FORUM:	World Health Assembly
ISSUE:	Measures to Positively Implement Artificial Intelligence in the Diagnosis of Illnesses
STUDENT OFFICER:	Matthew Choe
POSITION:	Deputy chair of World Health Assembly

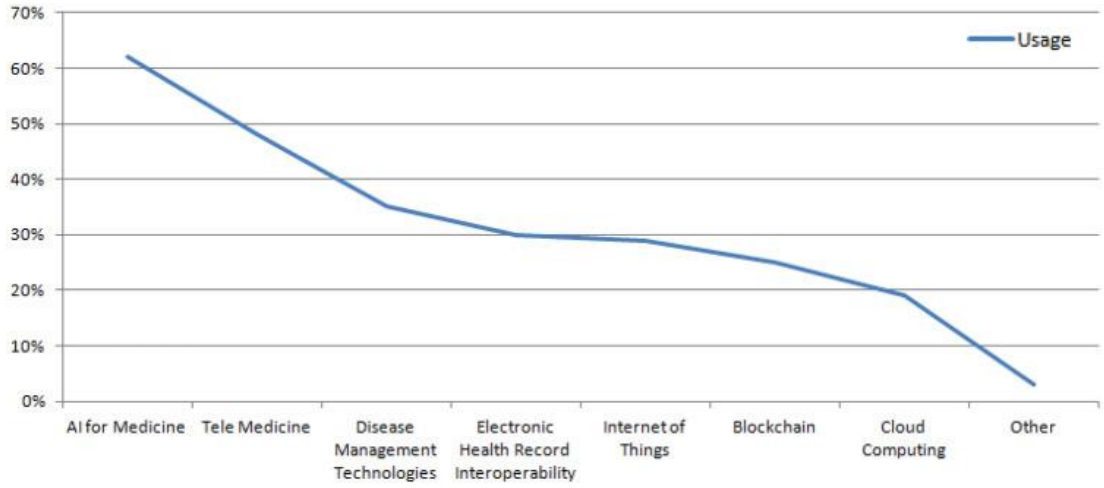
Introduction

The field of healthcare has seen remarkable advancements in artificial intelligence (AI) technologies: in disease diagnosing, health monitoring, and robot-assisted surgery. Although there are many positive aspects AI brought to the healthcare field, unfortunately, there are also negative aspects that come with it that need to be considered. Through the advancements in machine learning algorithms, AI can analyze vast amounts of medical data, detect patterns, and provide accurate diagnoses quickly. AI can also help various patients in diagnosis, drug discovery, and patient risk identification. On the contrary, AI still brings negative aspects, such as ethical concerns in privacy and data security, along with lack of accuracy, reliability, transparency, and explainability. Therefore, it is crucial to take measures to find the balance regarding how to safety implement AI while still using as many benefits as possible that AI can bring to medical and healthcare field.

Using AI models in healthcare.

