SRK INSTITUTE OF TECHNOLOGY

ENIKEPADU, VIJAYAWADA

AI SPYDER CLUB

Artificial Intelligence is a tool, not a threat

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MACHINE LEARNING IN HEALTH

ARTIFICIAL INTELLIGENCE IN HEALTH CARE

The role of artificial intelligence in healthcare has been a huge talking point in recent months and there's no sign of the adoption of this technology slowing down, well, ever really.

- What makes AI so suitable for use in medical research and the healthcare industry?

Largely, the appeal of AI is its ability to collect, analyze and make sense of vast amounts of unstructured and variable data—especially text, statistical numbers, and visual images—quickly and often more accurately than a human being. With the increase in digitization and computing power, there has been an ever-growing wealth of digital data produced by individuals and systems, and advances in machine learning and analytical algorithms mean AI systems will become ever more powerful and effective at performing their assigned tasks.

- **AI for Diagnostics**
  - Determining a patient's diagnosis is a vital aspect of healthcare.
  - Care providers and medical researchers alike can see the useful potential of using AI to augment or replace the human ability to identify illness and disease.

- **Mental and Physical Health Screening**
  - Another aspect of healthcare that is primed for assistive AI—in some cases, already seeing the use of AI—is the diagnostic screening process.
  - This is typically performed by a patient speaking with a doctor or other healthcare professional and answering a series of questions about their medical history and describing symptoms, which the health care provider uses to make a diagnosis or recommend a course of action for the patient.
  - As AI systems built around natural language recognition and processing become increasingly adept at interacting with human users, researchers are developing AI tools that can perform these initial diagnostic assessments—most often in the form of chatbots over a smartphone or computer interface.
  - This is essentially the concept of Telemedicine,which already exists in and is available in many parts of the world.

- **AI for Patient Care and Treatment**
  - Personalized healthcare is one of the overarching goals driving the development of healthcare AI systems.
  - This can include AI systems that perform personalized assessments and offer health care advice, assist patients with managing drug regimens and chronic medical conditions, or powering robotic systems to support patients living at home with conditions such as dementia and Alzheimer's, mobility issues, or other mental and physical disabilities.

Drug Discovery

A particularly relevant subset of medical research is drug discovery. Research into developing new drugs has historically been a long and arduous process. According to the US Food and Drug Administration (FDA), the drug discovery process involves five stages for the development and entry onto the market for new drugs:

1.Discovery and development

2.Preclinical research

3.Clinical research

4.FDA review

5.FDA post-market safety monitoring

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Artificial Intelligence in Blood Tests

Sight diagnostics, an Israeli medical devices startup that's using computer vision and machine learning technology to speed up blood testing, is launching a point-of-care blood diagnostics system today.

The device used for this is called OLO

- Which analyzes single use cartridges manually loaded with drop of the patient's blood can deliver lab-grade

  Complete blood count(CBC) tests from only from a finger prick of blood.

- The idea being for clinicians to use the device to perform the most prevalent medical blood diagnostics test directly in their office, rather than a patient having venous blood drawn and sent away to a lab for analysis-a process that take a few days.

- Sight diagnostics is touting OLO as the high tech alternative that healthcare provides have been waiting for-with AI powered analysis performing a blood count right then and there ,after a healthcare worker has pipetted a few drops of the patient's blood into place.

- Sight diagnostics points out that CBC tests are used to diagnose a broad range of common medical conditions, as well as for the vast majority of baseline tests ordered during routine 'well visits', arguing that speeding up this type of routine blood test could support faster diagnostics of medical problem. Or, indeed, speedier reassurance that a person is okay.

- The OLO system uses a patented process for 'digitizing' patient blood into a set of specifically colored microscope images.it then applies proprietary machine vision

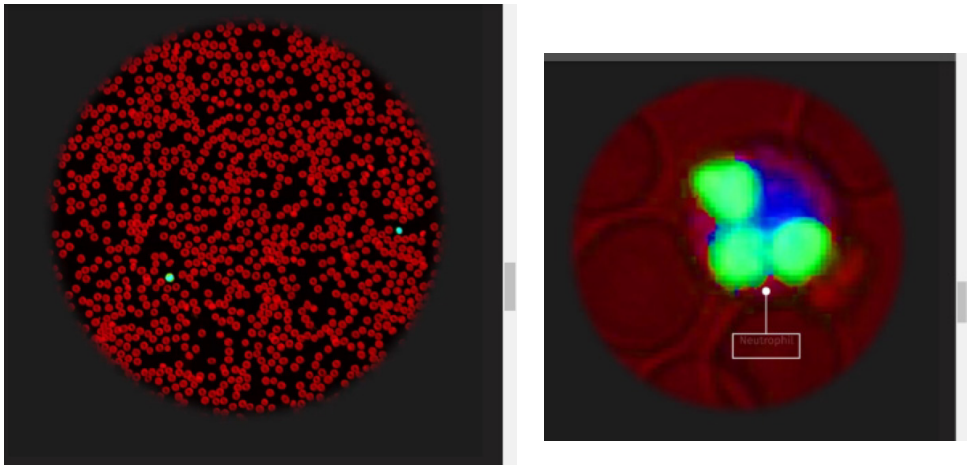
algorithms to the images to identify and count different blood cell types with the company claiming its technology simplifies blood testing so that even non -professionals can perform the tests. The cost of the testing kits can remain low.

"This novel way of digitizing blood important to our approach as the AI driving the analysis",they add.

- "CBC tests operate even today with low sample volumes"
- Sight diagnostics has been working on the OLO system for more than eight years at this stage.

Powerful analysis:

- The scanned images are analyzed usingmachine vision and AI techniques.
- Sight's advanced algorithm, first deployed in 2012 in detect malaria and have been field proven in more than 24 countries.



EXAMPLE:-As one example,imagine that OLO is used to run CBC for a patient, and an important finding is identified. In future, the physician could order a follow –on test and have the already digitized blood images streamed to an expert, he suggest.The expert could then analyze images remotely, saving the patient additional blood draws or travel.

READY IN SECONDS:-

The manual staining workflow has been replaced by a self-contained unit that is sample ready in seconds. Just 2 drops of blood is all it takes. Patented technology is used to form a standardized monolayer of cells.

*self-contained consumable.

*15 seconds preparation.

*patented live monolayer.

SMART VISION:

Once inserted into the instrument,the sample is rapidly imaged using a specialized multi-channel microscope. The extraordinary accuracy of the images allow sight's algorithms to carefully differentiate cells as well identify various anomalies.

*rapid scan

*15 sec preparation.

CONCLUSION: Sight diagnosticsstarts selling an AI- based diagnostics device for faster blood tests. We can identify which type of disease is occurred.

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ARTIFICIAL INTELLIGENCE IN FOOD INDUSTRY

ARTIFICIAL INTELLIGENCE:

When many of us hear the term “artificial intelligence” (AI), we imagine robots doing our jobs, rendering people obsolete. And, since AI-driven computers are programmed to make decisions with little human intervention, some wonder if machines will soon make the difficult decisions we now entrust to our doctors.

Main applications of artificial intelligence in food industry:

The food processing industry is **benefitting greatly** from the latest advancements in artificial intelligence, which is doing everything from helping to sort foods, maintaining top-notch health and safety compliances, developing new products, and bolstering the supply chain. The technology is essentially helping to **streamline work processes,** making the work of employees easier and making operations more efficient.

AI will never replace humans in the food industry, as humans will always be needed to oversee operations, repair and maintain old equipment, and come up with creative ideas for new food opportunities. The technology can essentially work side-by-side with humans to increase operational efficiency within the industry, **potentially automating up to 90% of operations.**

Here are four applications of AI in the food industry.

1) Sorting Food

2) Improving the Supply Chain

3) Ensuring Personal Hygiene

4)Cleaning Processing Equipment

HOW CAN ARTIFICIAL INTELLIGENCE HELP IN EARLY DETECTION ?

Let us see an application used in food indusrty on healthcare based on AI.

Ensuring Personal Hygiene

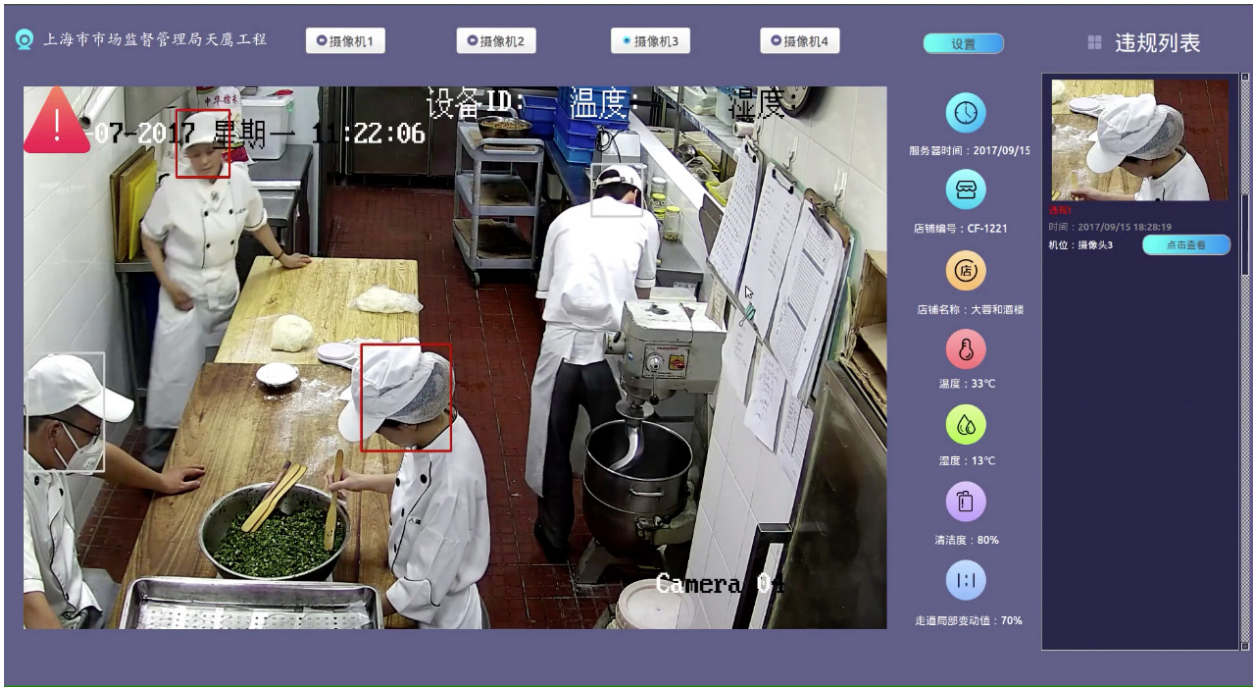
AI is also helping to improve personal hygiene in a food plant, which is just as important as hygiene in a kitchen, and helps to ensure that a facility is compliant with regulations. Companies such as **KanKan** have been working on creating smart solutions to make this happen as the business rolled out an AI-powered solution to improve hygiene in china.The system,which can also be used in restaurants, uses cameras to monitor workers, and it uses facial-recognition and object-recognition software to determine if workers are wearing hats and masks as required by food safety laws.

If it finds a violation, it extracts the screen images for review. According to the company'spress release, the accuracy of this technology is more than 96%.

Improved Food Safety Compliance

KanKan, a subsidiary of Remark Holding, last month announced a seven figure contract with one of the largest state-owned enterprises in China to provide Shanghai's municipal health agency with facial and object recognition. Their AI technology is currently being used in 200 restaurants but will soon expand to 2,000 facilities.

Cameras in the kitchen or food facility watch to make sure that individuals are wearing masks or hair protection when required by safety regulations.Violations can be caught and corrected in near real time. KanKan is using its AI object recognition for numerous applications range from fight IP privacy to automatic checking license plates.



This is a screen shot from KanKan's machine vision system, clearly highlighting proper (white box) and improper (red box) hat and hair net use in a kitchen setting (Source).

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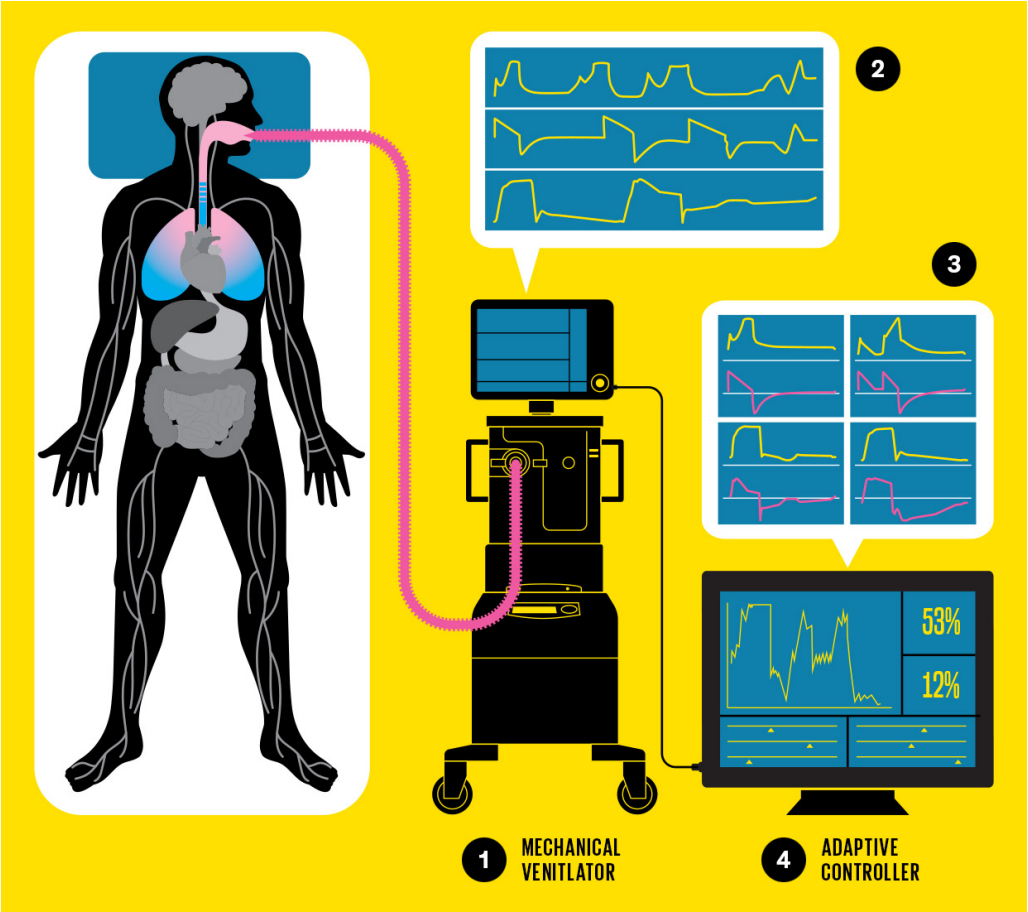
ARTIFICAL INTELLIGENCE IN ICU

- In a hospital's intensive care unit (ICU)
- The patients receive care as they lie in beds with their
- The mechanical ventilators push air into thelungs. Sensors attached to the body track heart rate, blood pressure, and other vital signs, while bedside monitors graph the data in undulating lines.
- machines record measurements that are outside of normal parameters, beeps and alarms ring out to alert the medical staff to potential problems.

- care as they lie in beds with their connected to a bevy of surrounding machines.
- the technology isn't being used to best advantage. Each machine is monitoring
- discrete part of the body, but the machines aren't working in concert. The rich
- streams of data aren't being captured or analyzed.
- for the ICUother specialists—to keep watch at every patient's bedside.
- which will autonomously adjust equipment settings to keep the patient in optimal condition
- At our company, Autonomous Healthcare, based in Hoboken, N.J., we're designing
- bedside every second, carefully calibrating treatment. Such systems could relieve
- The benefits could be huge. In the United States, ICUs are among the most expensive components of the health care system. About 55,000 patients are cared
- for in an ICU every day, with the typical daily cost ranging from US $3,000 to

- **In ICUs today,** the data from the raft of bedside monitors is usually lost as the monitors screens every few second
- Autonomous Healthcare, we're focusing first on AI systems that could manage a patient's ventilation and fluids. Mechanical ventilators come into
- patient is sedated or suffers lung failure, a common ICU condition. And careful
- fluid management maintains the proper volume of blood flowing through a patient's circulatory system ,therefore ensuring that all the tissues



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ARTICLE ON Artificial Intelligence in HealthCare

What is Artificial Intelligence

Artificial intelligence (AI) refers to a computer mimicking intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience to achieve goals without being explicitly programmed for specific action.

Artificial Intelligence in medicine

AI applications have become common, e.g. Siri, Alexa, and Cortana. In medicine, IBM Watson-Oncology has picked up drugs for treatment of cancer patients with equal or better efficiency than human experts. Microsoft's Hanover Project at Oregan has analyzed medical research to tailor personalized cancer treatment option. United Kingdom's National Health Service used Google's DeepMind platform for detecting health risks by analyzing mobile app data and medical images collected from NHS patients. Stanford's radiology algorithm picked up pneumonia better than human radiologists, while in diabetic retinopathy challenge, the computer was as good as expert ophthalmologists in making a referral decision.

Why Should India be Concerned?

There are no explicit laws covering data transfer for processing in India. Humongous amount of data was processed by an indirect third party by service providers, recoding the data according to US laws. A similar deal between Google DeepMind and the Royal Free London NHS Foundation Trust lead to much debate in 2017. That agreement was criticized on grounds of violating the Caldicott Principles by transferring more data than necessary and blurring of the line between the data controllers and data processors. Legal obligations and liabilities are associated with each.

What can be done?

The direct care providers need to be careful when sharing data with a third party which is not in a direct care relationship with the patient in question. Direct care is defined as activity concerned with the prevention, investigation and treatment of illness and the alleviation of suffering of an identified individual. A notice for use of such data must be given to the patient who is in-the-care. If explicit consent and notice have not been given, then all de-identified data should come into public domain and be published by a statutory body. This will keep a check on illegal proprietary exploitation of the data and force the data processor to seek limited amounts of data for exchange. Such publicly available public scrutinized datasets such as Messidor will aid independent development of algorithms and processes. Because in the absence of consent such de-identified datasets should be considered community resource, there is logic in placing it in the hands of the community, thereby enabling policing of these data exchanges at a level which is not possible for any government.

Why Teaching Machines what is Right is Important for the Human Race?

Humans were at the top of the food chain because of their intelligence. They could control dangerous snakes and tigers with cages. Today we are training machines to be smarter than us. Do we need to protect the humans and make these machines slaves to humans? Do we want them to be like friendly Siri, Cortana, and Alexa or like rogue heuristically programmed algorithmic computer of 2001: A Space Odyssey who killed the crew of the spaceship for the sake of his program? To prevent the latter, we must ensure that human physicians are informed of all reasons and decisions taken by the machine.

Conclusion

A successful AI system must possess the ML component for handling structured data and the NLP component for mining unstructured texts. The sophisticated algorithms then need to be trained through healthcare data before the system can assist physicians with disease diagnosis and treatment suggestions.

Although the AI technologies are attracting substantial attentions in medical research, the real-life implementation is still facing obstacles. The first hurdle comes from the regulations. Current regulations lack of standards to assess the safety and efficacy of AI systems. The second hurdle is data exchange. In order to work well, AI systems need to be trained (continuously) by data from clinical studies. However, once an AI system gets deployed after initial training with historical data, continuation of the data supply becomes a crucial issue for further development and improvement of the system.

