as decision trees (an algorithm for the A.I. to have a model of all possible decisions and its consequences) and neural networks (another algorithm used by the A.I. to solve problems on different and vast occasions). The same updates would be noticed to be used in medicine as well. Artificial Intelligence with a medical imagining system, which was coded using the algorithms mentioned before, was established in the middle 1980s by John Ross Quinlan [3]. It was the first ever used A.I. in radiology, one of the major branches of medicine.

The advent of electronic medical records (EMRs) *(Fig 2)* in the 1970s [4] has assisted the development of more modern A.I. systems exceedingly, which allowed them to store and remember copious information of patient data and diagnoses. Furthermore, EMRs also help in identifying patterns and predicting patients' future and potential illnesses and outcomes. There are many instances of Artificial Intelligence being used in correlation with EMRs even in the modern days, especially used to treat some grave complications, such as HIV and hypertension, as well as diabetes. Countries like South Korea have long since begun conducting on improving clinic workspace using these A.Is. [5].

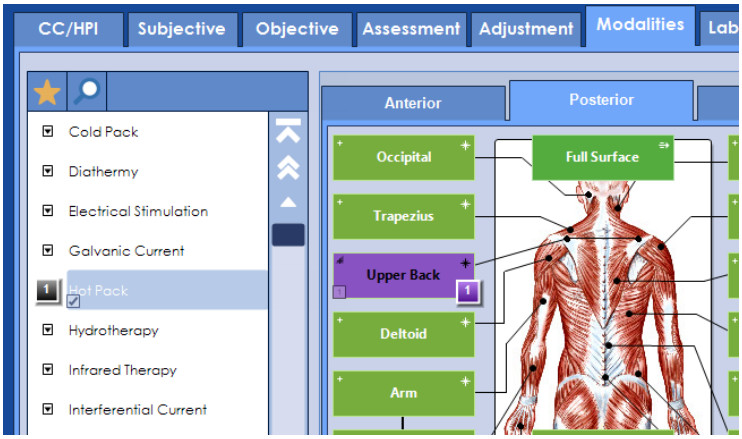

Figure 2. Electronic Medical Records being put to work [6]

Overall, technology has progressed immensely during the early 2000s, and Artificial intelligence is no exception, if not the main factor. The earliest Machine Learning (ML) algorithms appeared during the 1960s [7] and through aforementioned period, it has become more powerful than ever, where A.I. is now capable of remembering a considerable amount of medicinal knowledge. Additionally, Artificial Intelligence Systems based on Machine Learning can assemble multiskilled models that are proficient of performing compound tasks even without the help of scientists and doctors, unlike other A.I. systems made until now.

To a large extent, Machine Learning deserves its own topic of discussion as it is one of the predominant parts of Artificial Intelligence in Healthcare history for several reasons: it gives the medicinal systems the capacity to detect diseases as early as possible, analyze patients' personalized problems and prescribe the best, most efficient and least costly pharmaceutical cure, based on the said patient lifestyle, medication, and so much more. On top of that, with its potentially large amount of data, it can hold up to several terabytes of information regarding illnesses and patients, which sometimes is more than enough to withstand triple the amount of information of regular visitors to an American hospital.

During the 2000s, A.I. applications have begun to grow rapidly and be present in almost every workplace of a medic. A very powerful and significant piece of technology used daily by medical practitioners worldwide was introduced to the public in 2010, officially named IBM Watson (Fig 3). Created by the American Computer Scientist David Ferruci and his team of biomedical engineers, it was developed to aid clinicians and medicine major students around the world with its ability to answer medicinal-related questions and possess a composite yet brisk decision-making potential. It is widely known for its extremely complex software and hardware, capable of processing 500 gigabytes of data per second [8]. IBM Watson is also currently being utilized for education-related projects, hence why medicine students were mentioned earlier.

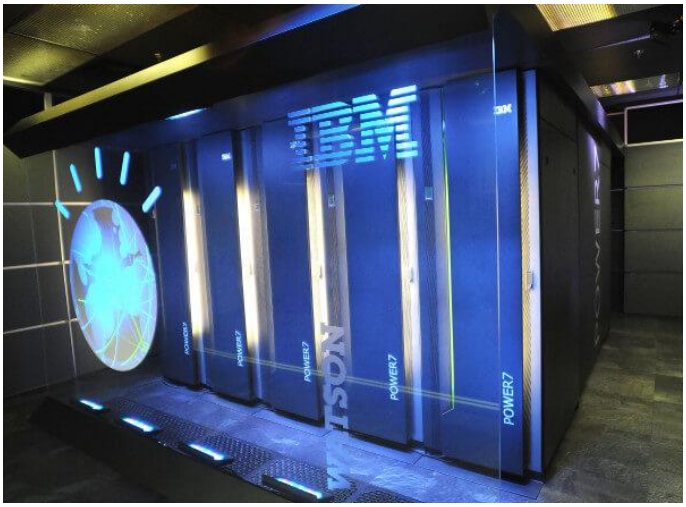

Figure 3. IBM Watson Supercomputer [9]