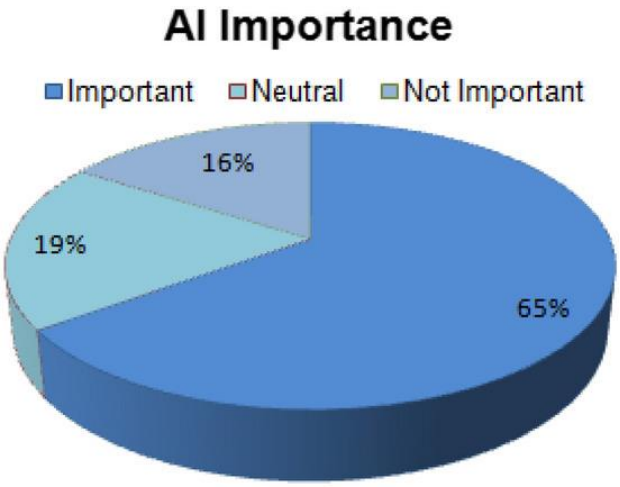
Background

"In terms of the healthcare industry, AI in health refers to a set of diverse technologies that enable robots to detect, comprehend, act, and learn to execute administrative and clinical healthcare activities" (Bohr). AI has the capacity to revolutionize the healthcare sector, tackling crucial challenges within the industry. For example, AI has the potential to enhance patient outcomes, boost productivity and efficiency in delivering care, and augment the daily experiences of healthcare professionals by allowing them to devote more time to patient care, thereby improving staff morale and retention. Furthermore, it has the prospect of expediting the availability of life-saving medications in the market. Likewise, in terms of disease diagnosis, AI has been used to enhance medical diagnosis. For example, "the technology, which is currently in use in China, may detect hazardous tumors and nodules in patients with lung cancer, allowing physicians to provide an early diagnosis rather than sending tissue samples to a lab for testing, allowing for earlier treatment" (Bohr).



Comparison between AI and other techniques

In addition, Al advancements enable rapid processing and analysis of complex data related to emerging diseases. "It achieves over 98% accuracy in recommending the correct decisions for at least ten diseases: Heart, Stoke and Cerebrovascular, Cancer, Chronic, Hypertension, Skin, Liver, Diabetes, and Alzheimer"(Bohr). Doctors utilize technologies like computerized tomography (CT) scans or Magnetic Resonance Imaging (MRI) to create detailed 3D maps for diagnosis. AI technology then swiftly analyzes these images using machine and deep learning models, identifying diseased areas within seconds. The framework involves training an AI model with a specific disease dataset, preprocessing it through data cleaning and transformation techniques to extract disease symptoms as feature vectors for further diagnosis. Without AI techniques, doctors face delays in treating patients due to the manual interpretation of scanned images, which is time-consuming. Conversely, AI techniques aid patients by facilitating early treatment, potentially saving lives.



A survey showing the Importance of AI in health care.