All the parties in the healthcare system, the physicians, the pharmaceutical companies and the patients, have greater incentives to compile and exchange information

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AI CAN SPOT ALZHEIMER'S YEARS BEFORE DIAGNOSIS

Artificial Intelligence:

The word Artificial Intelligence comprises of two words "Artificial" and "Intelligence". Artificial refers to something which is made by human or non natural thing and Intelligence means ability to understand or think. It can be "It is the study of how to train the computers so that computers can do things which at present human can do better".

- AI simplifies the lives of patients, doctors and hospital administrator by performing tasks that are typically done by humans, but in less time and at a fraction of the cost. It helps in finding new links between genetic codes or to drive surgery-assisting robots.

Alzheimer's:

It is a neurodegenerative brain disorder. It is usually seen in late middle age or in old age (above 65 years). It is characterized by progressive memory loss.

Causes of Alzheimer's:

- Increase in age
- Heredity
- Obesity High blood pressure and cholesterol etc;

Signs and Symptoms:

- Impairment in Memory
- Loss of spontaneity and initiative
- Mood changes
- Personality changes
- Loss of appetite
- Restlessness
- Increasing short-term memory loss and confusion.

AI research on Alzheimer's:

At the early stage of the disease alterations in brain can cause changes in their behaviour and sleep patterns and may also experience confusion and memory loss. Researchers think that AI can help recognizing these changes early and identify patients risk of developing the most severe forms of the disease.

Spotting the first indications of disease in early stages before any obvious symptoms come on could help maximum number of people most likely to benefit from experimental drugs and also helps the family to plan for a special care. Devices equipped with such algorithms could be installed in people's homes or long-term care facilitates to monitor those at risk.

Currently there's no easy way to diagnose Alzheimer's. No single test exists, and brain scans alone can't determine whether someone has the disease. Instead, physicians have to look at a variety of factors, including a patient's medical history and observations reported by family members or health-care workers, So machine learning could pick up on patterns that otherwise would easily missed.

Initially this device was developed as a fall detector for older people by Dina Katabi and her team at MIT's computer science and AI laboratory.But soon realized it had far more uses. If it could pick up on a fallthey thought, itmust also be able to recognize other movements, like pacing and wandering, whichcan be signs of Alzheimer's. Their intention was to monitor people withoutneeding them to put on a wearable tracking device every day. This is completelypassive. A patient doesn't need to put sensors on their body or do anything specific, and it's far less intrusive than a video camera.

How the device works:

The device's wireless radio signal, only a thousandth as powerful as wi-fi, reflects off everything in a 30-foot radiusincluding human bodies.It analyses every movement even the slightest ones, like breathing causes a change in the reflected signal.

The developers of the device developed machine learning algorithms that analyse all the minute reflections. They trained the system to recognize simple motions like walking and falling, and more complex movements like those associated with sleep disturbances. As you teach it more and more, the machine learns, and the next time it sees a pattern, even if it's too complex for a human to abstract that pattern, the machine recognizes the pattern.

the device creates large readouts of data that show patterns of behaviour. The AI is designed to pick out deviations from those patterns that might signify things like agitation, depression, and sleep disturbances. It could also pick up whether a person is repeating certain behaviours during the day. These are all classic symptoms of Alzheimer's. If we can catch these deviations early, we will be able to anticipate them and clearly manage them.

AI also finding use in helping physicians detect early signs of Alzheimer's in the brain and understand how those physical changes unfold in different people.When a radiologist reads a scan, it's impossible to tell whether a person will progress to Alzheimer's disease.

Rosa-Neto and his colleague Sulantha developed an algorithm that studyhundreds of positron-emission tomography (PET) scans from people who had been deemed at risk of developing Alzheimer's. From medical records, the researchers knew which of these patients had gone on to develop the disease within two years of a scan, but they wanted to see if the AI system could identify them just by picking up patterns in the images.

Sure enough, the algorithm was able to spot patterns in clumps of amyloid—a protein often associated with the disease—in certain regions of the brain. Even trained radiologists would have had trouble noticing these issues on a brain scan.From the patterns, it was able to detect with 84 percent accuracy which patients ended up with Alzheimer's.

Clinical trials

Machine-learning algorithms will greatly speed the process of recruiting patients for drug studies. And if AI can pick out which patients are most likely to get worse more quickly, it will be easier for investigators to tell if a drug is having any benefit, researchers could continuously monitor them to see if they're benefiting from the medication.

AI could be used to diagnose and predict Alzheimer's in patients in as soon as five years from now. But it will require a lot of data to make sure the algorithms are accurate and reliable.

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BATTLEFEILDHEALTHCARE

Artificial Intelligence

Rescuing wounded soldiers during active battlefield situations is one of the most dangerous positions and the cause of many military deaths. According to researchers, around 86% of battlefield deaths occur during the first thirty minutes post-injury. This is the reason researchers across the world are working toward developing artificial intelligence (AI) technology that can bolster battlefield healthcare.

Artificial intelligence (AI) can reduce serious injury and death on the field of battle. Most of the development is occurring in the application of robotic systems and unmanned ground vehicles (UGVs) to implement and provide aid in on-site surgery; look for and perform casualty extraction; and conduct intelligence, surveillance, and reconnaissance (ISR) activities.In war zones, AI can be integrated with Robotic Surgical Systems (RSS) and Robotic Ground Platforms (RGPs) to provide remote surgical support and evacuation activities. The US in particular is involved in the development of RSS, RGPs, and various other systems for battlefield healthcare. Under difficult conditions, systems equipped with AI can mine soldiers' medical records and assist in complex diagnosis.

Battlefield robotic surgical systems :

Remote surgical systems has changed the whole scenario of battlefield healthcare. Many private companies, as well as the U.S. military, are already invested resources that will ensure that semiautonomous technologies will be able to provide different health care options for locations that have none. With on-site robotic surgical systems, healthcare personnel can perform “remote” or “unmanned” surgery; even though currently there still must be a human doctor to oversee a robot-performed procedure, the systems can be helpful in places where highly skilled medical resources and doctors are not available to perform complex surgeries, such as on the battlefield and in isolated enclaves.

UGVs and platforms in the battlefield : UGVs and unmanned platforms can perform many tasks, from rescuing the injured to serving as an armed line of force.The role of UGVs can also be changed according to the situation on the battlefield, including for dangerous missions where it is hazardous to send a human operator .UGVs can also be operated entirely autonomously or can be sent into an unreachable location.

Battlefield casualty-extraction robots :

Battlefield casualty-extraction robots – designed especially for retrieval of injured soldiers – can wend through rough or uneven terrain while carrying the weight of a human. Metal-bodied remote-control UGVs currently have a top speed of 10 km per hour (6.2 miles per hour) and can easily lift weights up to 227 kg (500 pounds).

"Porter" UGVs and RGPs :

Soldiers who must carry loads on and off the battlefield have some of the most dangerous tasks, as often they are encumbererd and may not be able to defend themselves. AI seeks to change this scenario by determining how and where to deploy UGVs and robotic ground platforms (RGPs) to carry heavy loads over long distances and rough terrain. Such platforms can also guard soldiers – by conducting surveillance and gathering intelligence – on both operational and logistical missions. Some of these platforms have already been developed and can work up to 72 hours without refueling.

Artificial Intelligence is changing the face of the modern battlefield: AI is and will continue to be used not only for offensive measures, but also is playing a significant role in defensive measures, including saving lives on the front line."

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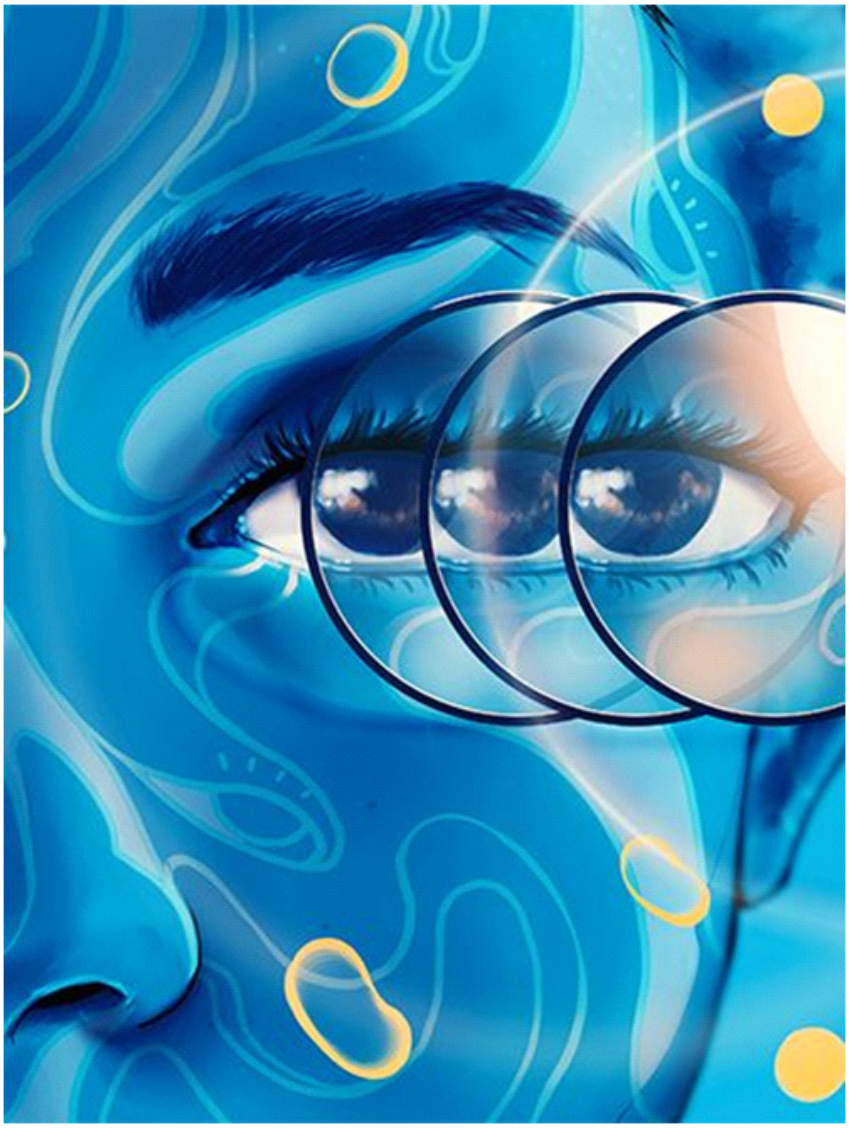
ARTIFICIAL INTELLIGENCE IN HEALTHCARE

When people with diabetes visit their general practitioner, they're often referred to an ophthalmologist, who can check their eyes for signs of diabetic retinopathy. The disease damages the light-sensitive layer of tissue at the back of the eye known as the retina and is a leading cause of blindness, resulting in up to 24,000 cases each year in adults in the United States. But when diagnosed before symptoms appear, the disease can usually be managed and the worst outcome avoided. "We know so well how to treat it, but we don't catch it early enough," says Michael Abràmoff, a retinal specialist and computer scientist at the University of Iowa in Iowa City.



Regular screening is therefore crucial to managing diabetic retinopathy. But assessing the 30 million or so people affected by diabetes in the United States, and more than 400 million people worldwide, seems an insurmountable challenge. Only about half of people with diabetes get their eyes examined every year, as recommended.

That's partly because of a shortage of ophthalmologists. Such specialist physicians require extensive training and particular equipment, and their scarcity in many regions of the world often forces people to travel long distances for an eye examination. The problem is particularly acute in low- and middle-income countries, but even richer countries are expected to experience a shortfall as elderly, high-risk populations grow faster than the pool of ophthalmologists that is needed to treat them. Telemedicine — in which ophthalmologists assess photos of the retina remotely — could help to improve access for patients but has yet to gain widespread acceptance.

Abràmoff had long wondered whether a computer program could be used to screen people for eye disease. Over several decades, he developed IDx-DR, an artificial intelligence (AI) system that can tell in minutes whether a person has a more-than-mild case of diabetic retinopathy. Such cases comprise only about 10% of people with diabetes, so under this AI system, ophthalmologists would have to examine many fewer people.

IDx-DR is the first device to be approved by the US Food and Drug Administration (FDA) to provide a screening decision without the need for a clinician. But it is not the only AI-based tool that is poised to transform the field of ophthalmology. Advances in computing and the availability of large data sets of retinal images have spurred the development of AI systems for detecting not only diabetic retinopathy, which is relatively easy to spot, but also other common eye diseases such as age-related macular degeneration (AMD) and glaucoma. These AI systems could improve the speed and accuracy of large-scale screening programmes, as well as improve access to eye examinations in underserved areas by enabling their provision at medical centres that could not otherwise offer eye care.

Using AI in the clinic will inevitably raise concerns about missed diagnoses and misdiagnosis, says Tien Yin Wong, an ophthalmologist at Singapore National Eye Centre. The legal and ethical issues that result might ultimately determine how common the technology becomes, he says.

Yet those in the field are optimistic that AI-assisted diagnosis is ready to take off. Pearse Keane, an ophthalmologist at Moorfields Eye Hospital in London, is also a consultant at DeepMind Technologies, an AI research company based in London, and owned by Google's parent company, Alphabet, that is developing a system that can diagnose eye diseases. "I still remember one of the first times where I saw the algorithm in action," he says. "I was just stunned and felt that I had seen something transformative for the whole field of ophthalmology."

A 30-year vision

Abràmoff began to look into automating the detection of eye diseases around 30 years ago. Ophthalmologists typically diagnose such conditions by studying either a colour photograph of the back of the eye or a cross-section of the retina captured using an imaging technique called

optical coherence tomography (OCT). But Abràmoff was uncertain whether a computer program could stand in for a highly trained specialist, at least at the outset.

Machine learning, which uses data and custom-built algorithms to train machines to perform tasks, had shown promise for use in image analysis since the 1950s. But the hardware wasn't powerful enough to make machine learning practical for analysing real-world medical images, even by the time that Abràmoff started his research 40 years later.

Nevertheless, Abràmoff painstakingly devised mathematical equations to describe various lesions in the retina, and then wrote algorithms to detect them. By the early 2000s, he had published numerous papers on the topic, and as the decade progressed he obtained relevant patents in the hope that a pharmaceutical or biotechnology company would license them. But the idea did not take off. "Nothing happened," he says.

The use of AI systems in medical imaging received a huge boost in the late 2000s, thanks to the video-game industry. The push for realistic graphics led to the development of more powerful graphics cards that were ideal for the kind of parallel processing that is required by AI systems. These graphics cards made it easier to implement computationally intensive systems known as artificial neural networks, which are inspired by the way that neurons interconnect in the brain. Such networks consist of layers of connected nodes that process different characteristics of an image. Each attribute is given a certain weight, which the system then combines to generate an output such as a decision on whether an eye has been affected by diabetic retinopathy.

By combining artificial neural networks with considerable processing power and massive image data sets, researchers were able to create deep-learning networks that can perform sophisticated tasks beyond the reach of conventionally programmed software, including beating some of the world's best players of the ancient board game Go. "There's sort of this quantum leap forward that's occurred, where all these things that used to be a pie in the sky are now technically feasible to do," says Aaron Lee, an ophthalmologist at the University of Washington in Seattle.

A successful trial

Amid these technological advances, Abràmoff founded AI research company IDx Technologies in Coralville, Iowa, in 2010. After a lengthy discussion with the FDA, he set up a clinical trial to show that IDx-DR could work in a real-world setting. The trial opened for enrolment in January 2017 and included 900 people with diabetes from 10 locations in the United States.

Retinal specialist Michael Abràmoff is developing artificial intelligence programs that could improve access to screening for eye diseases in regions with limited ophthalmology services.Credit: Brice Critser/Dept Ophthalmology/UIHC

The results showed that Abràmoff's decades of work had paid off. IDx-DR correctly identified the presence of more-than-mild diabetic retinopathy around 87% of the time, and correctly identified people who did not have the condition almost 90% of the time[1]. The AI system's accuracy met FDA requirements and, in April 2018, IDx-DR became the first autonomous diagnostic system to be approved for detecting diabetic retinopathy in the United States. "It was a very good day," says Abràmoff.

The system uses a camera to photograph the back of the eye. An AI algorithm then analyses the resulting images to detect early signs of diabetic retinopathy such as haemorrhaging. Another algorithm helps the operator to take high-quality images of the retina, which means that after receiving only four hours of training, anyone with a secondary school education could operate IDx-DR.

In June, University of Iowa Health Care became the first organization to implement IDx-DR in the clinic. Competing AI systems might not be too far behind. “With what IDx has done, there is now a precedent for other companies in the deep-learning space,” says Lee. So far, most have also focused on detecting diabetic retinopathy because the condition is relatively easy to spot in an image. “That is a fairly simple problem from a computer-vision standpoint,” says Lee.

Do as humans do

AI systems will eventually have to do more than detect a single eye disease. “When a physician assesses someone’s eye, they pick up many common conditions,” says Wong. “You can’t just say, ‘I’m only interested in picking up whether or not you have diabetic retinopathy’.” That’s why Wong and others, including Abràmoff, are developing AI systems that are capable of detecting several eye diseases at the same time.

Rather than teaching AI algorithms which disease features to look for (as Abràmoff did for IDx-DR), some researchers train their programs by instructing them to sift through numerous images that originate from healthy or diseased eyes. The AI systems must then work out by themselves how to differentiate between them. In 2017, Wong and his team used retinal images collected from several studies, including the Singapore National Diabetic Retinopathy Screening Program, to train an AI system[2]. They tested its effectiveness in 11 multi-ethnic cohorts of people with diabetes, and showed that their AI program could use differences in retinal images to detect not only diabetic retinopathy, but also glaucoma and AMD. The system’s screening prowess matched that of a human specialist for diabetic retinopathy roughly 90% of the time.

Researchers at DeepMind and Moorfields Eye Hospital have gone even further. They built an AI algorithm that taught itself to make referral decisions for 50 common eye conditions[3]. The system identifies signs of eye disease in an OCT retinal scan and then decides the urgency with which a person should see a specialist. DeepMind’s AI system could ease the patient load for ophthalmologists considerably. “People don’t realize the sheer volume of cases we deal with,” says Keane. The National Health Service in England scheduled 8.25 million ophthalmology outpatient appointments last year.

Training an AI algorithm typically requires large amounts of data and prepares the system to perform only narrow tasks; an algorithm trained to play Go by instructing it to play itself 30 million times would be no good at chess, for instance. But a method known as transfer learning could help to train AI programs using fewer task-specific data, enabling them to learn to perform similar tasks more quickly.

A team led by Kang Zhang, an ophthalmologist at the University of California, San Diego, in La Jolla, took an AI algorithm that had been pretrained on tens of millions of images of everyday objects from the public repository ImageNet, and then applied it to a set of around 100,000 OCT retinal images[4]. Despite the low number of retina-specific images used to train the system,

the pretraining enabled the team's AI program to accurately diagnose two common causes of vision loss — diabetic macular oedema and choroidal neovascularization (often a consequence of advanced AMD) — and to decide who needed an urgent referral to a specialist. Reducing the number of OCT retinal images used in the training to about 4,000 doubled the algorithm's error rate, but its performance was still broadly comparable with that of human experts.

Zhang, Keane and Wong are planning to conduct clinical trials in the next two years to confirm whether their AI systems are as effective at diagnosis as are ophthalmologists — a necessary precursor to receiving regulatory approval. But further work will still be required to produce a commercial product that is ready for use in a variety of settings. "Scientists need to make it as usable as an iPhone," says Wong.

