Artificial Intelligence In Health Care(Comprehensive Health-Care Model Using AI)

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Abstract- *In recent years, there has been massive progress in artificial intelligence (AI) with the development of deep neural networks, natural language processing, computer vision and robotics. These techniques are now actively being applied in health care with many of the health service activities currently being delivered by clinicians and administrators predicted to be taken over by AI in the coming years.In this paper, we describe the process of identifying opportunities for deploying artificial intelligence to health care and social services .The process described includes idea generation of an application or solution which consists of many small applications of AI when put together can create a health care system which is efficient in most aspects.It also discusses the different ways AI can help curb chronic diseases and pandemics which have been known to be problematic and hard to deal with.*

Keywords- AI, application, pandemic, future technologies

I. INTRODUCTION

Ultimately, health is a function of the multiple factors of genetics, behavior, and environmental exposures.To gain a complete picture of health, data from genetics, health care delivery and outcomes, and the social determinants of health should be integrated. This could include, for example, data on exercise, addictions, diet, the reporting and sharing of family history, treatment experiences, and social consequences associated with a chronic disease, and the widespread collection of health relevant information from wearable devices and smart technology platform apps.

Health care delivery because of the processes involved in detecting, managing and treating diseases involves a complex approach. This complex approach requires collaboration, not just between professionals or medical disciplines, but also between providers and beneficiaries.

This leaves time for human clinicians to drive and manage complex medical activity and spend time with patients more effectively. Also, low-cost AI technology delivered through economies of scale implies wider availability of health services.

A case in point is AI driven primary screening and virtual health assistants that are now increasingly being offered by several providers. Further, incorporation of machine learning in drug development can not only reduce the costs of development for the company but also decrease the AI to the government's aim to provide better well being for the citizens without an increase of the total directand indirect costs for the government.

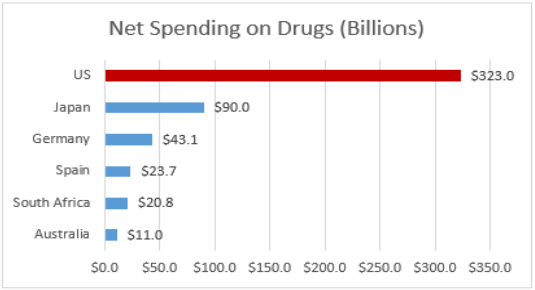


Fig1.Net spending on Drugs

In addition, AI driven diagnostics in laboratories and medical imaging departments can accelerate the diagnostic process and lessen the time spent in hospitals for patients, thus reducing costs and the risks associated with lengthy hospital stay.

III. LITERATURE SURVEY

The vast amount of data being generated means that it is impossible for every physician to read and indeed recall the entirety of all the data published Davenport, Hongsermeier and Mc Cord authored an article entitled in the Harvard Business Review (HBR) entitled "Using AI to Improve Electronic Health Records" and noted that the following areas have potential for AI in relation to EHRs:

Data extraction from free text – the ability to extract structured data or review the notes from a provider with AI applied to recognize essential terms, discover insights and increase productivity

Diagnostic - prediction models from big data to warn clinicians of high risk conditions such as sepsis and heart failure.

Clinical documentation and data entry - the use of natural language processing (NLP) to capture clinical notes freeing up medical practitioners to focus on patients instead of typing notes into keyboards. The example of Nuance given that offers AI-supported tools that integrate with commercial EHRs to support data collection and clinical note composition.

Clinical decision support - using Machine Learning that learn as additional data is gathered to recommend treatment strategies that enhance personalized care.

Ayn de Jesus observed the potential for potential AI enhanced AR use cases for EHRs with Google Glass in "Augmented Reality in Healthcare – 2 Current Applications" whereby "Google Glass may have missed the mark with consumers, but the healthcare industry has expressed interest in making it work for physicians. Although it's a nascent use-case, healthcare networks are looking to equip their doctors with Google Glass software that would allow them to see patient notes without taking their eyes off their patient."
"This could allow physicians to be more present with patients during visits. In the future, AI startups may develop natural language processing-based (NLP) software and/or facial recognition technology that automatically pulls up a patient's record with a voice commandand transcribes notes about the visit into an electronic health record system."

Robotic Surgery

Roger Smith in "How Robots and AI are Creating the 21st-Century Surgeon" noted that "More than 5,000 surgical robots were used in more than 1 million procedures worldwide in the last year."

