AI & IoT Technologies
In Healthcare

INSIGHT REPORT
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C4IR
CENTER FOR ANALYSIS AND COORDINATION
OF THE FOURTH INDUSTRIAL REVOLUTION

Contents

Foreword

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In today's tech-driven era, the fusion of Artificial Intelligence (AI) and the Internet of Things (IoT) is driving a revolutionary change. Healthcare, a cornerstone of progress, is embracing this blend, with AI and IoT poised to reshape patient care, diagnostics, treatment, and overall well-being. This report delves into their captivating synergy within healthcare.

In our interconnected world, AI and IoT are teaming up to revolutionize healthcare. By combining AI's thinking and IoT's connectivity, healthcare becomes more personalized and effective. This partnership equips medical professionals with advanced tools for solving complex issues and innovating, from remote patient monitoring to precision medicine. The impact of AI and IoT on healthcare is significant and promising.

This report explores how AI and IoT are shaping healthcare. We delve into the connected devices, sensors, and data flow of IoT in healthcare. Discover how AI's data processing and pattern recognition are transforming medical decisions and early disease detection.

Furthermore, this report examines the ethical and regulatory aspects tied to this digital shift. While we welcome the limitless potentials of AI and IoT in healthcare, we must also handle the ethical concerns regarding data privacy, security, and patient agreement. Finding the right equilibrium between progress and protecting patient rights is a crucial task.

In the end, the merging of AI and IoT in healthcare goes beyond technology—it's a transformative change in how we care for people. The ideas in this report encourage us to envision a healthcare future where predictive algorithms boost early treatments, where connected devices seamlessly integrate care, and where data-driven choices lift patient results to new heights.

As you read ahead, we welcome you to discover the remarkable teamwork of AI and IoT in healthcare. This coming together is changing what we thought was possible and giving a new meaning to caring and inventive healthcare.

Introduction

What is AI?

AI stands for Artificial Intelligence. It refers to the simulation of human intelligence in machines that are programmed to think, learn, and perform tasks that typically require human intelligence. The goal of AI is to create intelligent systems that can mimic human cognitive abilities such as problem-solving, learning, reasoning, perception, and natural language understanding.

AI can be broadly categorized into two types:

1. Narrow AI (Weak AI): Narrow AI is designed to perform a specific task or a set of tasks and is limited to those tasks only. It lacks the ability to generalize beyond its intended purpose. Examples of narrow AI include:

2. General AI (Strong AI): General AI refers to a hypothetical system that possesses the ability to understand, learn, and apply knowledge in a manner like human intelligence. This kind of AI does not yet exist and remains an active area of research and speculation.

Examples of AI in various domains:

1. Healthcare: AI is used to analyze medical data, identify patterns, and assist in diagnosing diseases. For instance, AI algorithms can help detect early signs of diseases like cancer from medical imaging.

2. Autonomous Vehicles: Self-driving cars rely on AI and machine learning to perceive their environment, make decisions, and navigate without human intervention.

3. Natural Language Processing (NLP): NLP powers language-related applications like language translation, sentiment analysis, and chatbots.

4. Gaming: AI is used in games to create intelligent non-player characters (NPCs) that can adapt their behaviour based on the player's actions.

5. Finance: AI algorithms are used in fraud detection, algorithmic trading, and customer service in the financial sector.

6. Robotics: AI plays a crucial role in making robots capable of performing complex tasks like an assembly line

7. Education: AI can be used in adaptive learning systems that personalize educational content based on individual student progress and needs.

It's important to note that while AI has made significant strides, we are still far from achieving true human-like artificial general intelligence, which would require machines to possess consciousness and self-awareness.

What is IoT?

IoT stands for the Internet of Things. It is a concept that refers to the interconnection of various everyday physical objects or "things" with the internet and other devices. These objects can range from household appliances and wearable devices to industrial machinery

and vehicles. The key idea behind IoT is to enable these objects to collect and exchange data over the internet without the need for direct human-to-computer interaction.

2. Data Analysis and Decision Making: The processed data is analyzed using various algorithms and machine learning techniques to extract meaningful insights. These insights can be used to make informed decisions, trigger actions, or provide valuable feedback to users.