Not just a question of technology

The abilities of these AI systems might, in some cases, exceed those of humans. For instance, Bernhard Weber, a geneticist at the University of Regensburg in Germany, and his colleagues have developed a deep-learning algorithm for classifying the progression of AMD[5], a leading cause of vision loss in people aged 50 and older. Although late-stage AMD is easy to detect, Weber found that his team's AI program could also identify early stages of the disease. "That's tough stuff," he says — challenging even for an ophthalmologist.

Although the accuracy of such AI systems helps to obtain regulatory approval, that green light might not be enough to win the trust of clinicians and patients. "As a society, are we ready to implement these things?" asks Lee.

One obstacle to gaining users' confidence is the closed nature of many AI systems, which operate as black boxes — it's not always clear how such programs reach a decision. "With a black-box algorithm, you have no idea why the algorithm chose to make that diagnosis," says Lee (see 'Opening the black box').

OPENING THE BLACK BOX

The complex artificial neural networks that make artificial intelligence (AI) systems so powerful also make it difficult to understand how such systems reach the decisions that they do — an issue known as the black-box problem.

This opacity is particularly vexing in the clinic, where the reasoning behind an AI system's diagnosis could be crucial to getting regulatory approval. "Explainability became a big issue with the US Food and Drug Administration," says Michael Abràmoff, a retinal specialist and computer scientist at the University of Iowa in Iowa City. "You need to be able to explain what your algorithm does if you want it to be autonomous."

Researchers are discovering how to peer into the black box. AI research companies IDx Technologies in Coralville, Iowa, and DeepMind Technologies in London use a two-pronged approach to interrogate their AI systems' decision-making when diagnosing eye conditions.

One algorithm detects disease features in an image of a person's retina. Another algorithm then uses those features to make a decision about whether that person needs to consult an ophthalmologist and, if so, how urgently. By dividing up those steps, clinicians can determine how a deep-learning network interprets an image before it makes a referral suggestion, says Olaf Ronneberger, a computer scientist at DeepMind.

Another way to untangle what's going on involves the use of a different sort of black box. Kang Zhang, an ophthalmologist at the University of California, San Diego, in La Jolla, and Bernhard Weber, a geneticist at the University of Regensburg in Germany, used black masks to shield parts of retinal images from their AI algorithm, and observed how such masking affected the system's diagnoses. This enabled Weber to determine where in the retina the AI algorithm was looking to make its decision[5]. "What you see is that it's exactly where a human ophthalmologist would look," he says. **S.R.**

Wong likens the rise of AI-based diagnosis to that of driverless cars — and in both cases, he is unsure whether people are ready for complete automation. He therefore designed his system to function as either a fully automated process, or a semi-automated one, in which it works in conjunction with a human. It's similar to ensuring that a driverless car has a steering wheel and brakes so that a person can take over in an emergency. "That gives a lot more confidence, as well as reducing the workload significantly," says Wong.

This two-tiered model might work well in places where ophthalmologists are readily available. But the technology's greatest potential lies in improving access to eye care in low-income countries or remote areas. That reasoning led Abràmoff to test IDx-DR in an isolated part of New Mexico, several hours' drive from the nearest ophthalmologist, and researchers from Google to trial a deep learning algorithm designed to spot signs of diabetic retinopathy in retinal photographs in eye hospitals in India, where just 15,000 ophthalmologists serve about 70 million people with diabetes.

More from Nature Outlooks

Existing AI systems require detailed images of the eye to reach decisions, and in many countries the equipment and expertise needed to take those images are in short supply. But smartphones fitted with special cameras for retinal imaging could be combined with cloud-based AI software to screen for diabetic retinopathy, making eye examinations even cheaper and more convenient.

“In my opinion, the greatest benefit to mankind will occur in resource-limited settings, where there is no expert available,” says Lee. “I think AI can play a very big and disruptive role in the delivery of medicine in those settings.”

M.Krishna pranathi
17X41A0593

AI predicts heart disease by looking at your eyes

"***We will move from mobile first to an AI first world***"

\- *Sundar Pichai, CEO at Google*

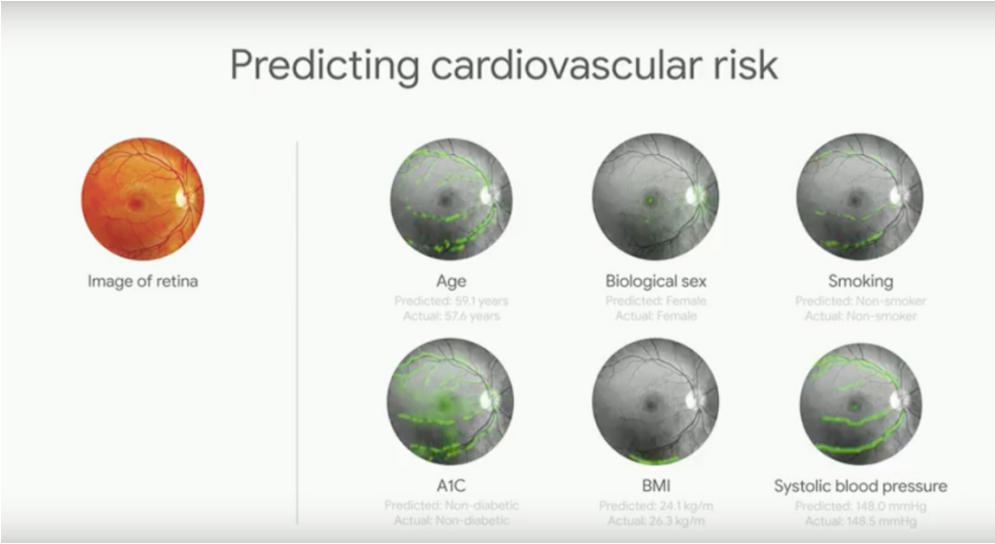
When the year 1991 began, no one knew that the internet, then known as the World Wide Web, was about to disrupt modern culture. In 2019, artificial intelligence (AI) is doing the same. It has the potential to be just as life-changing.

Artificial intelligence (AI) is having a major impact on the health care industry. In fact, AI in health care is redefining the medical care field and all its functions.

It is playing a big role in health care data. When health care data uses AI, it provides new and improved analytics. AI analytics are of use in the detection, diagnosis and treatment of many diseases. AI in health care is helping to provide more targeted care for patients fighting medical diseases or issues.

Google's new algorithm predicts heart diseases looking at your eyes:

Scientists from Google and its health-tech subsidiary Verily have discovered a new way to assess a person's risk of heart disease using machine learning. By analyzing scans of the back of a patient's eye, the company's software is able to accurately deduce data, including an individual's age, blood pressure, and whether or not they smoke. This can then be used to predict their risk of suffering a major cardiac event such as a heart attack with roughly the same accuracy as current leading methods.



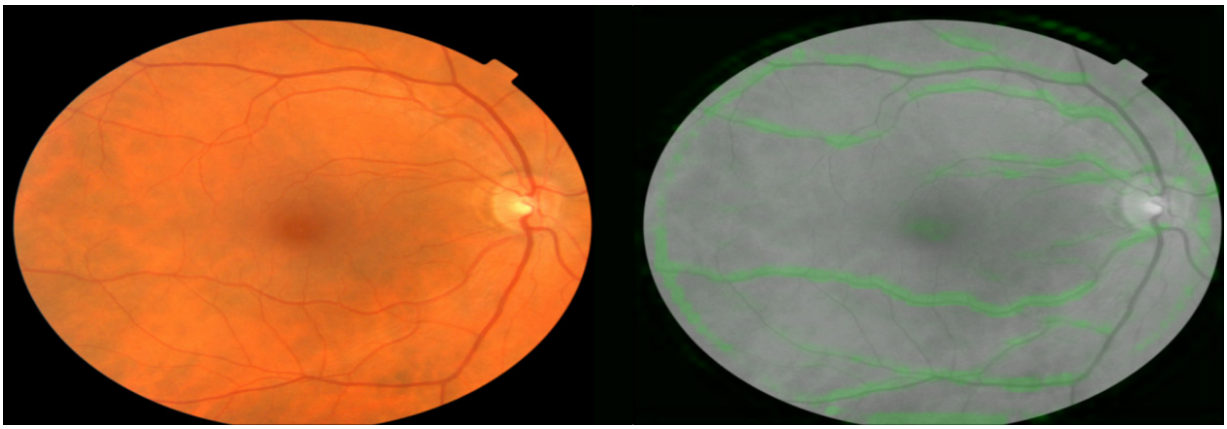
The algorithm potentially makes it quicker and easier for doctors to analyze a patient's cardiovascular risk, as it doesn't require a blood test. But, the method will need to be tested more thoroughly before it can be used in a clinical setting.

Luke Oakden-Rayner, a medical researcher at the University of Adelaide who specializes in machine learning analysis, told that the work was solid, and shows how AI can help improve existing diagnostic tools. "They're taking data that's been captured for one clinical reason and getting more out of it than we currently do," said Oakden-Rayner. "Rather than replacing doctors, it's trying to extend what we can actually do."

How does it work?

To train the algorithm, Google and Verily's scientists used machine learning to analyze a medical dataset of nearly 300,000 patients. This information included eye scans as well as general medical data. As with all deep learning analysis, neural networks were then used to mine information for patterns, learning to associate telltale signs in the eye scans with the metrics needed to predict cardiovascular risk (e.g., age and blood pressure).

Although the idea of looking at your eyes to judge the health of your heart sounds unusual, it draws from a body of established research. It is a fact that the rear interior wall of the eye (the fundus) is chock-full of blood vessels that reflect the body's overall health. By studying their appearance with camera and microscope, doctors can infer things like an individual's blood pressure, age, and whether or not they smoke, which are all important predictors of cardiovascular health.



Two images of the fundus, or interior rear of your eye. The one on the left is a regular image; the on the right shows how Google's algorithm picks out blood vessels (in green) to predict blood pressure. *Photo by Google / Verily Life Sciences*

Understanding the mechanism better:

To better understand this AI "black box", a deep-learning technique called **soft attention** was used to identify the anatomical regions that are most important for the model to generate these predictions.

Attention maps (saliency or heat maps) were generated, representing what the model was "looking at" in each fundus photo in order to predict gender and other issues. These maps were then given to 3 ophthalmologists to identify the highlighted features in these maps. Ophthalmologists were blinded to the output predictions.

For Google, the work represents more than just a new method of judging cardiovascular risk. It points the way toward a new AI-powered paradigm for scientific discovery. While most medical algorithms are built to replicate existing diagnostic tools (like identifying skin cancer, for example), this algorithm found new ways to analyze existing medical data.

With enough data, it's hoped that artificial intelligence can then create entirely new medical insight without human direction. It's presumably part of the reason Google has created initiatives like its Project Baseline study, which is collecting exhaustive medical records of 10,000 individuals over the course of four years.

For now, the idea of an AI doctor churning out new diagnoses without human oversight is a distant prospect — most likely decades, rather than years, in the future. But Google's research suggests the idea isn't completely far-fetched.

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AI in Health Care

Computers and information technology has played a pivotal role in the advancement of healthcare. Artificial Intelligence (AI) in medicine has significantly evolved over the last few decades, now making it possible to initiate its involvement in real world clinical practice. AI can also be incorporated in a personalized, integrated, adaptive and context aware environment creating the so called Ambient Intelligence (AmI). Neurology is a discipline of medicine that deals with the disorders of nervous system. Large amount of literature exist in regards to utilization of AI and AmI in several aspects of neurology. Using AmI, individual's neurological function can be monitored around the clock for early recognition of neurological disorders. Electroencephalography and electromyography data can be interpreted by AI with high accuracy. Treatment responses can be monitored objectively by AmI in many conditions like movement disorders and epilepsy. Large quantity of data produced in the neurocritical care units can be processed by AI for better monitoring, treatment and outcome prediction. AI can reduce the cost of care and may potentially benefit remote parts of the world by playing role of an expert adviser. In this brief article, author has discussed the application and potential of AI and AmI in neurology. Some obstacles in their development are briefly discussed and several speculations about their future are made.Computers and information technology has played a pivotal role in the advancement of healthcare. Artificial Intelligence (AI) in medicine has significantly evolved over the last few decades, now making it possible to initiate its involvement in real world clinical practice. AI can also be incorporated in a personalized, integrated, adaptive and context aware environment creating the so called Ambient Intelligence (AmI). Neurology is a discipline of medicine that deals with the disorders of nervous system. Large amount of literature exist in regards to utilization of AI and AmI in several aspects of neurology. Using AmI, individual's neurological function can be monitored around the clock for early recognition of neurological disorders. Electroencephalography and electromyography data can be interpreted by AI with high accuracy. Treatment responses can be monitored objectively by AmI in many conditions like movement disorders and epilepsy. Large quantity of data produced in the neurocritical care units can be processed by AI for better monitoring, treatment and outcome prediction. AI can reduce the cost of care and may potentially benefit remote parts of the world by playing role of an expert adviser. In this brief article, author has discussed the application and potential of AI and AmI in neurology. Some obstacles in their development are briefly discussed and several speculations about their future are made.Applications in Neurology

Stroke is one of the most common neurological disorders and AmI can potentially have heavy impact on its epidemiological and clinical course. Stroke occurs when there is either an interruption of blood supply to part of brain (known as ischemic stroke) or the rupture of a blood vessel in the brain causing hemorrhage (known as hemorrhagic stroke). Treatments for ischemic as well as hemorrhagic strokes are time sensitive and are most effective when administered within first few hours of onset [20-22]. However, the patients commonly don't recognize the symptoms or they may be rendered disabled to activate emergency medical services. Therefore, these treatments are largely underutilized [23,24] due to delayed hospital

presentation [25,26] or unclear time of symptom onset (as in patients waking up with strokes) [27]. Using AmI, individual's neurological function can be monitored around the clock [28-30] and presence of any alarming neurological signs can activate emergency medical services, even without patient's knowledge [19]. AmI in conjunction with tele-stroke networks [31], automated imaging interpretation [32-34] and prehospital thrombolysis [35] can exclude significant sources of delay in the management of acute stroke. Prognosis of stroke can also be predicted, even prior to treatment using the AI [36,37]. AmI can detect cardiac arrhythmias (especially atrial fibrillation) in cryptogenic strokes and can even potentially prevent the first cerebrovascular event by monitoring every individual in the population [38-40]. Stroke recovery can be improved as well using AmI in the neurorehabilitation [18,41,42].

Seizures are defined as transient, synchronous activation of a large number of neurons that results in focal or generalized dysfunction in brain activity and consciousness. Such disturbance in the electrical activity of the brain can sometimes be recorded using a number of recording electrodes on the scalp in form of an electroencephalogram (EEG). Due to transient duration of the event, the abnormality may not be recorded on the EEG and therefore, continuous EEG monitoring with automatic seizure detection could dramatically change the management of these patients. AI algorithm based seizure detection techniques for scalp EEG [43-48] and intracranial EEG [49-53] have evolved significantly and even surpassed human ability in certain aspects [44]. Responsive cortical stimulation involves implantation of seizure detection device that not only detects seizures, but can also suppress the seizure from spreading [54]. Ambulatory/ home EEG and accelerometers as parts of AmI can yield critical information on seizure frequency and semiology in certain patients [55-58]. Algorithms have been developed that can predict risk of recurrent seizures in the future based on several patient risk factors [59]. AmI can ensure better compliance in taking seizure medications [19], as forgetting a single dose may result in a breakthrough seizure. Self-driving cars will be able to provide more mobility and independence to the millions of patients across the world living with seizures or other neurological disabilities [60,61]. Similar to the EEG recordings, electrical potential recordings of the muscle and nerves (electromyography) can also be interpreted by AI [62,63] and then integrated with clinical [64] and imaging [65] data to help with the diagnosis of a number of neuromuscular disorders.

Neurodegenerative disorders (e.g. Alzheimer's disease, Parkinson's disease, Lou Gehrig's disease etc.) result in a very gradual decline in individual's cognitive and/or functional status, and such conditions may be diagnosed earlier with help of AmI that monitors individual's neurological function over a prolonged period of time. AmI can assist with activities of daily living in the cognitively impaired [66,67]. A brain computer interface device has been successfully implanted in a patient of Lou Gehrig's disease, enabling her to communicate better [68]. AI has been extensively studied in the field of movement disorders, especially in Parkinson's disease that often leads to disabling tremors and muscle rigidity. It can differentiate different types and subtypes of movement disorders [69-73] and can even interpret the neuroimaging [74].

Quantification of movement abnormalities can be utilized in the medical and surgical management [75]. Electrical stimulation of certain deep structures in the brain (also known as deep brain stimulation) significantly improves the symptoms of Parkinson's disease. Various stimulation parameters require frequent adjustments to obtain optimal clinical response and certain closed loop systems have been developed that can optimize these parameters automatically for individual patient by feedback information received from the body motion sensors [76,77].

Several catastrophic neurological emergencies like neurotrauma, large strokes, status epilepticus and brain infections require more frequent monitoring of neurological and other bodily functions, which is usually done by nurses and physicians. Neurocritical care units are equipped with a number of patient monitoring systems that generate large quantity of data pertaining to ventilation, hemodynamics, intracranial pressure, body temperature, fluid intake-output, serial neurological examinations and neurophysiologic parameters (e.g. electromyography, continuous EEG). Many of these parameters may require expert supervision around the clock that can potentially be provided by a single intelligent computer system to a large number of patients simultaneously. Closed-loop AI systems can potentially perform real time adjustment of ventilator settings [78-81], antiepileptic drugs, anesthetics/analgesics [82-84], neuromuscular blockade [85,86], glucose management [87], and blood pressure, fluids and electrolytes management [88,89] etc. with little or no human input [90,91]. Intelligent algorithms have been developed that can predict mortality in hemorrhagic stroke [92] and outcome after traumatic brain injury [93,94]. Prediction of intracranial pressure has also been achieved by AI [95,96]. More complex predictive algorithms in the future may take thousands of variables into account in order to predict complications and outcome with fair degree of certainty, well ahead of time. Wealth of data produced in the neurocritical care units makes them an ideal environment to incorporate AI techniques that can efficiently handle such data.

Future Direction and Limitations

AI systems have been developed which can learn from the electronic medical records and develop their own optimal treatment plan [97]. Such selection of optimum path can be individualized for each patient and can dynamically change over time to adapt the changes in clinical scenario. Nowadays large scale projects are under progress to develop cloud based intelligent computer systems to integrate and analyze enormous amount of patient data and medical literature [98]. These platforms may thrive on the exponentially increasing healthcare data and learn from it. The expected final product might be a capable expert computer system that is always up to date with medical knowledge, contain medical records of every individual, may guide physicians and surgeons around the world and may even learn from its own experience to become better over time. Initial goal would be to incorporate these systems effectively in physician's workflow and then eventually to replace the physician in performing many tasks. Complex medical conditions might be managed with the guidance of these systems at a very little or no cost, even in the remote parts of the world.