Problems Raised

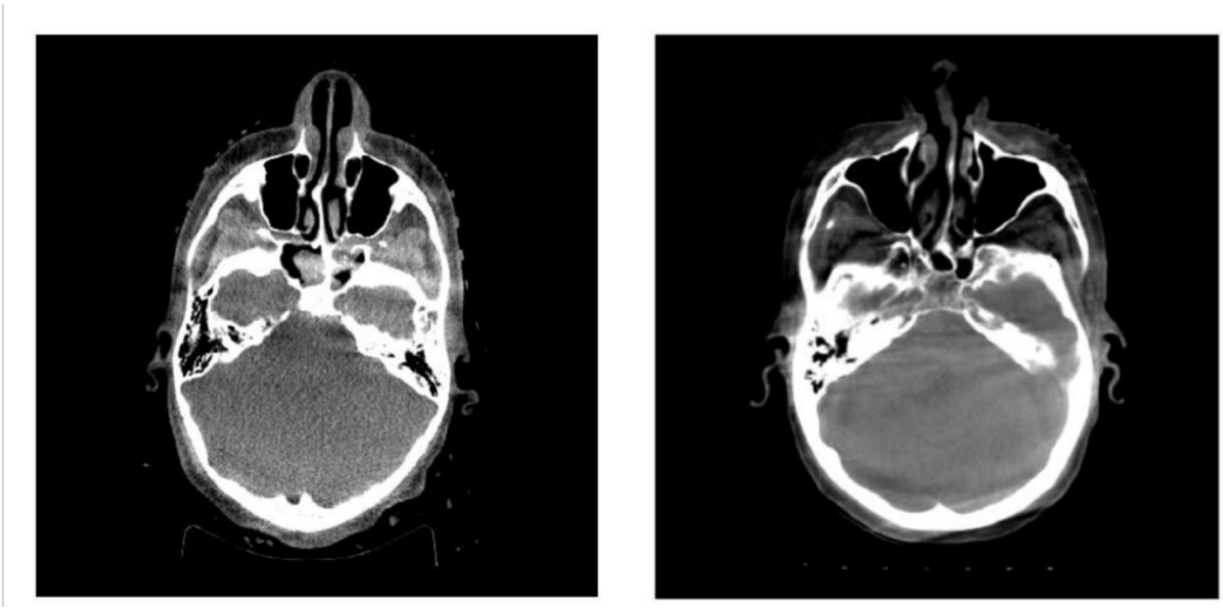
Data quality and bias

To properly validate AI models in clinical and technological settings, clinicians need extensive datasets. Gathering patient data for AI algorithm testing, however, is difficult due to the fragmentation of medical data across numerous electronic health records (EHRs) and software platforms. The manner in which data is gathered and used can potentially introduce bias due to the fact that AI algorithms entirely learns from past dataset that might have been biased itself, and user-generated data might operate as a feedback loop. Currently, there are no standards or criteria for reporting and comparing these data. Therefore, in order to minimize biases in data and have the most reliable data possible, the healthcare industry must concentrate on standardizing the medical data. Additionally, data is a major component in AI model training and decision-making. Unwanted outcomes may result from faulty or biased diagnoses caused by inadequate, biased, or unrepresentative training data. Also falsely diagnosed results might lead to false usage of treatments and delayed timing of treatment, eventually bringing harm to treatments.

Visualization of how biased data could cause unwanted results.

Limited generalizability

AI models may not generalize effectively to new or diverse populations if they were trained on certain datasets. When presented with scenarios that are unknown to it, the AI system's performance could decrease if the training data did not sufficiently reflect different demographics, conditions, or places. For example, even if one external dataset is considered better to another, the sole usage of that "better" dataset does not fulfill the generalizability of the model. Consider a current study on Deep Learning (DL) based breast cancer screening as an illustration. The researchers asserted that the DL system can generalize from the UK to the US after training the model on two datasets from the UK and using it on one dataset from the US. "The US sample, however, originated from a single institution, and 99% of the data were collected using scanners from the same vendor"(Liang). The test results for one institution's scanners from a single vendor are insufficient to represent all clinical contexts, data distributions, scanners from other vendors, scanning processes, etc. Many researchers attempt to gather as much and a variety of patient data as they can in order to train a DL model that performs well in any clinical scenario, anytime, anywhere, for anyone, in order to solve the issue of model generalizability. The bigger the sample size is for the data, the greater it can be applied for universal healthcare. On the other hand, for those people who currently don't have access to healthcare or professional doctors, the AI machines can really help because it will be much more efficient and cheaper to send AI models that have DL models in them to try to cure their diseases with the diverse sample data that the AI model has. unfortunately, this goal currently seems very unrealistic considering the difficulty to gather patient data from enough healthcare organizations to accurately represent all clinical circumstances.



Variation in brain scan across different scanning protocols.

Legal and ethical concerns

There are significant ethical and legal questions raised by the use of AI in diagnosis. To maintain patient safety and trust, concerns such as patient privacy, informed consent, accountability for inaccurate diagnoses, and transparency in algorithmic decision-making need to be carefully considered. In other words, concerns such as patient's right and privacy, the responsibility for false diagnoses on patients from using AI, and clear visible evidence for AI algorithmic decision-making needs to be considered. To maintain the patient's privacy, there must be strict guidelines for getting the patients informed consent to prevent legal issues in the future. Also, Technologists, unlike doctors, are not required by law to be held responsible for their conduct; instead, ethical standards of practice are used in this field. As a result, patients are directly impacted by the debate over whether technologists should be held accountable when automatic identification and data capture (AIDC) is used in healthcare. If a clinician decides to use the data, they will not be able to properly defend their decisions if they cannot account for the output of the AIDC they are using. The potential safety consequences of using unverified or unvalidated AIDC in clinical settings are raised by this lack of accountability.