"AI delivered advice would be derived by Machine Learning algorithms from thousands of previous cases and stored in the cloud for access when needed. For example, a visual overlay inside the surgical space could indicate where critical blood vessels lie behind the current operating plane, with the AI suggesting that the surgeon steer clear of those areas. It could also show how thousands of previous successful surgeons traversed the anatomy, and where they took action. The robot would also be aware of the specific tools loaded into the robotic arms, and might suggest previously successful alternatives."

Nguyen et al. "Manipulating Soft Tissues by Deep Reinforcement Learning for Autonomous Robotic Surgery" introduced a multi-point approach using Deep Reinforcement Learning for surgical soft-tissue cutting task and benchmarked the accuracy of the multiple pinch points.

IV. PROPOSED SYSTEM

Based on a study by Frost & Sullivan, the market for AI has the potential to improve healthcare outcomes by 30 to 40 percent while simultaneously cutting treatment costs in half by:

1. Integrating information such as medical records with operating metrics which can help assist physicians
2. Reducing unnecessary hospital visits by alerting staff only when patient care is needed
3. Creating time-saving administrative duties such as voice-to-text transcription

The benefits, including better patient care, reduced costs and leveraging the many opportunities offered by the integration of AI, significantly outweigh the fears and challenges.Various forms of medical imaging techniques like X-rays, CT, MRI and Nuclear imaging techniques are being used by clinicians to assist their diagnosis and treatment of various conditions ranging from cancers to simple fractures.
Computer Vision(CV) is now being applied in medicine to interpret radiological, fundoscopic and histopathologicalimages. The most publicized success of recent years has been the interpretation of retinopathy images to diagnose diabetic and hypertensive patients.

Natural Language Processing (NLP) has had a great impact on society in the form of voice assistants, spam filters, and chat-bots. NLP applications are also being used in health care in the form of virtual health assistants and in recent years have been identifiedto have potential in analyzing clinical notes and spoken instructions from clinicians.

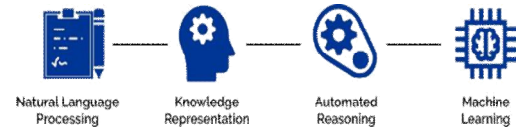


Fig 2. Different technologies integrated to improve healthcare.

This paper addresses a wider scope than a single organization or a single application or product. The target is to find opportunities for deploying the full variety of contemporary AI technologies to the social and health care services of a single country. This means that we do not address a single technology, service or a single organization. rather than look for opportunities in a network of multiple governmental and private sector healthcare, social and

wellbeing services operators as well as a variety of devices and service vendors in the ecosystem. In this context, the goals of the stakeholders vary from the wish of individuals to live healthy lives and vendors' aim to create global scalable products and applications based on AI.

Given below are different opportunities for using AI in health care.

ID	OPPORTUNITY/IDEA
1	Mobile solution for home care coordination and communication
2	Cognitive companion
3	Interactive memory care solution
4	Family caregiver risk assessment and early intervention
5	Care option comparison tool
6	Connected senior homes
7	Watson for occupational well being
8	360 degree pupil well being
9	Identifying children and youth at the risk of social exclusion
10	Parent support
11	Lifestyle Coach
12	Adviser for conscious shopping
13	Workplace safety solutions
14	Virtual Personal trainer powered by Watson
15	Motivation via strengths
16	Assistant Coach
17	Sports Insight Hub
18	Personal coach for patients preparing for an operation or medical procedure
19	Virtual family doctor
20	Advanced triage with cognitive computing
21	Medical imaging and analysis combined with patient data
	Care path optimization: Case cancer treatments of the future
23	Personal post-care virtual adviser
24	Personal avatar visualizing alternative futures
25	Remote monitoring of care effectiveness and learning from the results
26	Cognitive integrated operations center for a hospital
27	Overcoming data quality issues with cognitive computing
28	Identifying security and safety threats and preventing data misuse
29	Enabling patient centric care with cognitive computing
30	Resource optimization in hospital functions
31	Driving capacity evaluation
32	Total risk evaluation
33	Optimization of operating room utilization

Table 1.Ideas to incorporate AI into healthcareArtificial Intelligence (AI).These ideas could organize patientroutes ortreatment tactics better, and also provide physicians with literally all the information. Doctors don‟t have to learn by heart almost as much more data as they did 50 years before. Digital technology has liberated medical doctors, nurses and researchers to focus further mental energy on higher-level cognitive tasks and patient concern.As AI keep on progress, it has the capability to expand the energy of a person thinking in three crucial regions: highly developed computation, statistical analysis and hypothesis generation. These three regions correspond to three unique waves within AIprogression . Specialists roughly observe in excess of 50 patients for every day, which can be to a great degree debilitating thinking about the individual amount of notice and information per individual requires. Unlike a medical doctor, AI is un-phased by numbers of patients, stretch work hour, and task redundancy. AI helps doctors to evaluate the health endanger of a patient and then uses the intelligence to not only develop the quality of care, but also observe and advice patients on the side effects of certain medications .