Here's how IoT works in a nutshell:
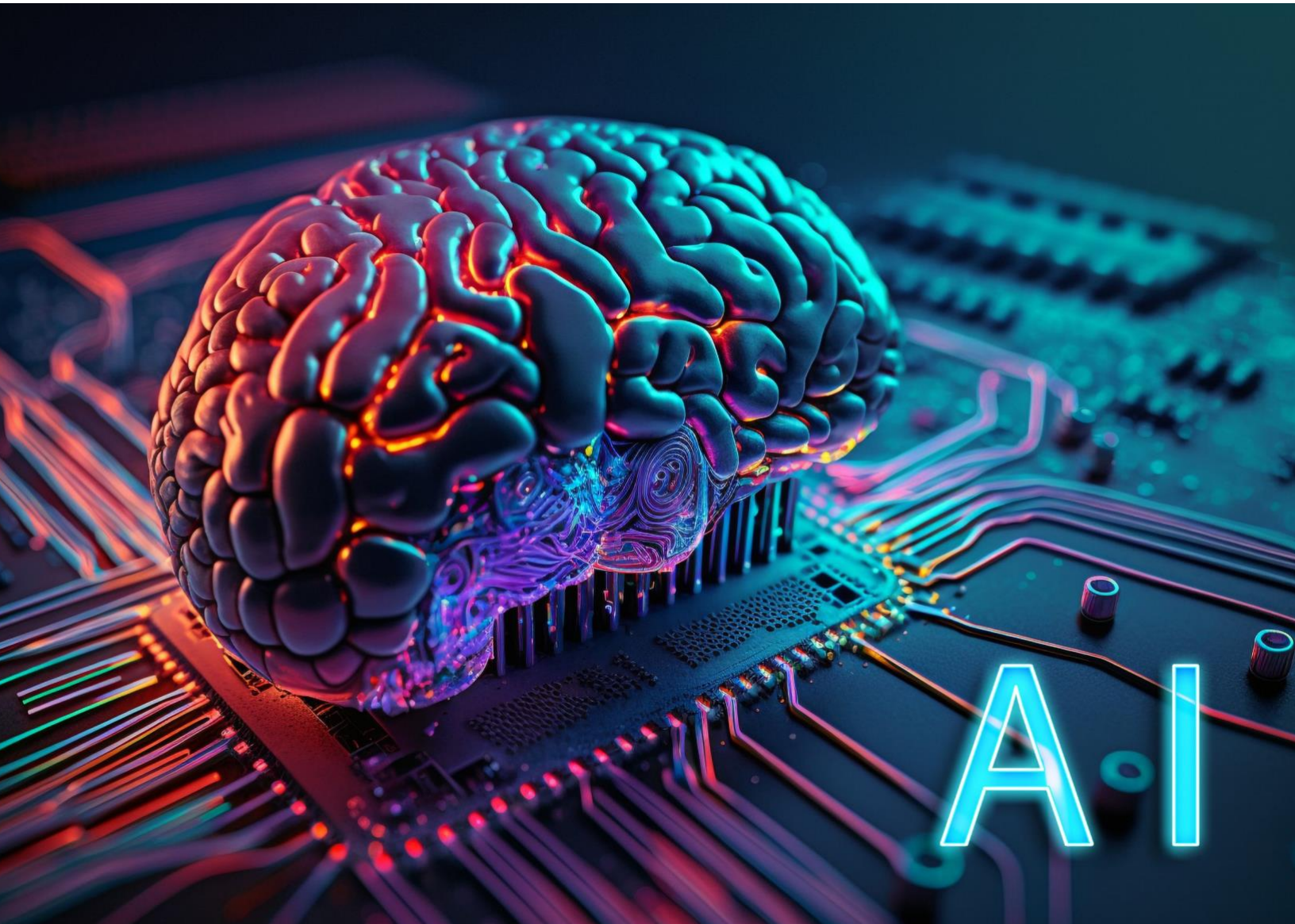
1. Data Collection and Processing: Once connected, the IoT devices can collect data from their surroundings or from the user interactions. This data can include temperature, humidity, location, motion, health metrics, and much more.

3. Automation and Control: One of the significant benefits of IoT is the ability to automate processes and control devices remotely. For example, a smart thermostat can automatically adjust the temperature based on occupancy and user preferences, or a smart irrigation system can water plants based on soil moisture levels.

1. Improvement of radiological diagnoses

"CheXNeXt" is a revolutionary AI algorithm developed by Stanford University researchers. It quickly screens chest X-rays for over a dozen diseases, providing accurate findings faster than human radiologists. The algorithm outperforms radiologists for ten illnesses, with outstanding accuracy after training on 112,000 X-rays. The ultimate goal is to use "CheXNeXt" for rapid and precise illness identification, benefiting resource-constrained areas with a lack of radiologists. Researchers aim to improve the algorithm for practical applications, such as ranking cases by urgency or providing on-demand consultation at the patient's bedside, to enhance global patient outcomes using advanced AI technology.