Very small number of professionals with both clinical and programming proficiency, lack of international biomedical information sharing network platforms and lack of credible international standards for communication and data exchange has been few of the major obstacles resulting in slow development and underutilization of AI [8]. Furthermore, new ethical, legal and privacy issues may arise [99,100] and dramatic shifts in the role and demand of medical personnel as well as in their reimbursement may occur. Major changes in the education curriculum of medical professionals may have to take place. Thus, the path towards utilizing AI in real world medicine may not always be straightforward. But the rising cost of healthcare [101-104] may prove to be an independent driving force to develop these technologies. We know that the health information technology not only improves the quality of care, but also reduces its cost significantly [105,106]. Many of these observations led to formation of funding programs (e.g. HITECH) by the US federal government to stimulate investment in the electronic health records [107]. Similarly, AI may also potentially reduce the cost of care markedly [97] and in future, this may translate into creation of promotional policies to accelerate investment in AI by rewarding the hospitals and the physicians who incorporates it into their workflow. Initial monetary investments can eventually be paid off by the numerous advantages of AI. Despite of certain limitations, the advantages of these systems are numerous. With the aid of advanced AI and AmI, acute neurological emergencies may be timely managed, chronic neurological diseases may be recognized early, treatments may be individualized and the quality of life with neurological disability may be improved.

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AI Is Transforming Healthcare Industry

The power of Artificial Intelligence is echoing across many industries. But its impact on healthcare is truly life-changing. With its ability to mimic human cognitive functions, AI is bringing a paradigm shift in the healthcare industry.
This transformative technology is revolutionizing the health sectors in many ways. From drug development to clinical research, AI has helped improve patient outcomes at reduced costs. Besides, the introduction of this technology in healthcare promises easy access, affordability, and effectiveness.

For the same reasons, there has been a huge investment by public and private sectors in the healthcare industry. According to a study, the investment will reach $6.6 billion by 2021. Accenture's reports are even more astonishing. According to their analysis, AI applications can create annual savings of $150 billion by 2026 for US healthcare.

Big Data & AI in Healthcare
Recent advancements in AI have fueled discussion of whether AI doctors will replace human doctors in the future. While the idea of replacing human doctors may sound absurd, but AI can help human physicians to make better decisions. In certain areas of healthcare like radiology, it can replace human judgment entirely.
Big Data has made successful applications of Artificial Intelligence in healthcare. There has been a rapid development in big data analytic methods, and so much healthcare data is available. Using this data, a lot of clinically relevant information hidden in a large amount of data can be unlocked by powerful AI techniques. This will help in making better clinical decisions.

Motivation
The ability of AI to use sophisticated algorithms and learn features from a massive amount of data is truly commendable. With the help of these algorithms, insights for assisting clinical practice can be obtained. AI can be equipped with self-correcting and learning abilities which help the system get better accuracy based on the feedback it receives.
Therefore, it gets better with time. These AI systems can help physicians in many ways. Since they are armed with a lot of information, they can assist in clinical decision making. Also, diagnostic errors and therapeutic errors can be minimized.
Besides, AI systems have access to large volumes of data; they can make predictions about potential health risks by extracting useful information.

But do we really need it?
AI is big and powerful. We cannot question its effectiveness. It is going to have a huge impact on the healthcare industry. Facts listed below tell us why:

Hospital error is one of the leading causes of patients' death. Such errors can be addressed and prevented by Artificial Intelligence.Nearly 440,000 Americans die each year due to medical

errors which can be easily prevented by AI.In the healthcare industry, nearly 86% of the mistakes are preventable.In the next 5 years, AI health market will grow by more than 10 percent.Applications Of Artificial Intelligence.

Artificial is changing the healthcare industry for better. From early detection to improved diagnosis, AI is positively contributing to the betterment of humanity. In some areas, it is already being used, and there are areas where we can see the introduction of AI in the coming time. In specialty care including pharma, radiology, and pathology, AI is delivering high value.

Chronic health conditions are expected to benefit the most from AI systems. Cancer, diabetes, heart diseases are big opportunities for healthcare trends such as pop culture and precision medicines.

Here are a few ways in which AI is (or will) changing the healthcare industry:

Personal Health Virtual Assistant

In the present era, most people have access to a smartphone. They are likely to have their virtual assistant on their mobile devices. Advanced AI algorithms power assistants like Cortana, Google Assistant, Siri. When combined with healthcare apps, they will provide massive value to the users.

Healthcare apps will act as a personal health assistant. They will also be used to provide medication alerts, and human-like interactions will also be possible. AI as a personal assistant will also help in assisting the patients when the clinical personnel is not available.

AI Improves The Quality Of Sleep

It has been proved that night of good night sleep is very important for better physical and mental health. People who get sound sleep at night are happier, healthier, and more productive during the day.

There are a lot of effective sleep gadgets in the market that help you sleep better at nights. From AI-powered smart mattresses to baby monitors, sleep apps, AI technology is continually working to improve the overall quality of sleep.

A healthcare company named AXA PPP created two lullabies; one by AI and other by humans. With deep learning, the AI system could get a feel for rhythm and harmony resulting in a new composition. This composition was then converted into a song with the help of a human, and it can help you sleep better.

Medical Imaging Analysis

Another important field in healthcare which is using AI is radiology. AI systems can help with diagnostic processes. It can examine medical images like X-rays, CT scans, MRIs, etc. and can provide feedback on what it thinks a human eye can miss.

Thus, medical imaging analysis becomes much more accurate and effective. It reduces the chances of errors.

IBM Watson is a live example. In the field of oncology, it can provide clinicians with evidence-based treatment options for the cancer patients based on the training provided by Memorial Sloan Kettering (MSK) physicians.

Precision Medicine

Genomic is the branch of molecular biology which deals with the structure, evolution, function, and mapping of genomes. It looks for the links to disease from the information obtained from the DNA.

When combined with AI, it is possible to spot cancer and some vascular diseases at a very early stage. Moreover, it can predict the health issues the patients might face based on their genes.

Healthcare Bots

AI technology is also gaining traction in the customer service domain. The world is likely to see healthcare bots very soon. Patients will be able to interact with these AI bots on the website through a chat window or via telephone.

Healthcare bots will be used to schedule appointments with the patient's healthcare provider. These bots can help patients with their medication as well. They can also improve customer service by offering 24 x 7 support.

These are some of the great things that AI can do. But it is not limited to that. As innovation pushes the boundaries of healthcare, better solutions to save time, money, and efficiency will be possible.

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Artificial Intelligence in Cardiology

The continuous development of the technological sector has enabled the industry to merge with medicine in order to create new integrated, reliable, and efficient methods of providing quality health care. One of the ongoing trends in *cardiology at present is the proposed utilization of artificial intelligence* (AI) in augmenting and extending the effectiveness of the cardiologist.

Cardiology is a vast field that focuses on a large number of diseases specifically dealing with the heart, the circulatory system, and its functions. As such, similar symptomatologies and diagnostic features may be present in an individual, making it difficult for a doctor to easily isolate the actual heart-related problem. Consequently, the use of artificial intelligence aims to relieve doctors from this hurdle and extend better quality to patients.

In the field of clinical cardiology, so far one study has shown that deep learning algorithms clearly outperformed clinicians in predicting prognosis and future events in patients with pulmonary hypertension .

In another study, machine learning has helped to develop a clear phenotypic classification of heart failure patients with preserved ejection fraction .Further cardiovascular research based on artificial intelligence tools is underway. Because of its potential to change the way of how we generate knowledge, interpret data and make decisions, artificial intelligence may trigger uncertainties and reservations among healthcare providers and clinicians.

The use of artificial intelligence in cardiology aims to focus on research and development, clinical practice, and population health.

In cardiac healthcare, AI technologies incorporate complex algorithms in determining relevant steps needed for a successful diagnosis and treatment. The role of artificial intelligence specifically extends to the identification of novel drug therapies, disease stratification or statistics, continuous remote monitoring and diagnostics, integration of multi-omic data, and extension of physician effectivity and efficiency.

TARUNI RENUKA
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A REPORT ON ARTIFICIAL INTELLIGENC IN MEDICAL SECTOR

Since ages, medicine has been the biggest boon the mankind has ever gifted with. The world has grown in its standards from a very low level to respectable standards in many aspects. The medical sector is one of the rapidly developing sectors. Our marvelous humankind has overcome the various problems with brilliant solutions in the medical sector in terms of technology utilization as well as in finding new medicines.however many people believe we can have enormous growth in the field of medicine rather than we are at now. Most of them strongly believe that the association of artificial intelligence with the Medical sector can do wonders in this field.

Machine-learning techniques, which are always a part of artificial intelligence can use simple learning and iterative techniques to find previously used techniques in available data and can act according to it for a similar problem. The resulting algorithms can make predictions, can suggest medicines can assume the disease according to the symptoms and also predicts how long can it take to recover but typically, these techniques cannot explain why or how they reach the conclusion they do. Either they cannot explain it at all, or they can give explanations that are accurate but meaningless in terms of medical understanding. Because of this ambiguity, they call it “Black box medicine”.

Artificial Intelligence utilization in medical care. But the accepted truth is sooner or later Artificial Intelligence has a vital role to play in the field of Medicine.

Using Artificial Intelligence to Rapidly Identify Brain Tumors

The use of artificial intelligence and, in particular, machine learning is becoming increasingly popular in research. These systems excel at high-speed data analysis, interpretation, and laborious research tasks, such as image assessment.

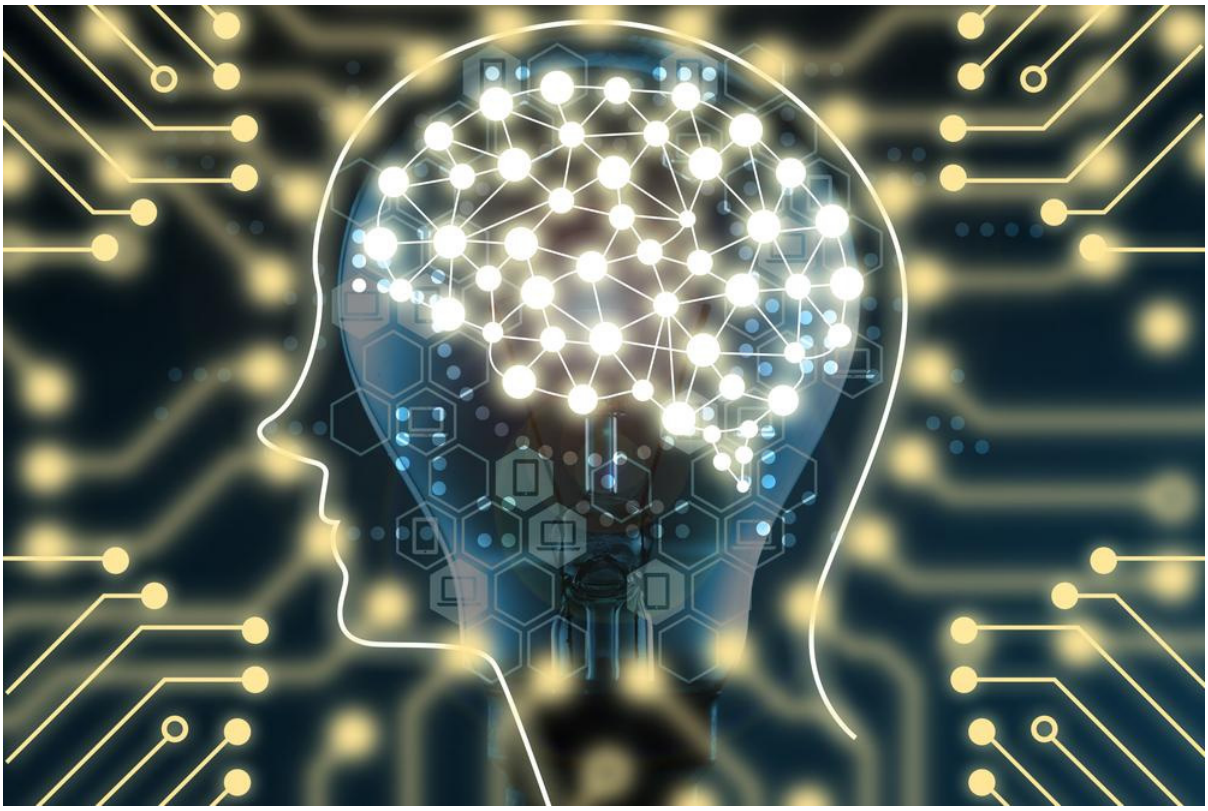
One of the areas in which machine learning has been enjoying success is image recognition. Now, researchers have begun to use machine learning to analyze brain tumors.

Training a machine to recognize tumors

Primary brain tumors include a broad range that depends on cell type, aggressiveness, and development stage. Being able to rapidly identify and characterize the tumor is vital for creating a treatment plan. Normally, this is a job for radiologists who work with the surgical team; however, in the near future, machine learning will play an increasing role.

George Biros, professor of mechanical engineering and leader of the ICES Parallel Algorithms for Data Analysis and Simulation Group at The University of Texas at Austin, has spent almost

a decade developing accurate computer algorithms that can characterize gliomas. Gliomas are the most common and aggressive type of primary brain tumor.



The goal of the contest is to be able to take an image of the brain and have the computer analyze it and automatically identify different kinds of abnormal tissue, including edema, necrotic tissue, and areas with aggressive tumors. This is a little like if you took pictures of your family and used facial recognition to identify each person, only here the images are brain scans, and it is tissue recognition that must be done automatically by the computer.

The image processing, analysis and prediction pipeline they used has two main stages: a machine learning stage assisted by humans, in which the computer creates a probability map for the target classes it needs to identify, such as whole tumor and edema, and a second stage in which these probabilities are combined with a biophysical model which represents how tumors grow; this serves to impose limits on analyses and aids correlation.

Tech meets health: Soon, AI may offer treatment for brain tumour

LONDON: Researchers have developed an artificial intelligence-based (AI) method for analysis of brain tumours, paving the way for individualised treatment of tumours.

According to the study, published in the The Lancet Oncology, AI machine learning methods, carefully trained on standard magnetic resonance imaging (MRI), are more reliable and precise than established radiological methods in the treatment of gliomas.

Glioma, a type of tumour that occurs in the brain and spinal cord, is common and most malignant of brain tumours in adults.

For the study, the team included 500 brain tumour patients. Using a reference database with MRI scans of patients, the algorithms automatically recognised and localised brain tumours using artificial neural networks.

The algorithms were also enabled to volumetrically measure the individual areas (contrast medium-absorbing tumour portion, peritumoral edema).

“We want to advance the technology for automated high-throughput analysis of medical image data and transfer it not only to brain tumours but also to other diseases like brain metastases or multiple sclerosis,” said Klaus Maier Hein at the varsity.

Glioma tumours often cannot be completely removed by surgery. Chemotherapy or radiotherapy are only effective to a limited extent because tumours are highly resistant. Therefore, new and precisely validated treatment approaches are urgently needed, the team noted.

Conclusion

This is yet another example of how machine learning is being employed in research and medicine, and the methods the team has developed here have the potential to go beyond brain tumor analysis. The system could be used for other medical applications of a similar nature though transfer learning, so the possibilities are fairly endless.

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ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Artificial intelligence (**AI) in healthcare** is the use of complex algorithms and software to estimate human cognition in the analysis of complicated medical data. Specifically, **AI** is the ability for computer algorithms to approximate conclusions without direct human input.

Robotics in surgical procedures:

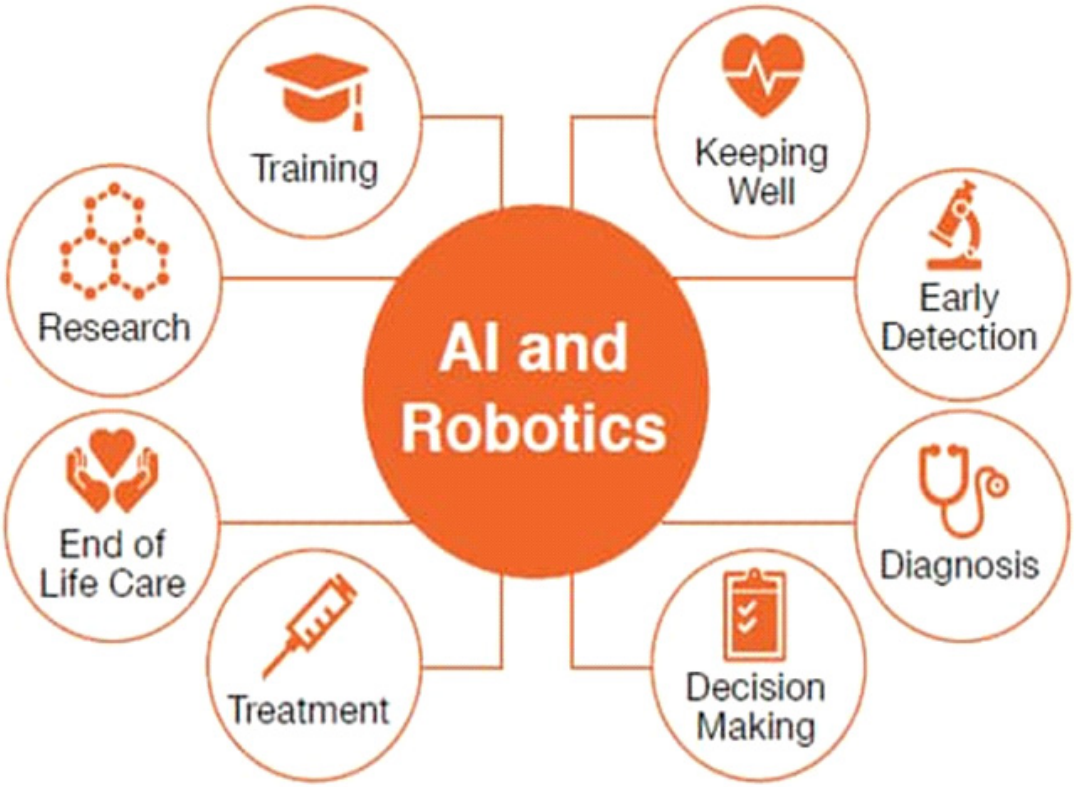
As robotic-guidance becomes more common in spine surgery, there has been a growing body of literature on the technology's accuracy, reduction of radiation and surgical efficiency. A study of 379 patients showed that the robots AI-assisted robotic technology reduced surgical complications five-fold compared to freehand surgeons. 13 Researchers from the University of Oxford completed the first successful trial of robot-assisted retinal surgery. Twelve patients that required dissection of the retina were randomly assigned to either undergo robot-assisted or manual surgery under general .Although the AI assisted surgery took longer, surgical outcomes were equally successful in the robotic and manual surgery groups.

Virtual observations to reduce patient falls and operational costs:

Between 700,000 and 1,000,000 people in the United States suffer from preventable falls in the hospital every year. These falls contribute to a range of complications and increased healthcare utilization. 17 In 2016, Atrium Health implemented a 3D-motion tracking camera system, based on AI that monitors fall risk patients at Carolinas Rehabilitation hospitals. The system enables the hospital to observe 12 patients at a time with one staff member at the centralized monitoring station, reducing costs of sitters, restraints and net beds. The motion detector alerts the monitoring technician of patient movement, prompting a recording asking the patient to return to bed; two-way audio communication with nurses; and bedside assistance with the care team. Since implementation of the system, there have been zero falls for the patients observed, while the overall unassisted fall rate fell 51 percent.

Artificial Intelligence in Medicine

AI applications have become common in medical field IBM Watson-Oncology has picked up drugs for treatment of cancer patients with equal or better efficiency than human experts. Microsoft's Hanover Project has analyzed medical research to tailor personalized cancer treatment option .United Kingdom's National Health Service (NHS) used Google's platform for detecting health risks by analyzing mobile app data and medical images collected from NHS patients .Stanford's radiology algorithm picked up pneumonia better than human radiologists, while in diabetic retinopathy challenge, the computer was as good as expert ophthalmologists in making a referral decision.