Below figure depicts the incorporation of ideas from Table 1 and incorporates new ideas that would work in regards to In Hospital Care Management for hospitals.

Table2.Ideas for In Hospital Care Management

IN HOSPITAL CARE MANAGEMENT	Based on patient - sourced data,Doctors will be able to detect and treat conditions through the use of **genetic sequencing,electronic health records,and enabled devices.**
	Through the use of **edible digital pills**, physicians will be able to track patients from the inside to determine the effectiveness of medications.
	Enable Data driven decisions to automate the patients 5 R's: **right doctor,right medication,right time for medication,right dosage and right delivery.**

An aspirational goal for health and health care is to amass large datasets (labeled and unlabeled) andsystematically curated health data so that novel disease correlations can be identified, and people can be matched to the best treatments based on their specific health, life-experiences, and genetic profile. AI holds the promise of integrating all of these data sources to develop medical breakthroughs and new insights on individual health and public health. However, major limiting factors will be the availability and accessibility of high quality data, and the ability of AI algorithms to function effectively and reliability on the complex data streams. It is estimated that 60% of premature deaths are accounted for by social circumstances, environmental exposures, and behavioral patterns. These three areas are a combination of experiences throughout our life based on where we were born, live, learn, work, and play. Frequently coined the social determinants of health, these include economic stability, neighborhood and physical environment, education, food, community and social context, and health care system .genetic sequencing continues to fall short in explaining many health conditions. In some cases, human diseases are easily tracked to well-characterized mutations in very specific genes. But this seems to be the exception rather than rule. Sometimes, human illnesses result from combinations of genetic mutations, and in these cases, it is much more difficult to track down the genetic underpinnings of disease. But, in addition, the forces of chance are at play, and susceptibilities are being altered by behavior (e.g., exercise, diet, smoking, etc.) and environmental exposures (e.g., environmental toxins, noise pollution, industrial chemicals). The human genome sequence, comprised of ~3 billion DNA bases, was completely determined in 2003, almost 15 years ago now. A primary goal of the human genome sequencing project was to provide highly-accurate DNA sequence data to researchers.Digital consultation Bots for healthcare exist first and foremost for patient engagement. Healthcare bots, which are found in mobile messaging apps, that can facilitate patients quickly and in actual time simply by sending a message for example Babylon and uMotif"s. Health conversation bots can reply to health-associated questions and even support patients manage medications by providing data on variety of medications and suggested doses.Healthcare Monitoring gadgets that use AI techniques are currently in extensive use. They can be utilized as remote patient monitoring for health indicators, such as postoperation heart action, patient height and weight, and so on. Wearable gadgets, similar to wristwatches, such as those of Fit BIT commercial fitness trackers, are now frequently used. AI can be utilized to remotely decide persistent treatment designs, or alarms to give the client with any issues. Wearable gadgets can monitor information associated to health and comfort, such as the number of steps walked, or else the number of calories burned. This might be significant to patients seeking to drop weight. AI can then interpret this information to provide people better access to knowledge regarding their physical state and thus, give confidence to patient lifestyle changes.

Below figure depicts the incorporation of ideas from Table 1 and incorporates new ideas that would work in regards to Post Discharge Care management.

Below figure depicts the incorporation of ideas from Table 1 and incorporates new ideas thatwould work in regards to Patient self-service (patients can carry their own devices).