International Actions

Continuous monitoring and evaluation by the National Institute of Health

Artificial intelligence (AI) and machine learning (ML) algorithms have the ability to gain knowledge from clinical data and enhance patient outcomes. These extremely complex systems are vulnerable to performance decline and are sensitive to environmental changes. To ensure their long-term safety and efficacy, ML/AI algorithms should be regularly examined and upgraded, even after their successful integration into clinical practice. For example, the National Institutes of Health

(NIH) is the principal US government body in charge of biomedical and public health research. The NIH is important in assessing the accuracy and dependability of AI-based diagnostic tools. The NIH continuously evaluates the scientific endeavors it funds. This involves site visits, evaluations of scientific data and findings, and the frequent progress reports that grant recipients provide. Throughout the course of the project, the NIH program officers, and scientific review committees offer advice and criticism to the researchers.

Continuous monitoring and evaluation of AI in healthcare.

Collaboration between AI and medical experts

Medical professionals have a thorough understanding of clinical procedures and patient care. AI researchers frequently create new algorithms and models, but working with healthcare practitioners is necessary to turn these developments into useful applications that can be included into workflows. As a result of their involvement, AI solutions are created to align with clinical needs, workflows, and priorities in the real world, enabling successful implementation and acceptance. For example, NVIDIA Clara works with researchers and medical professionals to create AI models specifically intended for healthcare applications. NVIDIA Clara is a platform that offers AI-powered solutions for applications in medical imaging, genomics, drug discovery, and other areas of healthcare. It is utilized internationally, with partnerships and deployments in both developed and developing nations such as China and the United States. The creation of AI algorithms that can precisely evaluate medical images, detect abnormalities, or forecast patient outcomes is guided by the domain knowledge and skill of medical experts.

NVIDIA using AI in healthcare.

Key Players

World Health Organization (WHO)

The WHO underlines the significance of AI's safe and effective deployment while acknowledging its potential in healthcare. They provide frameworks and rules for assessing and regulating the use of AI in healthcare, including diagnosis. Also, to establish proper regulatory frameworks for AI in healthcare, the WHO has been working with governments and regulatory organizations around the world. This includes thinking about evaluating, validating, and approving AI-based diagnostic tools so they adhere to strict requirements for precision, dependability, and safety. Furthermore, to facilitate knowledge exchange, research, and development in the field of AI for healthcare, the WHO actively interacts with a variety of stakeholders, including academic institutions, Information Technology (IT) firms, and other international organizations. These partnerships assist in identifying and resolving issues linked to the secure and reliable AI-based diagnosis of illnesses.

World Health Organization

World Health Organization in healthcare.

Center for Artificial Intelligence in Medicine & Imaging (AIMI)

The AIMI is an international organization that is dedicated to advancing medical imaging capabilities and enhancing patient outcomes by utilizing AI technologies, it intends to use AI to improve diagnosis, expedite workflows, and advance research in a variety of areas related to medical imaging. AIMI, like many research centers, works on gathering and curating extensive and diverse datasets that include medical pictures, patient information, and other pertinent healthcare data. These datasets are essential for training and validating AI algorithms. Also, to assure the accuracy and security of AI algorithms, AIMI does thorough validation and testing. This entails performing clinical studies, evaluating the generalizability of the algorithms across various patient populations, and contrasting the performance of AI algorithms with that of human specialists. Likewise, AIMI emphasizes the ethical use of AI in healthcare. Therefore, they address issues like data privacy, informed consent, transparency in algorithmic decision-making, and adherence to regulatory guidelines such as HIPAA (Health Insurance Portability and Accountability Act) in the United States.