3 COMMON APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

Many industries have been disrupted by the influx of new technologies in the Information Age. Healthcare is not different. Particularly in the case of automation, machine learning, and artificial intelligence (AI), doctors, hospitals, insurance companies, and industries with ties to healthcare have all been impacted – in many cases in more positive, substantial ways than other industries.

1. Managing Medical Records and Other Data

Since the first step in health care is compiling and analyzing information (like medical records and other past history), data management is the most widely used application of artificial intelligence and digital automation. Robots collect, store, re-format, and trace data to provide faster, more consistent access.

2. Doing Repetitive Jobs

Analyzing tests, X-Rays, CT scans, data entry, and other mundane tasks can all be done faster and more accurately by robots. Cardiology and radiology are two disciplines where the amount of data to analyze can be overwhelming and time consuming. Cardiologists and radiologists in the future should only look at the most complicated cases where human supervision is useful.

3. Treatment Design

Artificial intelligence systems have been created to analyze data – notes and reports from a patient's file, external research, and clinical expertise – to help select the correct, individually customized treatment path.

Conclusion

AI holds tremendous promise for transforming the provision of healthcare services in resource-poor settings. Many of the health systems hurdles in such environments could be addressed and overcome using AI supported by other technological developments and emerging fields. The ubiquitous use of smart phones, combined with growing investments in supporting technologies EMR and cloud provide ample opportunities to use AI applications to improve public health outcomes in low-income country settings. While we have provided several examples of how AI is already being applied with the aim to improve health outcomes in low-income countries, there are certainly many other AI applications already being implemented and surely there will be more in coming years.

R.Sai Krishna Phani
17X41A0542

Cancer Cell Detection Using AI

The early stage cancer detection is required to provide proper treatment to the patient and reduce the risk of death due to cancer as detection of these cancer cells at later stages lead to more suffering and increases chances of death. Cancer cells have huge variations in shape and size.Their nucleus is darker and larger than a normal cell. Some blood tests used to test the presence of cancer cell are: Blood Protein Test, Complete Blood Count (CBC), and Tumor Marker Test. Detecting a cancer cell in a microscopic image requires segmenting the image into multiple regions. Then filtering out those regions that are representative of cancer cells. But cancer cells have the pro-survival characteristic that makes them difficult to differentiate. Also, due to loss of contact inhibition, they grow in uncontrolled manner while normal cells stop when they increase beyond the body requirement limit. So, at early stage detection of these cancer cells because of too less size is difficult. Researcher's efforts have made it possible to detect cancer cells not only by going through radioactive or magnetic test rather it can be detected by simple blood test. However, detecting a tumor cell among all normal cells is like looking for 1 molecule in 1000. The new blood-based technique Strand LB is a liquid biopsy test that is conducted by taking blood sample hence it lowers the patient's diagnosis discomfort. After taking blood samples tumor can be detected by sensitive digital technology

The advantage of this technique is that it is a common test for detecting all kind of cancers.

Other researchers worked on image analysis of the cancer cell to accelerate diagnosis. Before analyzing the CT or MRI images for cancer cell detection some pre-processing is done and morphological operations are performed. Some has detected and segmented the cell using Sparse Reconstruction and Stacked Denoising Autoencoders. In that variation in shape is handled by sparse reconstruction and autoencoder was trained with discriminative losses and structured labels for segmentation.Some researchers have used automatic counting of cell in microscopic images using CNN.Others used different resolution images to identify cancer cells. Some has segmented the cell using marker-based watershed

Methodology:

The architecture of cancer cell Detection and segmentation is shown in Fig1.

Step 1: Data collection and dataset preparation

In this step, several microscopic images containing cancer cell will be collected and annotated.with expert help

Step 2: Developing a CNN based cancer detection

Popular pre trained Inception and Resnet models will be explored on cancer cell images.

Step 3: Implementation and Experiment

Dataset:

UCSB Bio-Segmentation

Bio GPS dataset

NCBI dataset

NCI data catalog

NTU dataset

ALL-IDB image datasets

TCGA dataset

AMIDAI13 dataset

Evaluation measures:

Measures such as accuracy and Mean Average Precision (MAP), the recall will be computed by comparing the detected cancer cell and ground truth from datasets.

Software and Hardware Requirements

Software:

KerasAnac

Python

Tensor flow

OpenCV

Hardware:

NVIDIA GPU onda

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17X41A0560

Article on Artificial intelligence for monitoring health & stroke detection

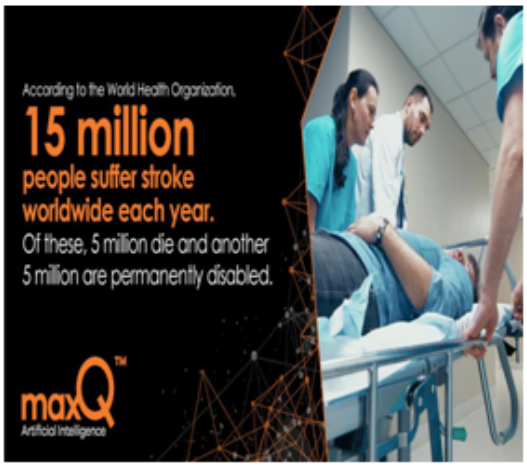
B. G.G.Nancy, A.Chaitanya , N.Ramya

Abstract

This is the document of the project proposal for developing stroke detection, monitoring and assisting system or a device. Discussion about one of the benefits of Artificial Intelligence in the level of performance in the interest of patients on transforming health care Management. Stroke is one of the third leading causes of death. These deaths are not because they don't have proper medication but because they don't have a proper analysis about the disease. So, it's important to recognize the symptoms and act quickly. This study gives a brief description of how a device detects stroke symptoms and acts as a nursing assistant.

Introduction

Worldwide Statistics :



- According to the World Health Organization, 15 million people suffer stroke worldwide each year.
- Of these, 5 million die and another 5 million are permanently disabled.
- High blood pressure contributes to more than 12.7 million strokes worldwide.
- And based on U.S Statistics, someone has a heart attack **every 40 seconds**. Each minute, more than one person in the United States dies from a heart disease-related event.

One of the solution for this is .....

Virtual Nursing Assistant and stroke detector

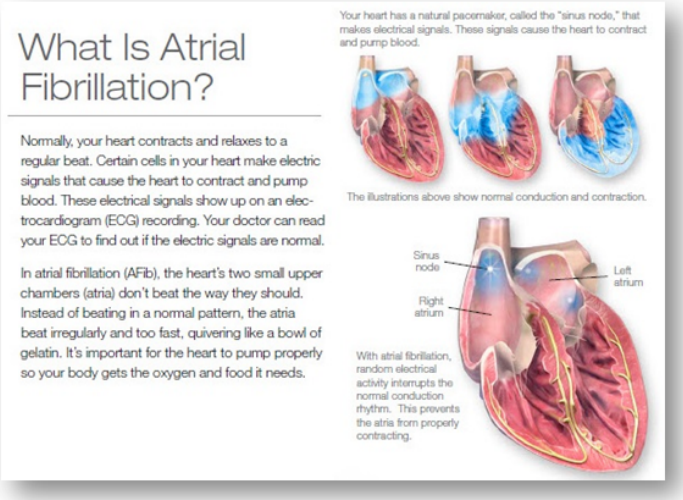
- This AI wrist watch is a cluster of applications which helps to detect and keeps track of the health condition of a person by recording his/her pulse rate.
- It also analyzes whether there is a continuous healthy growth or any fluctuations in his/her body.
- It updates the everyday health condition and the results are presented to the user in the connected smart phone.
- If the patient is under the observation of the doctor, this device sends the results to the connected healthcare provider securely on the Web in just seconds.

It also keeps track of :

1. Heart rate
2. Calories
3. Blood pressure
4. Sleep monitoring
5. Nurses medication
6. **Stroke detector** etc.,

According to Dr Eric Topol, a cardiologist and director of the Scripps Translational Science Institute, the cool-down period (after the exercise) provides critical information about our heart's fitness level stating,

- "Recovery is an important metric," further adding, "It's shown in many studies that if the heart rate recovery is slow, that suggests the heart condition is not ideal, and you need better conditioning. Providing that information is a new step forward for this device.

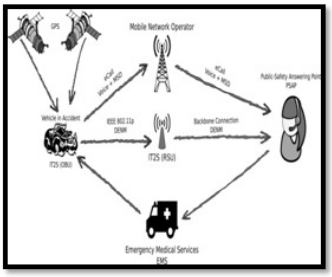


* How AI involves in monitoring and detecting heart stroke?

If a person is attacked with a heart stroke while travelling or staying alone in a less crowded area ,this device helps to detect the sudden stroke and inform to the very nearby hospitals, polis stations, family and friends.

This **Heart Monitor device** and patient-engaged medical system detects irregular heart beat using **Smart, cloud-based algorithms** analyze in real-time.

1.Then it activates and detect for **Atrial Fibrillation** (based on P-wave detection and RR variability),Immediately the **electrocardiogram** captures 2-lead ECG and heart sounds in just a minute.



2.Then sends the results to the healthcare providers or the cardiologist to detect murmurs and take necessary actions.

Result:

•No more off-line sticky ECG electrodes, itchy patches or wires. This device has no limits in time or place and provides instant results and reports.

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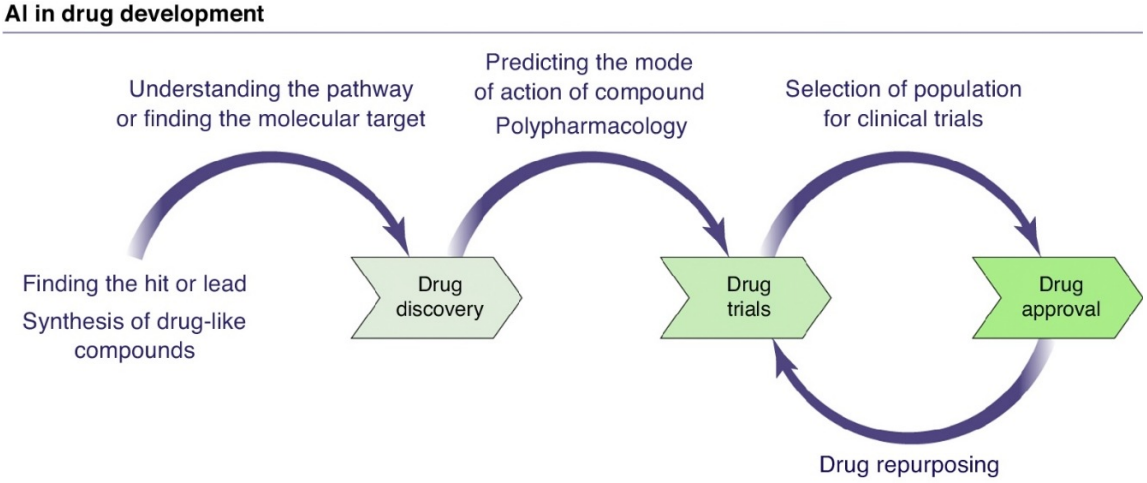
AI IN DRUG DEVELOPMENT

When many of us hear the term “artificial intelligence” (AI), we imagine robots doing our jobs. AI in health care mainly refers to doctors and hospitals accessing vast data sets of potentially life-saving information.

Highlights:

Advances in artificial intelligence (AI) are modernising several aspects of our lives.The pharma industry is facing challenges to overcome the high attrition rates in drug development.The pharma industry is collaborating with AI industries to overcome challenges.AI will improve the efficiency ofthe drug development process.Artificial intelligence (AI) uses personified knowledge and learns from the solutions it produces to address not only specific but also complex problems. Remarkable improvements in computational power coupled with advancements in AI technology couldbe utilized to revolutionise the drug development process. At present, the pharmaceutical industry is facing challenges in sustaining their drug development programmes because of increased R&D costs and reduced efficiency. In this review, we discuss the major causes of attrition rates in new drug approvals, the possible ways that AI can improve the efficiency of the drug development process and collaboration of pharmaceutical industry giants with AI-powered drug discovery firm



Methodology:

Step 1: Data collection and dataset preparation This will involve collection of data with chemical structures and activity data after this preprocessing is applied to extract features.

Step 2: Developing a Deep Q-learning technique for Drug Discovery. A reinforcement learning technology, called Deep Q-learning, together with an RNN is to be developed for drug discovery.

Step 3: Training and experimentation on datasets The Deep Q-learning model is then trained on the training data set to do drug discovery accurately.

Step 4: Deployment and analysis on real life design.

Software And Hardware Design:

Python based Computer Vision and Deep Learning libraries will be exploited for the development and experimentation of the project. Tools such as Anaconda Python, and libraries such as, Tensorflow, and Keras will be utilized for this process. Training will be conducted on NVIDIA GPUs for training the Deep Q-learning technique for Drug Discovery.

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17X41A0533

AI in Health Care

Artificial intelligence (**AI**) **in healthcare** is the use of complex algorithms and software to estimate human cognition in the analysis of complicated medical data. Specifically, AI is the ability for computer algorithms to approximate conclusions without direct human input.

What distinguishes AI technology from traditional technologies in health care is the ability to gain information, process it and give a well-defined output to the end-user. AI does this through machine learningalgorithms. These algorithms can recognize patterns in behavior and create its own logic.

AI algorithms behave differently from humans in two ways: (1) algorithms are literal: if you set a goal, the algorithm can't adjust itself and only understand what is has been told explicitly, (2) and algorithms are black boxes; algorithms can predict extremely precise, but not the cause or the why.[1]

The primary aim of health-related AI applications is to analyze relationships between prevention or treatment techniques and patient outcomes.[2] AI programs have been developed and applied to practices such as diagnosis processes, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. Medical institutions such as The Mayo Clinic, Memorial Sloan Kettering Cancer Center,[3] Massachusetts General Hospital,[4] and National Health Service,[5] have developed AI algorithms for their departments. Large technology companies such as IBM[6] and Google,[5] and startups such as Welltok and Ayasdi,[7]have also developed AI algorithms for healthcare. Additionally, hospitals are looking to AI solutions to support operational initiatives that increase cost saving, improve patient satisfaction, and satisfy their staffing and workforce needs.[8] Companies like Hospital IQ[9] are developing predictive analytics solutions that help healthcare managers improve business operations through increasing utilization, decreasing patient boarding

theory,[16] Bayesian networks,[17] and artificial neural networks,[18][19] have been applied to intelligent computing systems in healthcare.

Medical and technological advancements occurring over this half-century period that have enabled the growth healthcare-related applications of AI include:

- Improvements in computing power resulting in faster data collection and data processing[20]
- Increased volume and availability of health-related data from personal and healthcare-related devices[21]
- Growth of genomic sequencing databases[22]

Widespread implem History[edit]

Research in the 1960s and 1970s produced the first problem-solving program, or expert system, known as Dendral.[11] While it was designed for applications in organic chemistry, it provided the basis for a subsequent system MYCIN,[12] considered one of the most significant early uses of artificial intelligence in medicine.[12][13] MYCIN and other systems such as INTERNIST-1 and CASNET did not achieve routine use by practitioners, however.[14]

- The 1980s and 1990s brought the proliferation of the microcomputer and new levels of network connectivity. During this time, there was a recognition by researchers and developers that AI systems in healthcare must be designed to accommodate the absence of perfect data and build on the expertise of physicians.[15] Approaches involving fuzzy setentation of electronic health record systems[23]
- Improvements in natural language processing and computer vision, enabling machines to replicate human perceptual processes[24][25]
- Enhanced the precision of robot-assisted surgery[26]

Current research[edit]

Various specialties in medicine have shown an increase in research regarding AI.

Radiology[edit]

The specialty that has gained the greatest attention is the field of Radiology.[27] An ability to interpret imaging results may aid clinicians in detecting a minute change in an image that a clinician might accidentally miss. A study at Stanford created an algorithm that could detect pneumonia at that specific site, in those patients involved, with a better average F1 metric (a statistical metric based on accuracy and recall), than the radiologists involved in that trial.[28] The radiology conference Radiological Society of North America has implemented presentations on AI in imaging during its annual meeting. The emergence of AI technology in radiology is perceived as a threat by some specialists, as the technology can achieve improvements in certain statistical metrics in isolated cases, as opposed to specialists.[29][30]

Imaging[edit]

Recent advances have suggested the use of AI to describe and evaluate the outcome of maxillo-facial surgery or the assessment of cleft patients therapy in regard to facial attractiveness or age appearance.[31][32]

Telehealth[edit]

The increase of Telemedicine, has shown the rise of possible AI applications.[33] The ability to monitor patients using AI may allow for the communication of information to physicians if possible disease activity may have occurred.[34] A wearable device may allow for constant monitoring of a patient and also allow for the ability to notice changes that may be less distinguishable by humans.

Electronic Health Records[edit]

Electronic health records are crucial to the digitailization and information spread of the healthcare industry. However logging all of this data comes with its own problems like cognitive overload and burnout for users. EHR developers are now automating much of the process and even starting to use natural language processing (NLP) tools to improve this process. One study conducted by the Centerstone research insititute found that predictive modeling of EHR data has achieved 70–72% accuracy in predicting individualized treatment response at baseline.[*citation needed*] Meaning using an AI tool that scans EHR data it can pretty accurately predict the course of disease in a person.

Industry[edit]

The subsequent motive of large based health companies merging with other health companies, allow for greater health data accessibility.[35] Greater health data may allow for more implementation of AI algorithms.[36]

A large part of industry focus of implementation of AI in the healthcare sector is in the clinical decision support systems.[37] As the amount of data increases, AI decision support systems become more efficient. Numerous companies are exploring the possibilities of the incorporation of big data in the health care industry.[38]

The following are examples of large companies that have contributed to AI algorithms for use in healthcare.

IBM[edit]

IBM's Watson Oncology is in development at Memorial Sloan Kettering Cancer Center and Cleveland Clinic.[39] IBM is also working with CVS Health on AI applications in chronic disease treatment and with Johnson & Johnson on analysis of scientific papers to find new connections for drug development.[40]

Microsoft[edit]

Microsoft's Hanover project, in partnership with Oregon Health & Science University's Knight Cancer Institute, analyzes medical research to predict the most effective cancer drug treatment options for patients.[41] Other projects include medical image analysis of tumor progression and the development of programmable cells.[42]

Google[edit]

Google's DeepMind platform is being used by the UK National Health Service to detect certain health risks through data collected via a mobile app.[43] A second project with the NHS involves analysis of medical images collected from NHS patients to develop computer vision algorithms to detect cancerous tissues.[44]

Intel[edit]

Intel's venture capital arm Intel Capital recently invested in startup Lumiata which uses AI to identify at-risk patients and develop care options.[45]

Startups[edit]

identRx is the first fully automated medication verification and dispensing device, using AI to identify and verify pill in real time, with an accuracy greater than 99%.[*citation needed*] The device has been under development by PerceptiMed Inc. and is now commercially available for pharmacies in the US.

IDx's first solution, IDx-DR founded by Michael Abramoff, is the first and only FDA authorized AI system for the autonomous detection of diabetic retinopathy. As an autonomous, AI-based system, IDx-DR is unique in that it makes an assessment without the need for a clinician to also interpret the image or results, making it usable by health care providers who may not normally be involved in eye care. IDx is a leading AI diagnostics company on a mission to transform the quality, accessibility, and affordability of healthcare world-wide.