Table3.Ideas for Self service Care Management

PATIENT SELF-SERVICE ENABLMENT patients will be encouraged to bring their own devices to access the following things	Automatic syncing of EHR's(electronic health records)
	Food and entertainment choices
	Virtual personal assistants and clinical Chat-bots
	On demand recovery coaching and evaluation
	Recommendations based on past patient stays
	Real-time vr/ar apps that evaluate health
	Virtual lifestyle coaches
	Mass notifications for family members

Robot assisted surgery Robotic surgery, computerassisted surgery, and also robotically-assisted surgery are terms for technological improvements that utilizes the robotic systems to aid in surgical procedures. Robotically-assisted surgery was created to conquer the limitations of pre-existing minimally-invasive surgical procedures and to improve the capacity of surgeons performing open surgery. In the case of robotically-assisted minimally-invasive surgery, instead of straightly moving the instruments, the surgeon uses one of two methods to control the instruments; either a direct tele manipulator or through computer control . A tele manipulator is a remote controller that allows the surgeon to execute the ordinary activities related with the surgery in the meantime the robotic arms complete those movements using end-effectors and manipulators to do the real surgery on the patient. One beneficial use of the the computerized technique is that the surgeon does not need to be available during the surgery, but rather can be anywhere in the world, top to the likelihood for remote surgery.
remote surgery.

Table3.Ideas for Post Discharge Care Managemen

POST DISCHARGE CAREMANAGEMENT	Will utilize **incentives for patients** to improve medication adherence o r cooperate with care team.
	Through **telehealth and iot**,patients will have access to interact with **specialists virtually** through video ortext.
	Physicians and nurse s can track the patient s recovery status and outcomes through track ers,and wearbles to coll ect data like vital signs.
	When patients need to **follow up with another physician,** an upto date digital medical filewill increasethe vale of the visit and hence chances of full recovery.

Iot devices provides smart and intelligent ways to cure health and additionally provide remote health treatment, disease diagnosis, health monitoring, access of emergency services with no time, that can increase the life expectancy of a serious patient and secures healthy living.The regular health status can be monitored and analysed through smart wearable IoT devices , robot nurses and through AI tools and techniques implemented by the hospitals.Wearables devices like fitness bands [9] and other wireless connected devices like blood pressure (sphygmomanometer) sensor and heart rate monitoring cuffs, electrocardiogram (ECG) sensor, airflow sensor for breathing, electromyography (EMG) sensor, patient position (accelerometer) sensor, galvanic skin response (GSR) sensor to monitor sweating, pulse and oxygen in blood (SPO2) sensor, body temperature sensor, glucometer etc. give patients to avail personalized attention.

V. DIFFERENT WAYS AI COULD HELP DURING PANDEMICS

To identify, track and forecast disease outbreaks

BlueDot, a venture-backed startup has managed to build a sophisticated AI platform that processes billions of pieces of data to identify these outbreaks. This data can include the world's air travel network, health reports, and many others. With respect to the case of the coronavirus, BlueDot made its first alert on December 31st, 2019. This was much ahead as opposed to US Centers for Disease Control and Prevention, which made its own determination only on January 6th, 2020.

To help in the diagnosis of the virus

Alibaba (a Chinese tech company) said AI can detect **Covid-19** in just 20 seconds! The company has said that with the help of AI in CT Scans, it can detect Coronavirus in just 20 seconds. The model has a precision rate of 96% and if doctors were to do the same, it would take up to 20 minutes. The algorithm was built by Alibaba's research institute named Damo Academy. The AI model was trained with the help of data from more than 5,000 confirmed cases and can identify patients with the deadly virus in CT scans.

To process health care claims

Not only are the clinical operations of health care systems taxed but also the business and administrative divisions of it. A block chain platform offered by Ant Financial is assisting in speeding up the processing claims by reducing the number of face-to-face interactions between patients and hospital staff.

Drones to deliver medical supplies

One of the safest and the fastest methods of delivering medical supplies during an outbreak is through drones.

Robots to sterilize, deliver food supplies and perform similar tasks

Considering that robots are not susceptible to the virus, they are being deployed to complete tasks like cleaning, sterilizing and delivering medical supplies in order to reduce the amount of human-to-human contact.

To assist in the development of drugs

AI's predictive capabilities already began proposing existing drugs that might be useful in its cure. Google's DeepMind division uses its latest AI algorithms to study and understand proteins that make up the virus and arepublishing their findings to help in the development of treatments.

Everyday Wear for Precaution and Protection

AI-enabled glasses that can detect the body temperature of visitors. Developed by an Hangzhou-based startup, Rokid Corp, these glasses work along the concept of non-contact thermal augmented reality. Fitted with a camera and a cable, the regular-looking glasses detect anybody with a fever – immediately sending alerts and making digital records.