2. Virtual treatment of patients

At the RSNA 2021 Annual Meeting, "GE Healthcare" showcased 60 innovative technology solutions for patient screening, diagnostics, therapy planning, guidance, and monitoring. Amidst the pandemic, they accelerated AI and digital solutions to make healthcare more efficient and personalized. Their goals are to increase efficiency, reduce clinician burnout, empower clinicians with AI, create a resilient healthcare industry, and improve patient access to care. They introduced various AI-powered imaging and digital offerings, including advanced MRI systems, interventional image guidance, portable X-ray tech, and ultrasound devices. They also partner with industry leaders for integrated cancer care and precision diagnostics. The Revolution Apex platform offers one-beat cardiac imaging and advanced technologies for upgraded service lines.

3. Determination of kidney failure

Recognizing early signs of patient deterioration is crucial for healthcare professionals. To achieve this, "DeepMind" developed a sophisticated deep-learning approach using acute kidney injury as an example. The model was created using electronic health records from over 700,000 adult patients and successfully predicted 55.8% of acute kidney injury episodes with a lead time of up to 48 hours. It also provides confidence assessments, relevant clinical features, and predicts future blood test trends, aiding timely decisions and early treatment. This approach offers hope for identifying at-risk patients and improving outcomes through early intervention.

4. Prediction of cancer cells

AI techniques detected prostate cancer by analyzing tissue features. Radiomic methods extracted information from histopathology images to classify benign and malignant cases. The AI method identified invisible patterns, aiding cancer prediction. Performance metrics evaluated classification results, showing radiomics' potential for tumor analysis. AI algorithms (support vector machine, logistic regression, bagging tree, boosting tree, dual-channel bidirectional long short-term memory network) were tested on two datasets: one for training/testing and one for model evaluation.
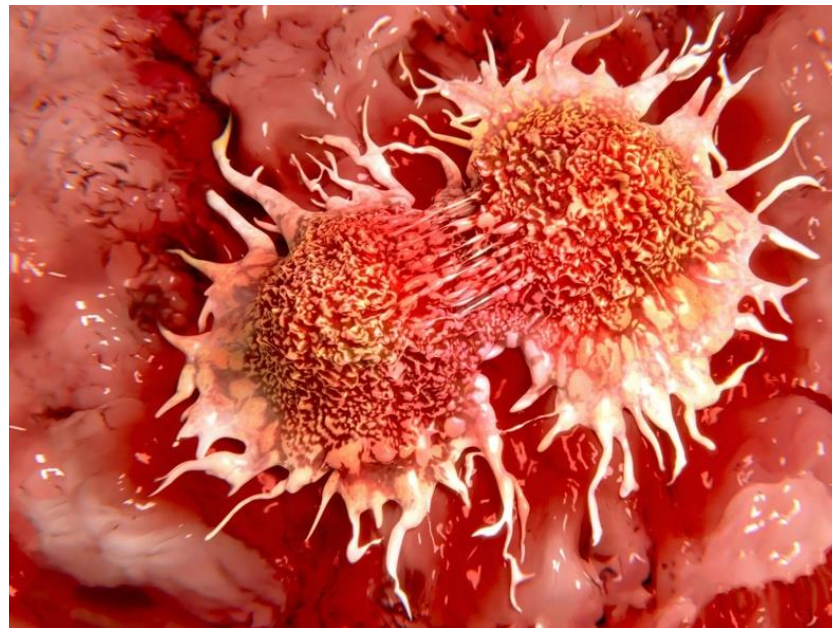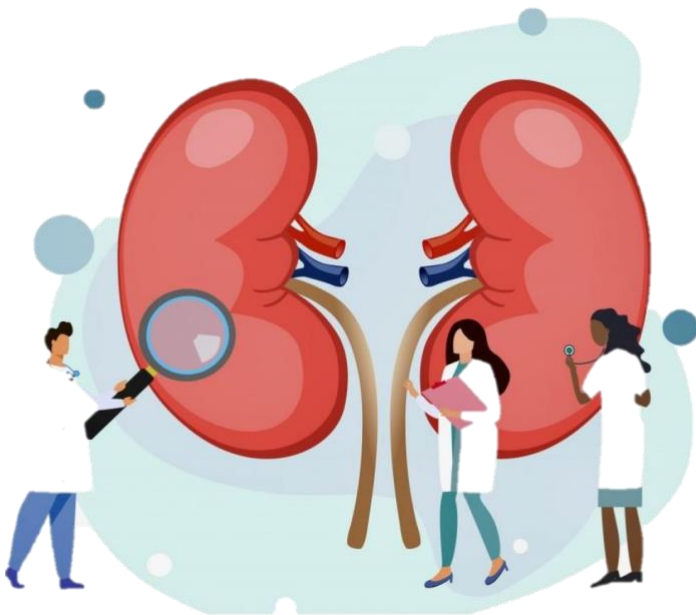
5. Determination of lung cancer

Introducing the AI-Rad Companion: an intelligent medical assistant! This AI-powered, cloud-based tool streamlines image interpretation, automating repetitive tasks and routine workflows, freeing you to focus on critical matters. Here's what it can do:

1. AI-Rad Companion Chest CT: Detects lung nodules, provides volume and diameter information, calculates coronary calcium volume, and generates a 3D overview of the thoracic aorta for more accurate reporting.