Kheiron Medical developed deep learning software to detect breast cancers in mammograms.[46]

Medvice provides real time medical advice to clients, who can access and store their Electronic Health Records (EHRs) over a decentralized blockchain.[47] Medvice uses machine learningaided decision making to help physicians predict medical red flags (i.e. medical emergencies which require clinical assistance) before serving them. Predictive Medical Technologies uses intensive care unit data to identify patients likely to suffer cardiac incidents.[39] Modernizing Medicine uses knowledge gathered from healthcare professionals as well as patient outcome data to recommend treatments.[48] "Compassionate AI Lab" uses grid cell, place cell and path integration with machine learning for the navigation of blind people.[49] Nimblr.ai uses an A.I. Chatbot to connect scheduling EHR systems and automate the confirmation and scheduling of patients.[50]

Infermedica's free mobile application Symptomate is the top-rated symptom checker in Google Play.[51] The company also released the first AI-based voice assistant symptom checker for three major voice platforms: Amazon Alexa,[52] Microsoft Cortana,[53] and Google Assistant.[54]

A team associated with the University of Arizona and backed by BPU Holdings began collaborating on a practical tool to monitor anxiety and delirium in hospital patients, particularly those with Dementia.[55] The AI utilized in the new technology – Senior's Virtual Assistant – goes a step beyond and is programmed to simulate and understand human emotions (artificial emotional intelligence).[56] Doctors working on the project have suggested that in addition to judging emotional states, the application can be used to provide companionship to patients in the form of small talk, soothing music, and even lighting adjustments to control anxiety.

Other

Digital consultant apps like Babylon Health's GP at Hand, Ada Health, and Your.MD use AI to give medical consultation[57] based on personal medical history and common medical knowledge. Users report their symptoms into the app, which uses speech recognition to compare against a database of illnesses. Babylon then offers a recommended action, taking into account the user's medical history. Entrepreneurs in healthcare have been effectively using seven business model archetypes to take AI solution to the marketplace. These archetypes depends on the value generate for the target user (e.g. patient focus vs. healthcare provider and payer focus) and value capturing mechanisms

Expanding Care to Developing Nations[edit]
With an increase in the use of AI, more care may become available to those in developing nations. AI continues to expand in its abilities and as it is able to interpret radiology, it may be able to diagnose more people with the need for less doctors as there is a shortage in many of these nations.[60] The goal of AI is to teach others in the world, which will then lead to improved treatment, and eventually greater global health. Using AI in developing nations who do not have the resources will diminish the need for outsourcing and can use AI to improve patient care.[62]For example, Natural language processing, and machine learning are being used for guiding cancer treatments in places such as Thailand, China and India. Researchers trained an AI application to use NLP to mine through patient records, and provide treatment. The ultimate decision made by the AI application agreed with expert decisions 90% of the time.

Regulation[edit]
While research on the use of AI in healthcare aims to validate its efficacy in improving patient outcomes before its broader adoption, its use may nonetheless introduce several new types of risk to patients and healthcare providers, such as algorithmic bias, Do not resuscitateimplications, and other machine morality issues. These challenges of the clinical use of AI has brought upon potential need for regulations.[63]

Currently no regulations exist specifically for the use of AI in healthcare. In May 2016, the White House announced its plan to host a series of workshops and formation of the National Science and Technology Council (NSTC) Subcommittee on Machine Learning and Artificial Intelligence.[64] In October 2016, the group published The National Artificial Intelligence Research and Development Strategic Plan, outlining its proposed priorities for Federally-funded AI research and development (within government and academia). The report notes a strategic R&D plan for the subfield of health information technology is in development stages.[65]

The only agency that has expressed concern is the FDA. Bakul Patel, the Associate Center Director for Digital Health of the FDA, is quoted saying in May 2017.

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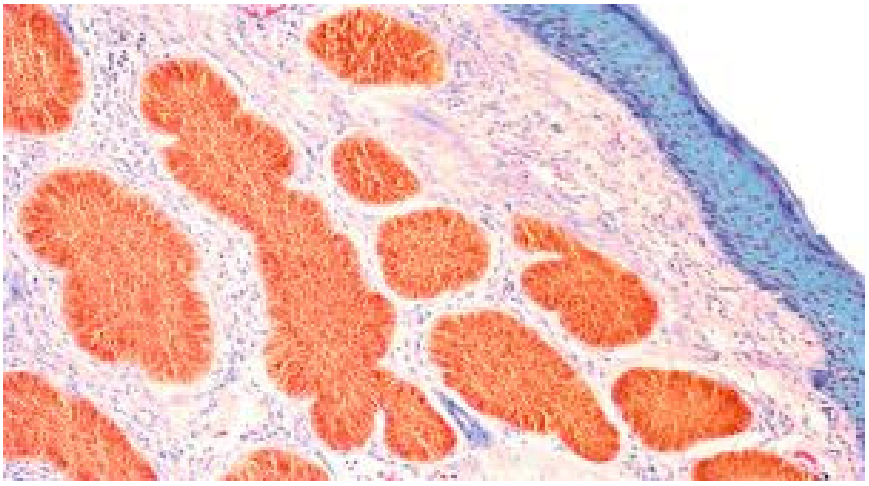
17X41A05B4

USING AI TO TELL THE DIFFERENCE BETWEEN HARMLESS MOLES AND DANGEROUS MELANOMAS

Created by FotoFinder Systems, Moleanalyzer pro is a portal that lets physicians confirm their skin cancer diagnosis using evaluation techniques, combining specialist expertise with AI and including the option of receiving a second opinion from international skin cancer experts.



FotoFinder Systems Global Brand Director Kathrin Niemela told HITNA that the technology aims to aid skin cancer diagnoses.

According to the Cancer Council Australia, every year skin cancers account for around 80 per cent of all newly diagnosed cancers in Australia, with GPs seeing more than a million patients per year for skin cancer.

In addition, the Australian Government identified that there were 14,320 new cases of melanoma skin cancer diagnosed in 2018, accounting for 10.4 per cent of all new cancer cases diagnosed.

“The earlier skin cancer is detected, the better the prognosis. The leisure behaviour of sunbathing in many parts of the world makes early detection of skin cancer more important worldwide,” Niemela said.

FotoFinder Systems first calculates and compares size, diameter and structure of moles and quantifies their percentage deviations.

Moleanalyzer pro works with deep learning. Its Convolutional Neural Network was ‘trained’ with a large data collection of dermoscopic images and corresponding diagnoses. Through growing experience and its own autonomous rules, it then distinguishes between benign and malignant lesions.

“Moleanalyzer pro features the possibility to manually evaluate lesions according to acknowledged checklists and optionally contains an innovative algorithm based on AI, allowing a risk-of-malignancy evaluation,” Niemela said.

“In the last few years, the new algorithm has been trained with a large number of dermoscopic images.

FotoFinder Systems has an international network of partners who contribute to the training of the algorithm with their pictures of histologically proven lesions.”

The analysis then determines a risk assessment score of both melanocytic and non-melanocytic skin lesions, allowing physicians to verify their diagnoses.

FotoFinder Systems is working towards making this AI score available for doctors on mobile devices.

“When this technology becomes available for mobile devices, rural physicians, for example, who practice far away from clinics or specialist centers can use the Moleanalyzer pro’s deep learning algorithm on their mobile phones to get a second opinion on their diagnosis of skin lesions,” Niemela said.

The application also allows physicians to request a second opinion from skin cancer experts.

“The AI represents a ‘silent virtual colleague’ that delivers a virtual opinion simply, uncomplicatedly and at any time. But together with the human experience delivered by the optional second opinion service, the tool helps to increase diagnostic accuracy.”

According to Niemela, a man-against-machine study involving 58 dermatologists from 17 nations found that whereas the experts correctly identified 86.6 of malignant skin tumours, Moleanalyzer pro successfully detected 95 per cent.

In addition, the technology identified 82.5 per cent of benign naevi correctly, while the experts identified 71.3 per cent as benign.

However, Niemela said the technology was not expected to replace specialists.

“As fascinating as AI is, it cannot take the place of human experience in the matter of skin cancer. AI will increasingly find its way into dermatology and mole examinations by supporting physicians, not by replacing them,” Niemela said.

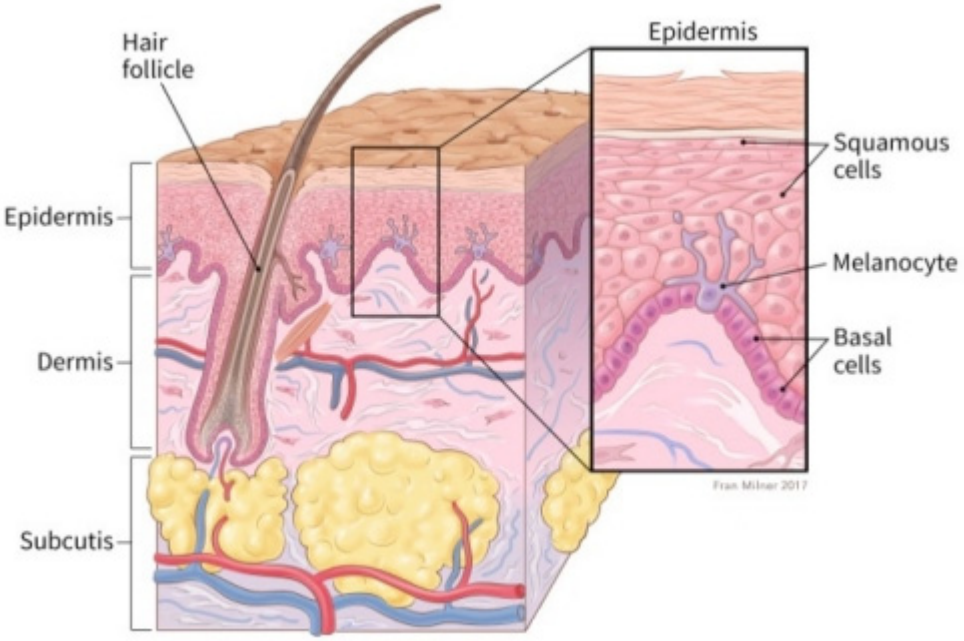
“Doctors need to combine total body mapping with video documentation of single moles and AI-based evaluation. The combination of these three elements are the pillars of early skin cancer detection. Only a physician with profound knowledge and experience can map this complex process.

“In addition, patients do not want to do away with doctors under any circumstances and want to combine high-tech solutions with specialist competence.”

And the future potential for AI in skin cancer detection is huge.

“The aim of AI is to bundle global knowledge and consistent diagnostic standards – independent of the practice location – all over the world. The combination of human experience and AI can contribute to a drastic improvement in diagnostic accuracy in early skin cancer detection, with the potential for almost 100 per cent accuracy,” Niemela added.

Melanoma is a cancer that usually starts in a certain type of skin cell.



Vamsi Priya
18X45A0518

SMARTPHONE AS A MEDICAL WEAPONBY SYEDKABIR

Continuing the theme of harnessing the power of portable devices, experts believe that images taken from smartphones and other consumer-grade sources will be an important supplementto clinical quality imaging – especially in underserved populations or developing nations.

The quality of cell phone cameras is increasing every year, and can produce images that are viable for analysis by artificial intelligence algorithms. Dermatology and ophthalmology are early beneficiaries of this trend.

Researchers in the United Kingdom have even developed a tool that identifies developmental diseases by analyzing images of a child's face. The algorithm can detect discrete features, such as a child's jaw line, eye and nose placement, and other attributes that might indicate a craniofacial abnormality. Currently, the tool can match the ordinary images to more than 90 disorders to provide clinical decision support.

Every day in our digital world, we generate more than 2.5 million terabytes of data. In cell phones, the manufacturers believe they can use that data with AI to provide much more personalized and faster and smarter services."

Using smartphones to collect images of eyes, skin lesions, wounds, infections, medications, or other subjects may be able to help underserved areas cope with a shortage of specialists while reducing the time-to-diagnosis for certain complaints.

Can Smartphones Help Diagnose Skin Cancer?

Researchers at the University of Texas Health Science Center at Houston (UTHealth) have reported using "smartphone microscopes" to diagnose non-melanoma skin cancers with about 90 percent accuracy and melanomas with about 60 percent accuracy.

The technology platform offers advantages to clinicians who don't haSmartphone microscopes can be purchased as an attachment to the smartphone (costing roughly $75 to $85) or built with a 3mm ball lens typically used in laser optics, a piece of plastic to hold the lens in place over the smartphone's camera and tape. A smartphone user positions the microscope over a skin sample affixed to a slide, then either reads the sample or photographs it and sends it to a clinician.ve access to high-powered microscopes but do have their smartphones.

The study, conducted by researchers from UTHealth and Harvard Medical School, used the handmade smartphone microscope to analyze 1,021 slides, then compared them against slides analyzed through a traditional microscope. The smartphone microscope was accurate in detecting 95.6 percent of basal cell carcinoma cases, 89.4 percent of squamous cell carcinoma cases and 60 percent of melanoma cases

mHealth Replaces The Specialist Consult in Retinopathy Detection

The FDA has approved anmHealth platform that can detect diabetic retinopathy in adults, and says the platform can be used by primary care doctors in place of a specialist consult**.**

Source: ThinkStock

April 11, 2018 - Federal regulators have given the green light to mHealth technology that can identify diabetic retinopathy in adults without the need for a specialist consult.

The U.S. Food and Drug Administration has cleared the IDx-DR, which uses artificial intelligence tools to screen for a greater than mild level of retinopathy in adults with diabetes. In issuing its approval, the agency said the device can be used by healthcare providers who may not have experience in eye care, such as primary care doctors and those in community health clinics.

"Early detection of retinopathy is an important part of managing care for the millions of people with diabetes, yet many patients with diabetes are not adequately screened for diabetic retinopathy since about 50 percent of them do not see their eye doctor on a yearly basis,"MalvinaEydelman, MD, director of the Division of Ophthalmic and Ear, Nose and Throat Devices at the FDA's Center for Devices and Radiological Health, said in a press release.

Dig Deeper

- Store-and-Forward Telemedicine Services Expand Connected Health
- mHealth Tools, AI Combine to Avert Serious Diabetic Health Issues
- Research Validates Telemedicine in Identifying ROP in Newborns

"Today's decision permits the marketing of a novel artificial intelligence technology that can be used in a primary care doctor's office," she added.

Developed by Coralville, Iowa-based IDx, whose partners include IBM Watson Health, the IDx-DR software screens images taken by the Topcon NW400 retinal camera and uploaded to a cloud server and issues a positive or negative finding for "more than mild diabetic retinopathy." A positive result includes the recommendation that the patient see an eye care professional.

"The healthcare system desperately needs a more efficient and cost-effective way to detect diabetic retinopathy," IDx Founder and President Dr. Michael Abràmoff, a retina specialist at the University of Iowa Hospitals & Clinics, said in a press release announcing the FDA's acceptance of the technology for De Novo review. "Too many patients go blind needlessly because they aren't diagnosed in time."

The FDA based its approval on a study of some 900 patients at 10 primary care clinics. According to that study, the IDx-DR software was 87.4 percent successful in identifying more than mild diabetic retinopathy and was 89.5 percent successful in identifying patients whose eye images did not meet that level.

The agency also noted that the technology should not be used on patients with a history of laser treatment, surgery or eye injections, as well as those experiencing persistent vision loss, blurred vision, floaters, previously diagnosed macular edema, severe non-proliferative retinopathy, proliferative retinopathy, radiation retinopathy or retinal vein occlusion. Also excluded are pregnant patients, who may experience a rapid progression of diabetic retinopathy that the technology won't identify.

The FDA approved the IDx-DR as a Breakthrough Device, "meaning the FDA provided intensive interaction and guidance to the company on efficient device development, to expedite evidence generation and the agency's review of the device."

To qualify for that classification, a device "must provide for more effective treatment or diagnosis of a life-threatening or irreversibly debilitating disease or condition, and meet one of the following criteria: the device must represent a breakthrough technology; there must be no approved or cleared alternatives; the device must offer significant advantages over existing approved or cleared alternatives; or the availability of the device is in the best interest of patients."

Syed Kabir
17X41A0552

VIRTUAL NURSES WITH ARTIFICIAL INTELLIGENCE

Have you ever been stuck in the waiting room full of people trying to see your doctor? See, it's not a secret that some hospital consultations are not emergency situations. People feel bad, they're worried or scared, they want to know what's going on. This is absolutely understandable but it also puts a lot of pressure on the doctors and nurses to help even more patients and solve problems even faster. Virtual nurses can reduce the number of unnecessary hospital visits, which is beneficial to both the doctors and the patients.According to Syneos Health Communications, 64 percent of patients reported they would be comfortable with AI virtual nurse assistants, listing 24/7 access to answers and support, round-the-clock monitoring, and the ability to get quick answers to questions about medications as some of the benefits. Since virtual assistants are available 24/7, they can help whenever they are needed and provide instant answers.

virtual nursing helps in:Virtual nurses help coach patients during hospital stays.The iCare Navigator platform was inspired by research at the Boston University School of Medicine, which developed virtual nurses named Louise and Elizabeth to coach patients on things such as when to take their medications. A study found that 74 percent of patients preferred receiving discharge instructions from a virtual nurse instead of a human. Other companies also have developed health care applications that use avatars. One example is Reflexion Health's Virtual Exercise Rehabilitation Assistant (VERA), which guides patients through physical therapy exercises and monitors their progress. A recent report by consulting firm Accenture predicts that virtual nursing assistants could save $20 billion a year in health care costs by 2026.

The virtual nurse is here!

Nursing has evolved over the past few decades. The commonly perceived view of the nurse at the bedside, monitoring a patient's vital signs or assisting physicians during rounds, has changed. With the advent of new digital technologies in health care, such as telehealth and remote monitoring tools, today's nurse can be practically virtual. As we celebrate International Nurses Day today, I want to shed some light on what it takes to be a virtual nurse.As a critical care nurse at Banner Health, a health system serving seven states in the Western United States, I've spent the last eight years working in telehealth, as a "virtual nurse." On average, I monitor 40 to 45 patients every day, across three to six facilities in the region – a far shot from the five or six patients I could monitor as a bedside nurse in the past. My job is to provide care to patients and support to nurses when they need it most, especially at remote community hospitals that don't have specialized ICUs. When these hospitals admit high acuity patients, our virtual telehealth command center allows me to monitor patients remotely, so these local care teams can keep the patient in their community hospital, rather than having to transport them four or five hours away to access higher acuity care.

- Expanding nurses' specialization – Telehealth nurses need to be tech savvy, with the majority of their role being behind a computer screen and heavily based on digital analytics. But the new virtual nurse also has deeper knowledge and understanding of a variety of clinical specialties from neurology, cardiology, oncology, etc. Telehealth nurses are seen as a resource for clinicians, which means they can get all kinds of medical questions that need quick research and answers. It's not surprising that all telehealth nurses begin with at least five years of experience in intensive care. But a virtual nurse's learning continues for a longer time.

- Serving as a critical resource for all clinicians – A nurse may be responsible for several patients, but when working on a single patient, he/she must be – and can only be – focused only on that patient. With a telehealth program, nurses can feel confident that if they're wheeling one patient down for a test and another patient needs help, a remote nurse can attend to them immediately or call in another nurse on the floor to help provide care. Bedside nurses now also have access to a physician at the push of a button.