Identification and risk predictions of the infected

Computer scientists at the University of Copenhagen are currently developing AI-based Computer Models that are capable of calculating the risks of an individual patient's need for a ventilator or intensive care. While the models are not aimed to treat individual patients, their objective is to create a planning tool to make a big difference for hospital staff. This will be useful for hospitals to plan and deploy their resources in the best possible way.

Chat bots to share information and spread awareness

AI-based Chat bots are an essential means of communication for people to access free online health consultation services, updates on the latest travel procedures and disruptions, and more.

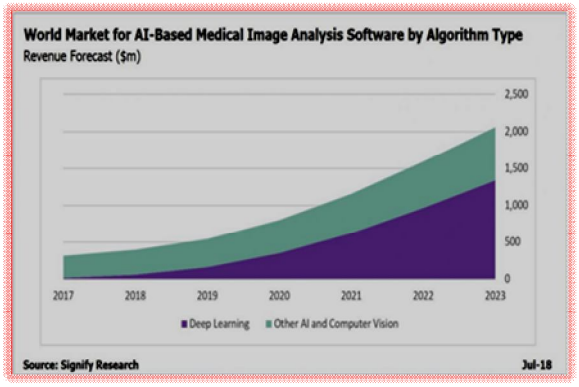
Supercomputers to work on vaccines

The speed these computers is much faster than the standard computer processing and hence can run faster calculations and provide model solutions for necessary situations.

Faster Hospital Bed Assignments

Enter AI with the capability to help hospitals more accurately anticipate demand for beds and assign them more efficiently. For instance, by combining bed availability data and patient clinical data with projected future bed requests, an AI-powered control center at Johns Hopkins Hospital has been able to foresee bottlenecks and suggest corrective actions to avoid them, sometimes days in advance.

VI. FUTURE SCOPE



The chart above from Signify Research shows the rapid growth rate in AI technologies for image analysis to hit revenues of $2Bn by 2023 with Deep Learning set to play the major role. The advantage of deploying such technology is that it can alleviate the skills gap as it takes years and significant investment to train medical staff.

We will see a convergence of emerging technologies with AI being at the heart of all of them. 5G with AI will usher in a new era of Robotics, Virtual Reality, Augmented Reality with Machine to Machine communication.

5G will certainly bring the ability to stay in touch with the patient through these monitoring technologies, whether it's out in the field with an ambulance or in the patient's home.

For most part, wearables require high-frequency updates from a central repository but at low-data rates. 5G connectivity is not limited to wearables; it also enables patients to carry a medical-grade 5G router that then connects to various wearables using Bluetooth.

AI startups that will truly scale and transform healthcare will be those that leverage 5G, edge computing and AI in combination including in the drug discovery world so as to enable clinical trials to gather large amounts of near real-time data and real world evidence so as to enhance and accelerate the process.

The AI in elder care market is expected to exceed US$5.5 billion by 2022, and will grow into one of AI's most important support roles in societies of the future

Melanie Walker authored "Healthcare in 2030: goodbye hospital, hello home-spital"envisions a world where hospital wards will prioritizeinstant diagnosis with one device used for scanning metabolic, functional and structural aspects entailing physics of spectroscopy, magnetic resonance and radiation. This will mean you only need one scan, and no biopsy.

Wearable ,devices like fitness bands and other wireless connected devices like blood pressure (sphygmomanometer) sensor and heart rate monitoring cuffs, electrocardiogram (ECG) sensor, airflow sensor for breathing, electromyography (EMG) sensor, patient position (accelerometer) sensor, galvanic skin response (GSR) sensor to monitor sweating, pulse and oxygen in blood (SPO2) sensor, body temperature sensor, glucometer etc. give patients to avail personalized attention.

Quantum Machine Learning could create AI that more efficiently performs complex tasks in human-like ways. For example, enabling humanoid robots to make optimized decisions in real-time and under unpredictable circumstances.

VII. CONCLUSIONS

It is imperative for health service providers, medical professional bodies, medical schools and health departments to actively incorporate AI/technology (machine learning, robotics and expert systems) in their policies and strategies. If not, it will be a scenario of too little and too late, depriving patients of the immense benefits of personalized and cost-efficient care that AI enabled health systems can deliver.

Collaborate with governments to create a clear governance structure and road map that will attract and nurture investment;encouragethe development andregulationof broad AI principles(including on-going human oversight) rather than specific algorithms; create a national or regional AI advisorycommittee made up of government and business leaders to make policy recommendations.

VIII. ACKNOWLEDGEMENT

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