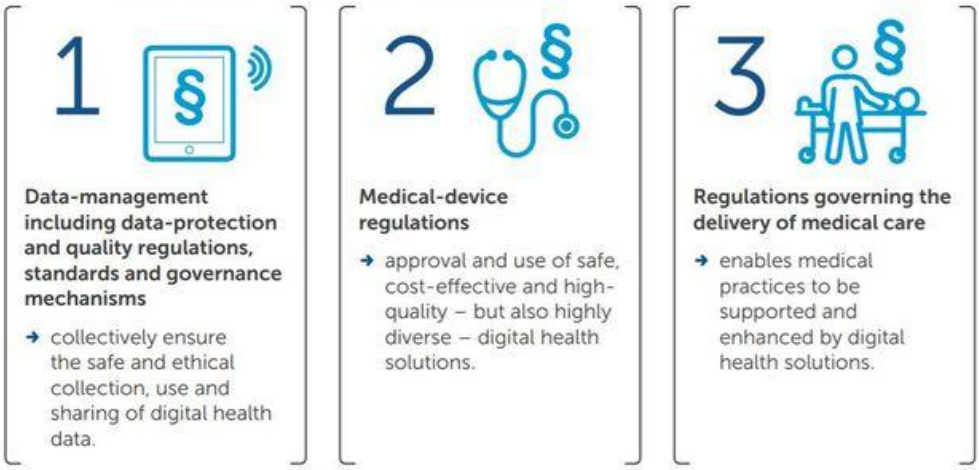
Professionals at Center for Artificial Intelligence in Medicine & Imaging using AI in diagnosis of illness.

Possible Solutions

Regulatory frameworks and standards

In order to minimize biases in data and have the most reliable data possible, the healthcare industry must concentrate on standardizing the medical data. Governments and regulatory bodies should establish clear guidelines and standards for the developments, deployment, and use of AI in all of the healthcare system including private hospitals. These frameworks should address issues such as data privacy, security, accountability, transparency, and ethical considerations, fostering responsible and safe AI adoption.

Figure 8 **Three types of regulations for digital health**



Examples of different types of regulations for digital health.

Education and professionally training

In order to implement AI in the most professional manner, the healthcare professionals need to have a solid understanding of the AI algorithms used in diagnosis. This comprises expertise in model selection, data preprocessing, machine learning techniques, and validation procedures. Through rigorous training, the healthcare professionals will gain understanding of the algorithms' benefits, drawbacks, and potential biases and therefore could handle any possible issues professionally. The training will be incorporated into all the medical schools and will be a required course to become a professional. This should be enforced because even though some health care professionals might not use AI in their career, it is still beneficial to understand how the system works.

Medical experts getting training about AI for healthcare at National Academy of Medicine.

Further advancements and usage of explainable AI

Due to the fact that complex AI models have neural nets that have millions of parameters and hundreds of layers, it can be extremely difficult to interpret. This is why complex machine and deep learning models are often called black boxes. In another words, understanding the logic underlying AI models' predictions can be difficult because they frequently function as "black boxes." Trust in AI systems can be undermined by a lack of interpretability and explicability, particularly regarding important healthcare choices. Therefore, for clinicians to confirm the outcomes and give patients transparent information, they must interpret and explain the judgments made by AI algorithms. In order to do so, healthcare AI models should be created with the ability to explain their choices. Explainable AI techniques make it possible for medical professionals to comprehend the logic underlying AI-generated diagnoses, improving communication, cooperation, and trust between healthcare professionals and AI systems.

Further advancements and usage of Explainable AI.

Glossary – Define jargons specific to the topic

Electronic health record (EHR)

An electronic health record (EHR) is a digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users. While an EHR does contain the medical and treatment histories of patients, an EHR system is built to go beyond standard clinical data collected in a provider's office and can be inclusive of a broader view of a patient's care.

Deep Learning (DL)

Deep learning is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to "learn" from large amounts of data. While a neural network with a single layer can still make approximate predictions, additional hidden layers can help to optimize and refine for accuracy.

Automatic Identification and Data Capture (AIDC)

Automatic Identification and Data Capture (AIDC) is a broad category of technologies used to collect information from an individual, object, image or sound without manual data entry.

Artificial Intelligence in Medicine & Imaging (AIMI)

Stanford has established the AIMI Center to develop, evaluate, and disseminate artificial intelligence systems to benefit patients. They conduct research that solves clinically important imaging problems using machine learning and other AI techniques.

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