- Increasing length of career – Nursing is a physically demanding job. Imagine moving a 200 pound patient, on a 350 pound bed, with a couple of hundred pounds of additional monitoring equipment needed for transport. Over time, these physical demands become more difficult. Telehealth provides nurses with the opportunity to extend their career. It certainly had its own demands – for example, nurses are accustomed to focusing on a few patients, rather than managing larger populations of patients. However, nurses now have the option for extending their skills into the later years of life.

  live example for virtual nurse:

  Alice Larsen Sneed RN BSN CCRN FCCS is a critical care nurse at Banner Health. She has more than two decades of experience as a critical care nurse, before transitioning to her current role in Banner's Telehealth program since. Alice is a graduate of the Oregon Health

Sciences University, and received her CCRN, critical care certification from the AACN in 2003.

HealthLoop enables care teams to engage all patients before and after admission through automated, daily check-ins. By sending the right information at the right time, HealthLoop identifies those patients that need help in real-time, allowing care teams to proactively intervene before costs and complications escalate.In a case study they write – when patients in Chicago seek healthcare, they have many outstanding options. Administrators at Northwestern Medicine understood this market dynamic and wanted to differentiate themselves from the competition when it came to patient experience.Northwestern wanted patients to feel supported by their care teams when outside the hospital's walls with regular check-ins and ongoing follow-up care. They hoped that this personalized, high-touch solution would keep patients engaged throughout their care, and increase their "likelihood to recommend" their physicians to others.At the same time, as a research institution, physicians needed a better way to gather patient-reported outcomes measures (PROMs). They sought a data collection tool that was both painless for patients to complete and uncomplicated for clinical staff to administer.

Virtual Care Benefits Patients :

It's Convenient: With telehealth, healthcare providers can move between patients faster and patients can take care of appointments from home.

- It Can Save Money: By reducing the need for travel, office staff, and office space, telehealth creates cost-saving efficiencies.
- It Can Expand Access: For those who are homebound or live in underserved areas, telehealth provides much needed access to healthcare providers.
- It Can Increase Patient Engagement: By making healthcare and health information easier to obtain, telehealth makes patients more likely to work to improve lifestyle choices and comply with treatment guidelines
- the Disadvantages to Telehealth:
- There Can Be Technology Barriers: Telehealth requires patients to have access to appropriate technology, such as a laptop with video conferencing capability. Those who can't get a hold of the appropriate technology can't benefit from telehealth.
- There Can Be Reduced Continuity of Care: Patients using telehealth may connect with different providers each time they use a telehealth service. They may also come to rely on apps rather than in-person exams. This disassociation between patient and provider can increase the likelihood that medical issues go unrecognized and/or untreated.

Conclusion:

For sure! With the rapid development of new technologies, it's certain that new solutions will emerge, while the existing ones will get improved. As you can see, AI in healthcare is more than just analyzing medical records, it also presents opportunities across many areas, including diagnostics, virtual assistants, wellness management, and wearables. AI can sense, understand, and perform actions, so it can support people in both administrative and clinical functions.The importance of consumer health is an issue that huge companies like Apple are more and more interested in. In an interview with CNBC, Tim Cook, the CEO of Apple, said that Apple has been investing in health and wellness in recent years. With solutions like the electrocardiogram-equipped Apple Watch, they aim to empower individuals to manage their health. While Apple is not associated with the healthcare sector now, With the introduction of Apple Watch and Apple Health Records, the company has officially entered the healthcare space, allowing users to track their health data, aggregate their health records, and visualize the records. Health and wellness solutions are constantly developing, and they offer more benefits to patients and institutions. We'll surely witness changes in healthcare in the upcoming years and the introduction of AI may bring some astounding results.

Shaik Sazid
17X41A0550

Medical Robots with Artificial Intelligence

A **medical robot** is a robot used in the medical sciences. They include surgical robots. These are in most telemanipulators, which use the surgeon's actions on one side to control the "effector" on the other side.

Types of medical robots

- Surgical robots: either allow surgical operations to be carried out with greater precision than an unaided human surgeon, or allow remote surgery where a human surgeon is not physically present with the patient.
- Rehabilitation robots: facilitate and support the lives of infirm, elderly people, or those with dysfunction of body parts effecting movement. These robots are also used for rehabilitation and related procedures, such as training and therapy.
- Biorobots: a group of robots designed to imitate the cognition of humans and animals.
- Te lepresence robots: allow off- site medical professionals to move, look around, communicate, and participate from remote locations.
- Pharmacy automation: robotic systems to dispense oral solids in a retail pharmacy setting or preparing sterile IV admixtures in a hospital pharmacy setting.
- Companion robot: has the capability to engage emotionally with users keeping them company and alerting if there is a problem with their health.
- Disinfection robot: has the capability to disinfect a whole room in mere minutes, generally using pulsed ultraviolet light. They are being used to fight Ebola virus disease.

Features Of Medical Robotics

Medical robotics is managed by physicians through computerized consoles. The consoles may be near the patients, or at an external site. Consoles include single or multiple arms being in the control of the physicians who pe r fo r m o pe r a t i o n s o n patients. The shape and dimensions of these arms depend upon the type of surgery being performed. The medical data and requirement is fed in the robotics before start of surgery, including the X- rays, and other diagnostic examinations. This information facilitates the medical robotics to traverse the human body correctly.

The purpose of utilizing medical robotics is the provision of enhanced diagnostic capabilities, increased patient comfort, and less hazardous and more meticulous interventions. Robots are being used for multiple operations, including replacement of joints, kidneys, and open heart surgery. The patient images are visible to the physician, and he can accordingly control the robot by a computer. He may not be required to be present in the patient room. The robots have enabled the physicians to perform operations on patients who are located at long distances. Therefore, the environment produced is friendly where the physicians experience less fatigue. (Some surgeries may be performed for long durations causing extensive fatigue to the physicians.) The use of robotics in the medical field makes many medical procedures much more smooth and comfortable.

Medical Robots Making a Difference in Healthcare

1. The da Vinci Surgical Robot

It is unthinkable, but true: More than 250,000 people die in the U.S. each year from medical errors, some of which are likely preventable.1 While this is a broad category encompassing a range of different problems, it's certainly true that the more control surgeons have in their operations, the better. The da Vinci Surgical System, a multi-armed wonderbot, is being used to reduce surgical errors and make surgery less invasive for thousands of patients.

The da Vinci Surgical System gives surgeons more precise control for a range of procedures. Using magnified 3D high- definition vision and controls that strap to a surgeon's wrists and hands, the da Vinci System makes tiny, exact incisions that human hands might not otherwise be able to make. This offers enhanced control to surgeons and, since the surgery is less invasive than traditional surgery, a faster healing time for patients.2

2. The Xenex Germ-Zapping Robot

Along with minimizing medical and surgical errors, hospital-acquired infections (HAIs) are another widespread problem in healthcare that could be improved with robots. The CDC reported that there were 722,000 HAIs in U.S. acute care hospitals in 2011.3 HAIs often occur because hospitals can't always clean rooms with 100 percent sterility between patients, whether due to time constraints or the simple invisibility of germs. Whatever the reason, patients who are already immunocompromised are more susceptible to bacterial infection.

To combat this elemental problem, the Xenex, an automated and portable robot, is used to disinfect entire hospital rooms in minutes using pulsed, full-spectrum UV rays that kill a range of infectious bacteria. It's designed to reduce HAIs such as Methicillin-resistant Staphylococcus aureus (MRSA) by killing the microorganisms that cause them, which can be particularly resistant to treatment. Plus, the robot is kind of cute— it looks like an R2-D2 designed to save lives.

P.Sasikanth
17X41A05A2

Artificial Intelligence (AI) in rheumatology

Artificial Intelligence (AI) is a term applied when a machine mimics the 'cognitive' functions of the human mind, such as learning and problem solving . This technology has gained attention in the field of radiology, with remarkable progress being achieved for image-based diagnostics, demonstrating the many possibilities for AI subsystems trained for specific diagnostic contexts. Stanford University's CheXNet is one such example, where an AI system was developed to diagnose pneumonia, based on patient chest radiographs . The learning algorithm was trained on over 100 000 frontal radiographs images with 14 different thoracic diseases and was able to detect pneumonia from frontal view radiographs at a level exceeding that of a practising radiologist .

Elements of AI have now also been integrated into the field of rheumatology. Last year, Versus Arthritis, a UK Charity, has provided IBM Watson to create an AI platform that will support patients to better self-manage their condition. Patients type questions into a chatbot, which then directs them to relevant and reliable answers in an interactive chat format . Versus Arthritis provided IBM Watson, a collection of algorithms and systems that combine AI with sophisticated analytics software, with over 15 000 pages of unstructured data to learn from and develop content for this initiative . This highly specialized chatbot can be available 24 h a day, 7 days a week, to engage with patients and provide quick and medically accurate references. Advances in high-performance computing, availability of much larger quantities of data through electronic health records, investments from big players such as Google and IBM, and cheap storage for big data in the form of the cloud are among many developments that have opened out an array of potential opportunities. AI offers increasingly sophisticated algorithms that rheumatologists can use to better harness data to potentially predict disease flares , determine long-term prognostics, and monitor response to treatment and outcomes. To take one example, the massive computational power offered by AI has widened the horizons of available research opportunities. Recently, an association has been found between perturbed microbial composition and function (termed 'dysbiosis') and autoimmune diseases, including RA.

Looking into the future, we will now look at a few specific challenges in rheumatology and describe the possible applications of AI and machine learning (ML). There are often difficulties in managing PsA, owing to the heterogeneity of this inflammatory condition. Furthermore, there is currently a paucity of data from controlled clinical trials to guide decisions on therapy changes . PsA requires targeted treatment based on clinical manifestations, symptom severity, co-morbidities, and treatment history, among other factors . ML can be leveraged to sift through existing and new sources of data. These data sources exist outside of clinical trials and include electronic health records, data from biosensors and smart devices, and personalized genomics. ML can be applied to these multiple data sources, distilling the data and seeking correlates between variables at volumes and levels of complexity that were once unimaginable . Thus, ML can be used in this setting to facilitate treatments tailored to the individual characteristics of a patient (precision medicine), and reduce the incidence and costs associated with treatment failure. Disease activity in RA is currently assessed by patient self-reporting,

directed questions and observations, subjective measures, and non-specific blood tests. AI could potentially be applied to identify more specific and sensitive disease biomarkers that objectively measure changes from pre- to post-therapy , and furthermore predict flairs and non-compliance earlier .

It is anticipated that the applications of AI and ML are set to advance in the field of rheumatology. Factors driving this transformative technology and its increased adoptions include progress in wearable technologies and their ability to track activity and cardiovascular data, with the possibility of extension to the monitoring of serum parameters, including inflammatory markers such as CRP . These technologies have also been used to monitor drug adherence with ingestible sensors . The decreasing costs, increasing speeds and rising use of genetic sequencing will further drive the adoption of AI . Much of this data is being recorded and is available today. The next steps are the application of AI and ML to these vast amounts of complex health-care data, analysing it and obtaining insights to support clinical practice.

As with any new technology, there will be hurdles to overcome before there is widespread adoption of AI within health-care ecosystems. At present, there are debates around data privacy, regulations, and technical challenges. Foremost is the need for very high-quality curation of the existing data used for training AI systems, and a critical, measured approach to the deployment of ML. In this, there is as yet no replacement for human scrutiny and care.

As we move forward and look at potential future applications, it is imperative for rheumatologists to remain at the helm of any such developments. Rheumatologists have a wealth of experience and deep contextual understanding of the challenges faced by patients, clinicians, and health-care systems. Thus, they will need to guide the development in, and applications of, this technology to areas where it will be of most benefit. AI will ultimately be a tool in the rheumatologists's kit, which among other things, has the potential to support research and clinical care, and perhaps even ease some of the bureaucratic burdens. With these caveats in mind and ultimate goals in mind, further considerations into applying AI technologies can be sought.

G.L. Krishnasri
17X41A0519

AI in Health Care

What is artificial intelligence?

AI could be simply defined as computers and computer software that are capable of intelligent behavior, such as analysis and learning. It is a broad category at the cutting edge of technological development, growing and changing every day.

Why do we need AI in healthcare?

It puts consumers in control of health and well-being. Additionally, AI increases the ability for healthcare professionals to better understand the day-to-day patterns and needs of the people they care for, and with that understanding they are able to provide better feedback, guidance and support for staying healthy.

How is AI used in healthcare?

AI is still a relatively new technology, especially in the healthcare industry where adoption remains in its infancy. As AI and machine learning tools become more sophisticated, their use cases have expanded; however, adoption of AI remains low, according to John Frownfelter, chief medical information officer at Jvion .

It is still in the hype phase where many organizations are trying to understand how it fits into an overall strategy," said Frownfelter.Early AI was seen … with more of an emphasis on pattern recognition for billing processes. It has evolved to a much more sophisticated use of deep machine learning and leveraging the power of big data." Modern AI applications include wide-ranging use cases, from cybersecurity to radiographic imaging, Frownfelter said. As AI applications continue to improve, the entire healthcare industry could undergo a shift. Here are some of the major ways AI is expected to shape healthcare in the coming years.

Virtual nursing assistants

Think of virtual nursing assistants like an Alexa for your hospital bedside. These virtual assistants replicate the typical behavior of a nurse by assisting patients with their daily routines, reminding them to take medications or go to appointments, helping answer medical questions and more. Accenture estimates that virtual nursing assistants could be the second-largest source of annual savings for the U.S. healthcare industry, cutting as much as $20 billion in costs.

Diagnostics

AI excels at categorizing data, especially once it has been exposed to large amounts of data on the subject. That creates great promise for AI when it comes to diagnostics – medical imaging analysis and patient medical records, genetics, and more can all be combined to improve diagnostic outcomes. Moreover, AI tools can use similar information to craft unique treatment approaches and offer recommendations to doctors.

Robot-assisted surgery

Robotic surgeries allow surgeons to use smaller tools and make more precise incisions. Surgeons (and patients) could also benefit from AI by combining medical records with real-time data during operations, as well as drawing on data from previous successful surgeries of the same type. Accenture, a technology consulting firm, estimates that AI- enabled, robot-assisted surgery could save the U.S. healthcare industry $40 billion annually by 2026.

Ch.Mounika
17X41A0568

AI in Security

What is cyber security?

Cybersecurity analysts help prevent attacks through their expertise and knowledge of databases, networks, hardware, firewalls and encryption. ... Cybersecurityanalysts may also regulate access to computer files, develop firewalls, perform risk assessments and test data processing systems to verify security measures.

How AI helps:

AI technologies like machine learning and natural language processing enable analysts to respond to threats with greater confidence and speed.

AI for cybersecurity:

As cyberattacks grow in volume and complexity, artificial intelligence (AI) is helping under-resourced security operations analysts stay ahead of threats. Curating threat intelligence from millions of research papers, blogs and news stories, AI provides instant insights to help you fight through the noise of thousands of daily alerts, drastically reducing response times.

Why Artificial Intelligence in Cyber Security

Forget those scenes of shiny robots flying around data centres or super-cool disembodied voices discussing advanced concepts. Cyber security has far more basic needs. Through our reliance on ever larger quantities of data, we have created the need for a parallel problem of keeping it all safe. Unfortunately, it is far easier to produce data than it is to protect it.

Where artificial intelligence is really needed?

AI's crucial role right now is to offload work from human cyber security engineers, to handle the depth and detail that humans cannot tackle fast enough or accurately enough. Advances in machine learning technology mean that AI applications can also automatically adapt to changes in threats and spot problems as they arise.

The current state of cyber security:

Today, companies place an emphasis on the security of their internal network. If hackers manage to infiltrate that layer of their infrastructure, it is only a matter of time before a "small" breach becomes a large-scale attack.

The most common tactic for network protection is a firewall. Firewalls can exist either as a software tool or a hardware device that is physically connected to the network. In either scenario, the firewall's job is to track what network connections are allowed on which ports and block all other requests. Typically, server administrators set and control these firewall policies and adjust them via a change management process.

How artificial intelligence will shape the future:

The majority of legacy cybersecurity tools require human interaction or configuration at some level. For example, a person from the IT team has to set the firewall policies and backup schedules and then ensure that they are running successfully. The advancement of AI changes the whole equation. In the future, companies will be able to rely on smart tools to handle the bulk of event monitoring and incident response. The next generation of firewalls will have machine learning technology built into them, allowing the software to recognize patterns in web requests and automatically block those that could be a threat.

Why AI Is The Future Of Cyber security

61% of enterprises say they cannot detect breach attempts today without the use of AI technologies. 48% say their budgets for AI in cybersecurity will increase by an average of 29% in Fiscal Year (FY) 2020.Breach attempts are proliferating with Cisco reporting that in 2018, they blocked seven trillion threats on behalf of their customers.These and many other insights are from Capgemini's Reinventing Cybersecurity with Artificial Intelligence Report published this week. You can download the report here (28 pp., PDF, free, no opt-in). Capgemini Research Institute surveyed 850 senior executives from seven industries,including consumer products, retail, banking, insurance, automotive,utilities, and telecom. 20% of the executive respondents are CIOs, and 10% are CISOs. Enterprises headquartered in France, Germany, the UK, the US,Australia, the Netherlands, India, Italy, Spain, and Sweden are included in the report. Please see page 21 of the report for a description of the methodology.

G.Kinnera
17X41A0575

AI face-scanning app spots signs of rare genetic disorders CAN WE DO MIRACLES IN HEALTHCARE USING AI ??

YES . AI in healthcare is the use of complex algorithms and software to estimate human cognition in the analysis of complicated medical data.

it has the ability for computer algorithms to approximate conclusions without direct human input.

Deep-learning algorithm helps to diagnose conditions that aren't readily apparent to doctors or researchers .

A deep-learning algorithm is helping doctors and researchers to pinpoint a range of rare genetic disorders by analysing pictures of people's faces.

ABSTRACT

Rare genetic diseases collectively impact a significant portion of the world's population. For many diseases there is limited information available, and clinicians can find difficulty in differentiating between clinically similar conditions. This leads to problems in genetic counseling and patient treatment. The biomedical market is affected because pharmaceutical and biotechnology industries do not see advantages in addressing rare disease treatments, or because the cost of the treatments is too high. By contrast, technological advances including DNA sequencing and analysis, together with computer-aided tools and online resources, are allowing a more thorough understanding of rare disorders. Here, we discuss how the collection of various types of information together with the use of new technologies is facilitating diagnosis and, consequently, treatment of rare diseases.

according to analysis i made ..

In a paper published on 7 January in **Nature Medicine**, researchers describe the technology behind the diagnostic aid, a smartphone app called " Face2Gene ".

It relies on machine-learning algorithms and brain-like neural networks to classify distinctive facial features in photos of people with congenital and neurodevelopmental disorders. Using the patterns that it infers from the pictures, the model homes in on possible diagnoses and provides a list of likely options.

Recently,doctors have been using this technology as an aid , even though it's not intended to provide definitive diagnoses. But it does raise a number of ethical and legal concerns, say researchers. These include ethnic bias in training data sets and the commercial fragmentation of databases, both of which could limit the reach of the diagnostic tool.

Researchers at FDNA, a digital-health company in Boston, Massachusetts, first trained the artificial intelligence (AI) system to distinguish Cornelia de Lange syndrome and Angelman syndrome — two conditions with distinct facial features — from other similar conditions. They also taught the model to classify different genetic forms of a third disorder known as Noonan syndrome.

