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The Rise of Artificial Intelligence and Machine Learning in HealthCare Industry

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Abstract: In this study, we examine some of the recent advancement in health care system as regards the rise of artificial intelligence. We analyzed background knowledge and review many literatures to examine some real world application of artificial intelligence for treatment, diagnoses, and prediction of diseases.

As healthcare industries continues to embrace artificial intelligence to improve the quality of healthcare services, machine learning for prediction and diagnoses of treatment. All together, these create a new window of opportunities as well as challenges to overcome. We dived into how healthcare industry had been affected by the rise of AI technologies, what technologies are used and how they function, the limitations of AI technologies in healthcare, the future prospects of AI technologies in healthcare as it continue to advance and mature, and also the social and ethical implications of AI in healthcare system. There is clear evidence that continuous advancement of AI and machine learning will raise the operational efficiency of healthcare and its allied providers.

Keywords: Artificial intelligence; machine learning; AI in Healthcare; opportunities and challenges in AI; ML in healthcare industry

I. Introduction

The rise of Artificial Intelligence (AI) and Machine Learning (ML) has revolutionized several industries including the healthcare industry. Advanced digital technologies and devices such as AI, ML, smart sensors, robots, big data analytics, and the Internet of Things (IoT) have been implemented by hospitals and care providers worldwide for improved quality of care and operational efficiency. Several studies have shown that AI-supported technologies, which include machine learning, natural language processing, and smart robots, provide numerous opportunities for innovation in the knowledge-intensive healthcare industry. AI has attracted the attention of researchers, physicians, program developers, and consumers in various fields in terms of its potential for transformative innovations in treating human diseases and public health efficiency. This paper analyzes some real-world examples of the application of AI technologies in healthcare industry to understand how AI affects care services, operational processes, and its recommendation of a set of strategies to enhance efficiency of patient treatment. Despite the potential benefits of AI in healthcare, there are several challenges that still need be addressed, such as privacy concerns, cyber security, data integrity concerns, data ownership, medical ethics issues, responsibility for medical errors, and risks of system failures. Therefore, it is essential to assess the role that AI can play in healthcare, explore opportunities and challenges that are associated with its applications.

Most of the notable challenges involved in the widespread application of AI in healthcare such as privacy concerns, cybersecurity, data integrity concerns, data ownership, the problem of data-sharing by various organizational silos, medical ethics issues, responsibility for medical errors, and risks of system failures [8,9,11] are very glaring to see. The challenges are very critical due to the fact that AI technology may threaten patients' preferences, safety, and privacy [7, 8, 10, 13, 14]. Current, policies and ethical guidelines for healthcare services that incorporate AI and its applications lag behind the speed of advances in AI [15, 16]. Also, AI-based technologies should encompass problem solving flexibility and human-oriented values. However, AI-based technologies are still quite controversial in the healthcare industry because they are not yet universally available to all care providers. Hence, there is still need to analyze existing cases of AI-based technologies and their applications to understand the future direction of their use in diagnoses, quality care services, and operational strategies.

II. Literature Review

With recent advances in artificial intelligence and intelligent system which continued to be taken critical roles in our daily life and organizational process [3,5,24] despite the high cost of computation in training model on a very large dataset [25] with algorithm. Consumer demands for responsive and flexible AI-smart devices keeps increasing in this digital age due to their increasing capability in the treatment, diagnoses, and prediction of illness in the healthcare industry.

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Artificial intelligence had becomes the driving force for rapid growth and investment in the healthcare industry[1], one of the most eye catching example is the leveraging of AI by IBM to market sophisticated diagnostic and treatment device such as for the treatment of cancer. As AI in healthcare keeps evolving at a very fast pace, so will be its influence in the treatment and diagnosis of patient with diseases. This is as a result of more clinical data being more readily available, and as more clinical data becomes more available, so will the advancement and improvement in AI devices keep going higher. Kiseleva[2] showed that the 'black-box' nature of AI algorithms creates the challenges of its use in all the areas where the decision-making process shall be transparent and accountable and one of these areas is the healthcare industry.

Social and ethical implications of AI in healthcare

When the London Story Foundation published its finding on the enablement of the "infodemic" of COVID-19 in the Netherlands by facebook business model [3], there was a lot of surprises and this raises load of questions on the social implication of AI in healthcare sector. Facebook introduced a model to curb disinformation on COVID-19, but rather than combating hate speech and disinformation on COVID-19, it allowed wide spread of disinformation on facebook platform which negatively affects life of people during the COVID-19 pandemic. Not only does this generate distrust concerning the Dutch government which adopted COVID-19 measure, it also greatly influenced general public opinion which led to anti-vaccine and anti-mask campaigns, and ultimate surge in COVID-19 patient.