Fast forward to modern days, as deep learning procedures have been severely upgraded, with some more complex algorithms put to use, one could argue that Artificial Intelligence generally will go through a long way in an ever-expanding process. Today, A.I. is being used in a handful of medical applications and branches, and as mentioned before, some of them are entirely dependent on previously mentioned algorithms. From the first medical imaging in radiology to some of the most precise medications potentially prescribed to each individual, A.I. has come to be a core part of contemporary healthcare, and it is expected to continue to expand and develop in the upcoming years.

A deeper look into A.I. abilities

The examples stated in the previous paragraph are a few of the many techniques A.I. can perform in the medical field. Seeing that it is as advanced as ever before and, as previously stated, getting progressively superior, Artificial Intelligence boasts a great deal of complex aptitudes.

One of the most significant characteristics of the A.I., and undoubtedly the reason why it was introduced in the medical field, is its astute diagnosis and treatment applications. Since it is one of the first implemented codes (having first appeared with MYCIN in 1972) and a clear fundamental data basis of the system, it is one of the most researched and overall used abilities available. With the more recent aforementioned upgrade, Machine Learning, the Diagnosis and Treatment applications base has begun to work much more appropriately in other fields as well. For instance, it can

effectively draw conclusions regarding one's well-being and outcomes in a matter of seconds, as well as detect higher and more dangerous diseases and afflictions, such as lung cancer from computerized tomography scans, assess cardiac health from various electrocardiograms, identify retina related illnesses such as retinopathy from eye images, scan and draw deductions on one's potential and future complications and substantially more. Doctors and scientists expect more broad and advanced A.I. diagnostics, as some of them are currently being in development, namely in genomics and oncology.

Artificial Intelligence could potentially not only prescribe the most unexampled drugs to sick visitors of a hospital but also develop the said drugs rapidly and with extra careful measures. This feature has the prospects of saving a doctor's time and, most importantly, money that would be otherwise wasted on searching for the right cure and drugs. It usually goes through a few steps of developing the right treatment, which begins with the identification of the disease itself. The system regularly recognizes the proteins and DNA or RNA of a disease, e.g. a virus, and using its rich bank of storage it already has, A.I. can now begin the next stage: locating the right drugs. Machine Learning algorithm comes into play once again, as lest not give inaccurate and worst case scenario malpractice suggestions of drugs, Artificial Intelligence can provide possible cures with minimal side effects and minimal costs, both for the workplace and for the patient. The final stage includes pinpointing the process of curing the disease. For the most part, the patient has already been cured thanks to the A.I. and has to go through biomarker testing once again, in order to check if the disease is gone or not.

One more pivotal algorithm found in A.I. in healthcare is Natural Language Processing (NLP), which is the ability given to the A.I. to understand the spoken words and sayings by humans more accurately and naturally. Clinicians can directly contact a machine by talking to it as simply as it would be effortlessly talking to someone else, instead of coding and writing tens of hundreds of code rows and set of rules to find out a specific answer regarding one activity or medical thought. It is an incredibly complex and powerful tool present in every popular A.I. in the world, as much as it is a fundamental part for the A.I. to work properly with people. With the help of Machine Learning, A.I. with NLPs can now remember certain tasks and eventually overcome challenges given by the hospitals with ease over time.

Other minor yet worth stating sets of rules discovered in Artificial Intelligence used in healthcare include improved genes editing and summary, personalized complex treatment, surgical robots *(Fig 4)*, and infection rate prediction.

Figure 4. The da Vinci surgical robot. Photo taken on a US Navy hospital ship [10]

Conclusions

Without a doubt, Artificial Intelligence is one of the key factors of science in the 21st of the century, being present in almost every field of study and professional field, where medicine in every respect is much present. It has the potential to permanently change and revolutionize the way medicine is and the way people across the board are cured.

It possesses the overall power and dexterity to alleviate doctors' work and perform even the most difficult engagements in a hospital. Its algorithms can analyze a vast range of medical data and store them for future uses, including patient records, learn by themselves and create their own precise conclusions, prescribe the most efficient and careful drugs to a patient with even the most complicated illness ever met and so much more. While it is already considered potent and has a great effect on healthcare in general, it continues to improve by engineers, data scientists and computer scientists around the world. Many sub-branches of medicine, and eventually the medicine itself, will depend one day on Artificial Intelligence for the benefit of all.

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