Then the researchers, led by FDNA chief technology officer Yaron Gurovich, fed the algorithm more than 17,000 images of diagnosed cases spanning 216 distinct syndromes. When presented with new images of people's faces, the app's best diagnostic guess was correct in about 65% of cases. And when considering multiple predictions, Face2Gene's top-ten list contained the right diagnosis about 90% of the time.

Eventually, FDNA wants to develop this technology to help other companies filter, prioritize and interpret genetic variants of unknown significance during DNA analysis. But to train its models, FDNA needs data.

So the Face2Gene app is currently available for free to healthcare professionals, many of whom use the system as a kind of second opinion for diagnosing rarely seen genetic disorders, says study co-author Karen Gripp, a medical geneticist at the Nemours/Alfred I. duPont Hospital for Children in Wilmington, Delaware. It can also provide a starting point in cases in which a doctor doesn't know what to make of a patient's symptoms. "It's like a Google search ," Gripp says.

Gripp, who is also FDNA's chief medical officer, used the algorithm to help diagnose Wiedemann–Steiner syndrome in a young girl she treated last August. Although a little short for her age, the four-year-old didn't have many of the syndrome's distinguishing physical features, other than the fact she had lost most of her baby teeth and several adult teeth were already coming in. Gripp had read case reports describing premature dental growth in children with Wiedemann–Steiner syndrome, an exceedingly rare disorder caused by mutations in a gene called KMT2A. To shore up confidence in the diagnosis, Gripp uploaded a photo of her young patient to Face2Gene. Wiedemann–Steiner syndrome appeared among the software's top hits.Gripp subsequently confirmed the girl's diagnosis with a targeted DNA test. But she says that the AI approach helped her to narrow down the possibilities and saved the cost of more expensive multi-gene panel testing.

The program's accuracy has improved slightly as more healthcare professionals upload patient photos to the app, says Gurovich. There are now some 150,000 images in its database.

And in an unofficial comparison conducted between Face2Gene and clinicians last August at a workshop on birth defects, the program outperformed the people. Charles Schwartz, a geneticist at the Greenwood Genetic Center in Greenwood, South Carolina, distributed facial pictures of ten children with "fairly recognizable" syndromes and asked attendees to come up with the correct diagnoses.

if we look through some silos and bias,

But the algorithm is only as good as its training data set — and there's a risk, especially where rare disorders that affect only small numbers of people worldwide are concerned, that companies and researchers will begin to silo and commodify their data sets. "That threatens the main potential good of this technology," says Christoffer Nellaker, a computational biologist at the University of Oxford, UK, who has spearheaded efforts to facilitate data-sharing in this field.

And ethnic bias in training data sets that contain mostly Caucasian faces remains a concern. A 2017 study of children with an intellectual disability found that whereas Face2Gene's recognition

rate for Down syndrome was 80% among white Belgian children, it was just 37% for black Congolese children. With a more-diverse training data set, however, the algorithm's accuracy for African faces improved, showing that more-equitable representation of diverse populations is achievable.

CONCLUSION:

Here by , I conclude that from Unlocking Smartphones with Your Face to detecting disorders and diagnosing the health care , AI made ocean of miracles in this field.

Your Face is The Next Computer Cookie, AI can do miracles.

N. Mansi
17X41A0534

ROBOT-ASSISTED SURGERY

AI-assisted robotic surgery has the estimated value of 40 billion dollars. No wonder, actually, it is really impressive as technology. Robotic surgeries are considered minimally invasive as they allow replacing large incisions with a series of quarter-inch incisions and utilize miniaturized surgical instruments. In a robotic procedure, the pre-op medical records are integrated with real-time operating metrics to improve the outcomes. This technique allows for better physician precision and **can lead to a 21% reduction in the length of patient's post-operation hospital stay**.The da Vinci, considered the world's most advanced surgical robot, lets the doctors perform a variety of procedures with greater flexibility and control than the conventional approaches can offer. The da Vinci has robotic limbs with surgical instruments attached to them and provides a high-definition, magnified, 3D view of the surgical site. The surgeon controls the machine from a computer console near the operating table.Robots enabled with artificial intelligence are increasingly assisting microsurgical procedures to help reduce surgeon variations that could affect patient recovery. Following the successful outcome of AI-assisted surgery last year, experts said they expect to see more robot-aided procedures in the next few years."Artificial intelligence can help surgeons perform better," said Dr. John Birkmeyer, chief clinical officer at Sound Physicians, a national practice of 3,000 doctors and medical practitioners offering acute care management. "We know that a surgeon's skill, particularly with new or difficult procedures, varies widely, with huge implications for patient outcomes and cost. AI can both reduce that variation, and help all surgeons improve – even the best ones. It's important to leverage that digital feedback."While AI-assisted surgery is still in its infancy, Birkmeyer said it is progressing rapidly as health systems collect and integrate data into their processes.Advanced analytics and machine learning techniques are being used concurrently to help uncover critical insights and best practices from the billions of data elements associated with robotic-assisted surgery, Birkmeyer said.This will help reduce surgical variation and its attendant inefficiencies and poor outcomes, as surgeons better understand the techniques that align with better outcomes. In addition, those insights can link to a patient's post-operative and long-term health outcomes.

Origins of the surgical robot

As early as 1985, industrial robots were experimentally converted into surgical devices. The Kawasaki Puma 560 is an example of a manufacturing robot that was modified to insert a biopsy needle into patients at calculated angles and depths. The robot could move the needle more accurately than surgeons' unaided hands, reliably arriving at the coordinates of a tumor deep in the brain.

In the 1990s, the U.S. Defense Advanced Research Projects Agency (DARPA) began combining robotics with computer networking to remotely treat injured soldiers on the battlefield. The data communication required to do experiments with remote instruments successfully proved to be well beyond the network capabilities of the time, but the design concept was very effective for delivering robotic precision to a locally performed procedure. The first da Vinci robot in the early 2000s was based on this technology and patents, creating a product line that has endured to this day.

Intuitive Surgical and the da Vinci's success has spurred stakeholders to apply robotics to every surgical specialty. Some of the new devices compete with the da Vinci, while others reach entirely new specialties. The result has been more than a dozen robotic surgical devices in use today, with at least another three dozen entering the market in the next five years. Robotic assistance is becoming the norm for all surgical procedures, rather than the exception.

Categories of surgical robots

Existing surgical robots can be grouped into four categories, each of which represents a different method for augmenting human clinicians. Machines like the da Vinci, TransEnterix Senhance, CMR Versius and Titan SPORT convert surgeon movements into instrument movements through computer communications between a remote patient cart and a physician's console. This category can be classified as "**Surgeon Waldo**," inspired by the 1942 science-fiction short story "Waldo", by Robert A. Heinlein, where a scientist named Waldo used similar devices for industrial manufacturing. Surgeon Waldos are designed to improve the precision of the human, augment strength, increase endurance and reduce hand tremors.

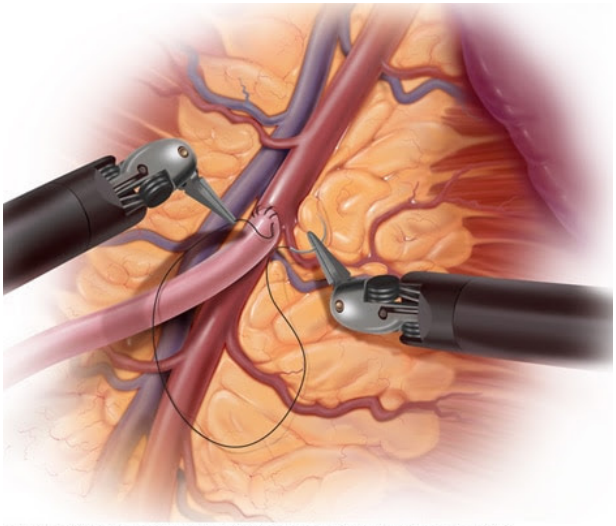
The Waldo category is the most known, but it's not the only approach. Energy delivery robots like Accuray's CyberKnife are "**Programmable Automatas"** that use a predefined treatment plan to calculate the positions and orientations to fire energy to focus on and destroy tumors at specific locations inside the body (see video, above).Orthopedic and dental implant robots work from a digital map of the patient, similar to the previous category, but they function as

an **"Assistive Guide"** to the human. They ensure that the human-initiated actions conform to the digital plan created in the preoperative stage. The robot can physically enforce adherence, avoiding deviations that could deliver non-optimal treatment.

"Motorized Laparoscopic" tools are a more modest family that bring more flexibility to straight laparoscopic sticks. An example would be adding motors and steering controls to laparoscopic handles, giving the surgical tip a flexible wrist joint similar to the Surgeon Waldo machines, but at a fraction of the cost and size. This category also includes the automation of laparoscopic cameras through voice, laser, eye-tracking, and other

methods, enabling a surgeon to steer the camera without a camera-holding assistant.

These four categories – Surgeon Waldo, Programmable Automata, Assistive Guide and Motorized Laparoscopic – capture most of what's being used or developed currently. However, new categories will certainly be required in the future as we continue to expand capabilities.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Advantages

Often, robotic surgery makes minimally invasive surgery possible. The benefits of minimally invasive surgery include:

- Fewer complications, such as surgical site infection
- Less pain and blood loss
- Quicker recovery
- Smaller, less noticeable scare

Is robotic surgery right for you?

Robotic surgery isn't an option for everyone. Talk with your doctor about the benefits and risks of robotic surgery and how it compares with other techniques, such as other types of minimally invasive surgery and conventional open surgery.Robotic surgery may not be available at medical centers in your geographic location.

Conclusion

Is artificial intelligence in healthcare going to gain popularity?

For sure! With the rapid development of new technologies, it's certain that new solutions will emerge, while the existing ones will get improved. As you can see, **AI in healthcare is more than just analyzing medical records**, it also presents opportunities across many areas, including diagnostics, virtual assistants, wellness management, and wearables. AI can sense, understand, and perform actions, so it can support people in both administrative and clinical functions.

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DERMATOLOGICAL CLASSIFICATION OF SKIN CANCER

HOW AI IS BENEFICIAL IN DERMOSCOPY:

Skin cancer represents a challenging diagnostic problem because only a small fraction (3–5% of about ~1.5 million annual US skin cancer cases) are the most serious type, melanoma, which accounts for 75% of the skin cancer deaths.

Identifying melanomas early is a critical health issue, and because diagnosis can be performed on photographic images, there are already services that allow individuals to send their smart-phone photos in for analysis by a dermatologist .

However, the detection of melanomas in screening exams is limited – sensitivity 40.2% and specificity 86.1% for primary care physicians and 49.0%/ 97.6% for dermatologists .

A recent demonstration of automated skin cancer evaluation using a convolutional neural network (CNN) algorithm yielded striking results. The authors drew on a training set of over 125,000 dermatologists labelled images, from 18 different online repositories.

Two thousand of the images were also labelled based on biopsies. The algorithm was trained on all the dermatologist labelled images, using 757 disease classes and over 2000 diseases. The top levels of the taxonomy .In testing the algorithm, the algorithm performed similarly to dermatologists in classifying at the 1st level I with 72.1% accuracy vs. 66.0 and 65.56% for two dermatologists. In classifying for the 2d level (9 disease classes), the respective accuracies were 55.4% for the algorithm versus 53.3 and 55.0% for the two dermatologists. The performance levels of the algorithm are almost certainly limited by levels of sensitivity and accuracy for the labeling of images in the training sets.

AI mechanism by dermoscopic images

Computer-assisted diagnosis of dermoscopic images of skin lesions has the potential to improve melanoma early detection.We sought to evaluate the performance of a novel classifier that uses decision forest classification of dermoscopic images to generate a lesion severity score is its main objective.the methods used here are mostly,Severity scores were calculated for 173 dermoscopic images of skin lesions with known histologic diagnosis (39 melanomas, 14 nonmelanoma skin cancers, and 120 benign lesions). A threshold score was used to measure classifier sensitivity and specificity. A reader study was conducted to compare the sensitivity and specificity of the classifier with those of 30 dermatology clinicians.it has few limitations even ,This is a retrospective study using existing images primarily chosen for biopsy by a dermatologist. The size of the test set is small.

The classifier sensitivity for melanoma was 97.4%; specificity was 44.2% in a test set of images. In the reader study, the classifier's sensitivity to melanoma was higher (P < .001) and specificity was lower (P < .001) than that of clinicians.

Conclusion, We need to evaluate the performance of a novel classifier that uses decision forest classification of dermoscopic images to generate a lesion severity score is its main objective.

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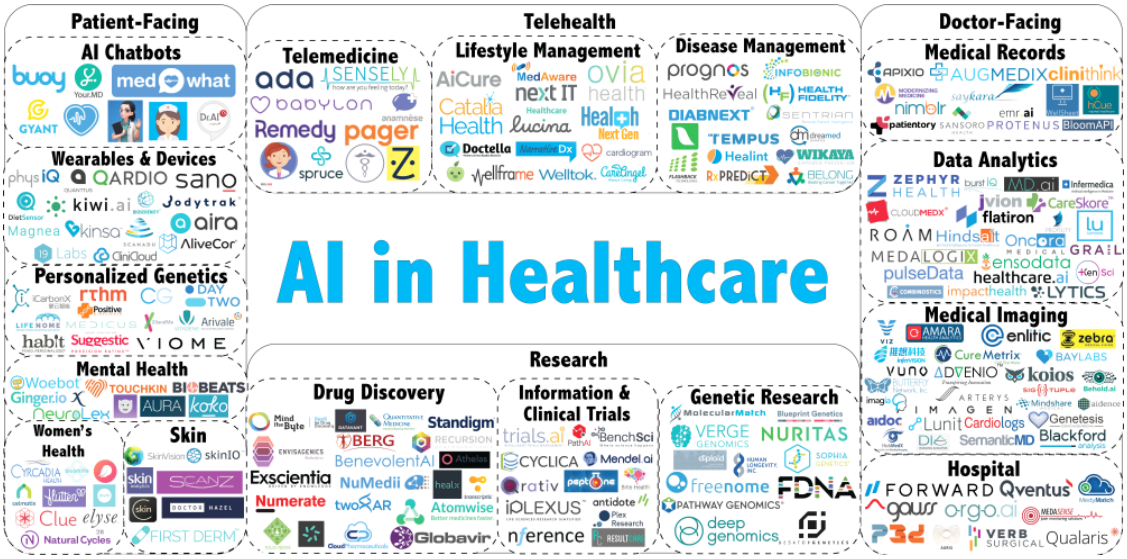
17X41A0541

Artificial Intelligence's Impact on Patient Safety.

August 19, 2019 - Artificial intelligence (AI) has numerous applications for the healthcare industry. Machine learning, natural language processing, and robotics can predict an individual's risk of contracting HIV, assess a patient's risk of inpatient violence, and assist in surgeries. Proponents of the technology are optimistic about its potential to impact clinical care through early and accurate identification of disease and reduction of administrative burdens for providers. Opponents, however, remain skeptical and warn that AI is not a panacea to cure all that ills the healthcare industry, with an eye well trained on patient safety. If AI is to become commonplace in clinical practice, the impact on patient safety needs to be better understood. Without such careful forethought, AI could do more harm than good for healthcare. Development of an AI system is only as good as the data used to create it.

Many AI technologies rely on machine learning, a process wherein the system learns to predict outcomes based on training datasets. An algorithm combs through large amounts of data and generates a result, such as a diagnosis. The more robust and varied the data the input, the more accurate the output. READ MORE: Artificial Intelligence, Big Data to Improve Diabetes Management The quality of data inputted determines the reliability of outputted information. Flawed or bias underlying data can result in faulty learning and generate erroneous outputs. Minority populations are often underrepresented in data, making them particularly vulnerable to over- or under-diagnosis when AI strategies are used to inform decision-making. Homogeneous data forms the basis of many AI tools, which means that their outputs do not apply to a diverse population. For example, if a deep learning tool that predicts an individual's risk of contracting HIV learned from a dataset that only included males, the tool would not have the same power to reliably and accurately predict the risk in female patients.

Using the tool as-is would result in ultimately harmful or unnecessary interventions. “What these systems are doing is learning from ordinary people’s behavior. If you were to take a poll among a certain group of people as to what is ethically best, it depends on that group of people. Different groups are going to come up with different things,” said Susan Anderson, PhD, professor emerita of philosophy at the University of Connecticut. Along with her husband Michael Anderson, PhD, the pair published a response in the American Medical Association’s Journal of Ethics focusing on AI and are currently developing an elder care robot that uses ethical principles to help daily activities such as medication reminders. An algorithm can be adjusted if the developers see this problem and account for potentially biased input, Michael Anderson said. “Computers are not able to make a differentiation unless you foresee that problem and make sure there’s enough data to cover it.” READ MORE: Artificial Intelligence Models Identify Alzheimer’s Cognitive Decline Further data can be integrated into a system to overcome the potential bias, but if that data is not available, the output of the system risks being inherently biased and potentially unrepresentative of a particular patient population. Downstream, this can make AI less effective for that patient population. Michael Anderson noted, though, that eliminating bias in the dataset can be challenging. “You have to clean the data of bias. You’d have to go through each person’s piece of data and look to find the bias. That seems crazy,” he said. Source: Getty Images While using robust and high-quality data helps ensure the accuracy of AI, respect for patient’s confidentiality and privacy must remain paramount. Some patients may not feel comfortable with their data being shared and used to develop AI tools especially if it is unclear how and where their data is stored. Patients have the right to decide if and how their data is shared. In order to make informed decisions, they must fully understand AI and its potential vulnerabilities to hacking and data breaching.



In either case, if the false findings pose too high of a cost burden, using AI output for decision-making is not the best strategy and could potentially harm the patient. Human-centric thinking must remain at the heart of AI technologies if AI is to become part of clinical practice. "Robots need to be programmed to do the right thing. That's the heart of the concept. You need to understand someone's suffering, but the robot itself does not have to suffer in order to make sure it does the right thing," Michael Anderson stated. The purpose of AI is to help the provider make the best decision that ultimately benefits the patient. Often, how the data predicts the outcomes (which variables are more influential) and how the information is combined are unclear to the end-user, making clinical decisions difficult. This "black box" problem means the provider cannot assess the accuracy of the methods that lead the system to its output. "Black boxes are when it's hard to describe what's going on, if at all possible. They have no problem with making decisions that nobody can understand or can explain," Michael Anderson elaborated. "People are now seeing that maybe this is not something that they were hoping it would be." Given the novelty of AI, informed consent becomes more complicated. Not only does the provider need to explain to a patient what AI is trying to accomplish, but they must also ensure the patient understands the concepts of AI and its associated risks. Providers must understand the process AI is going to undertake to generate its outcome, which is impossible if the black-box problem is present. Patients cannot make informed decisions about their care if they do not understand the tools used in their treatment. Tensions arising from this lack of understanding could alter the doctor-patient relationship as a patient may no longer fully trust their physician to make the best decisions about his care. No AI tool is completely accurate, yet. If it were, the black box problem would not be an issue because AI's output would be correct 100 percent of the time. There would be no need to question the methodology because the output would always be accurate. Until AI reaches the point where it does not pose a threat to patient care, its methods must undergo continuous scrutiny. Human-centric and ethical decision-making practices need to remain at the core of AI development. "There always has to be an ethical judgment that is quite independent of facts. And I just don't see how you're going to get that from a bunch of data," Susan Anderson concluded. This is the first of two-part series on the implications of artificial intelligence on patient care.

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