Regarding the ethical implication of AI in healthcare, there are several ethical issues arising from the direct and indirect application of intelligent system or AI in healthcare, these ethical issues fall under four major category namely; (1) informed consent to use, (2) safety and transparency, (3) algorithmic fairness and biases, and (4) data privacy, but despite several ethical implication due to the deployment of AI in healthcare, the advantages outweigh the disadvantages

Machine Learning and Radiology

A team of researchers at Osaka University developed a deep-learning algorithm that can reliably diagnose many neurological diseases including epilepsy [12]. The program scans patients' magneto encephalography results, comparing their images with tens of thousands of other scans from healthy patients. It then identifies potential lesions and other abnormal regions in the brain. Since epilepsy often spreads across the brain, identifying abnormal scans as early as possible is crucial to improving patients' treatment options and ultimate outcome [12].

Figure 1: Application of Artificial Intelligence (AI) in Healthcare

Source: https://igniteoutsourcing.com/healthcare/artificial-intelligence-in-healthcare

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All deep learning solutions rely on neural network alongside artificial neurons that are modeled to mimic human brain. The network have multiple hidden layers with the capability to derive enough insights, and so deep learning algorithms are basically used to reconstruct as well as enhance the quality of medical images. Using AI in radiology can be in two ways which can be either programming an algorithm with predefined criteria supplied by an experienced radiologists which are then hardwired into deep learning software to enable it to perform a particular clinical tasks or to allow an algorithm to learn hidden pattern from a large volume of several medical images, with this, the algorithm is able to detect hidden pattern which can eventually lead to the training of a model to detect tumor or any other radiological related task.

There is also the concept of learning the normal approach, in this concept, a classifier is trained with images to learn the representation of image features, so as to be able to differentiate between abnormal and normal images based on the deviation of features from the learned representation of normal image class. Researchers trained a Convolusional Neural Network by using CT scans with normal heart anatomy. The feature maps of the trained model provide information on the learned relationship between imaging data and semantic labels to detect deviations from normal anatomy. In another way, encoder can be trained with negative patches extracted from mammographic images to detect microcalcifications. In this case, test images will be fed to the trained encoder as patches from the learned representation from normal images, and so, the reconstruction error, which indicates the deviation from the learned representation of what is normal, is then set to a certain threshold such as to detect anomalies in the image.

Limitations of AI technologies in Healthcare industry

"We are so far away from artificial intelligence becoming a tool to improve the way we deliver care despite all the sensational research publications," co-author Leo Anthony Celi tells Managed Healthcare Executive [4]. Celi says "An algorithm that was developed using data from another hospital or clinic cannot be used immediately by another hospital or clinic, this is more challenging especially when we consider the fact that there is practically no healthcare organization that has the data infrastructure and skillset to oversee the validation, deployment, and continuous re-calibration of AI algorithms". Also considering that, health information or data are not share accross organization, and this ultimately put smaller organization at a disadvantage when it comes to the application of AI because they will lack access to sufficient amount of data to train an AI model, and algorithms that are used and trained on smaller data sets won't "'fit' the local population thereby negatively affect the local practice patterns which is a requirement that is needed to be met prior to deployment of AI[4]. Al, these are in addition to the lack of enough data to sufficiently train an AI model.

Future prospects of the field as AI technologies in Healthcare

As the applications of AI in health care fall into the category of; Patient-oriented AI, Clinician-oriented AI, Administrative- and operational-oriented AI [5]. In the future, some of AI tasks could range from doing simplest of task to the most complex task which could be anything from receiving phone call to medical record review, population health trending and analytics, therapeutic drug and device design, reading radiology images, making clinical diagnoses and treatment plans, and even talking with patients. It is expected that AI will eventually master that domain where it is currently having challenges in its application in healthcare. Given the rapid advances in AI for imaging analysis, it is likely that most radiology and pathology images will be examined at some point by an AI system [6]. Speech and text recognition are already employed for tasks like patient communication and capturing of clinical notes, and their usage is expected to increase.

III. Conclusion

In conclusion, while the use of AI in healthcare has proven to be beneficial in various areas such as diagnosis, treatment, and research, there are still limitations and challenges to be overcome. The lack of accessibility to medical information and the inability of AI to provide justifications for its decisions coupled with the inability of human interference remains a drawback and so, it is a pending issues that needed to be addressed as AI is aimed at replacing human interference. As AI is unable to explain and justify its decision, medical institutions and clients do experiences misrepresentation or fraudulent activities.

As AI is continued to be utilized in the detection of digital assaults, cyber attacks, and protection of medical computer systems. We concluded that human physicians will not be replaced by machines to make better clinical decisions. And as AI system is had proven to be superb in providing training, medical research, diagnosis, medical treatments, and decision. We believe that AI systems will become more advanced and will attain the ability to carry out a wider range of tasks without human control or input. But it still has to be developed and used in a transparent, and in such a way that it can explain some of its decision in a similar way to human physician.

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