2. AI-Rad Companion Brain: Automatically segments brain areas, performs volumetric analysis, and generates a deviation map for monitoring changes over time.

3. AI-Rad Companion Prostate MR for biopsy support: Automatically segments and estimates prostate volume, calculates PSA density, allows manual marking and characterization of lesions, and aids in biopsy guidance.

6. Offering personalized treatments to patients

AI-powered insights in healthcare improve service experiences for patients, providers, and members. Proactive, personalized information is delivered through mobile, web, and call centers, leading to lower costs and better outcomes.

Ways AI enhances service experience:

1. Agent Assist: Call center agents get personalized insights to address inquiries effectively.
2. Self-Service & Proactive Channels: AI-driven chatbots offer personalized predictions and solutions via preferred channels.
3. Insights Based on Personalized Profiles: CognitiveScale's Profile of One creates personalized profiles for members, patients, and providers.
4. Scalable Solution: The Cortex Service Experience solution scales across different inquiry types and personas using CognitiveScale's AI platform and reusable assets.

7. Providing online health advice

"Babylon" aims to revolutionize healthcare, shifting from reactive sick care to preventive health using existing devices. They serve over 24 million individuals worldwide and forge strong partnerships to address unique challenges globally.

In the UK, they created Babylon GP at Hand, a digital-first NHS GP practice, and collaborate with NHS Trusts for patient-centric care. In the US, they provide 24/7 primary care support to millions. In Rwanda, they assist the government in healthcare delivery for 20% of the population.

Their mission is to make healthcare accessible and affordable, leveraging AI and technology to empower GPs and nurses. Their diverse team includes doctors, specialists, scientists, and engineers from over 60 countries.

"Babylon" believes technology can positively transform healthcare, using cutting-edge AI to provide advanced insights for better healthcare outcomes.
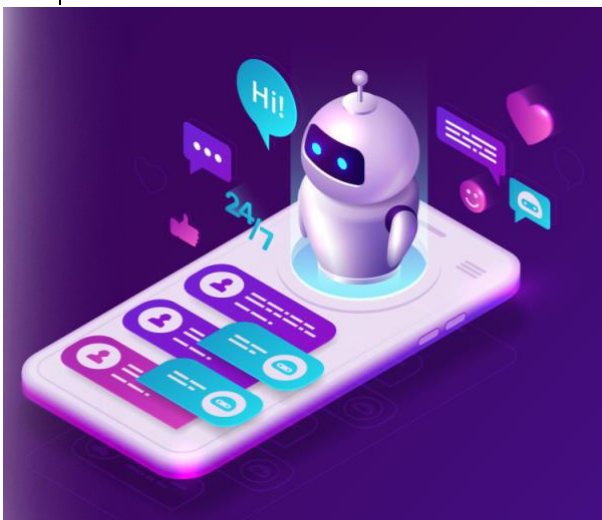
8. Prediction of cancer-based on blood tests

Freenome, a biotech company, achieved significant advancements in early cancer detection using a simple blood test. Their multi-omics platform combines signals from tumour and non-tumour sources, delivering impressive sensitivity and specificity of 94% for detecting early-stage colorectal cancer (CRC).

Presenting promising data from their clinical study, AI-EMERGE®, at ASCO GI, Freenome outperformed a leading faecal immunochemical test (FIT), positioning their blood test as a preferred screening method.

Their ultimate goal is accessible and affordable healthcare, achieved through AI and technology to support informed decisions by healthcare providers, delivered via patients' existing devices.

With a diverse and world-class team of doctors, nurses, specialists, AI engineers, and scientists from over 60 countries, Freenome is revolutionizing healthcare through cutting-edge technology, providing valuable insights for improved clinical outcomes in the fight against cancer.

9. Prediction of tuberculosis

Qure.ai uses cutting-edge AI technology to predict tuberculosis (TB) with remarkable accuracy. Their advanced algorithms analyze medical imaging data from chest X-rays or CT scans to identify potential TB cases early, enabling prompt intervention.

The AI system is extensively trained on vast TB datasets, differentiating between TB-infected lungs and normal conditions accurately.

Qure.ai's technology delivers highly precise results within moments, rivaling human radiologists in sensitivity and specificity.

Early detection enables timely treatment, leading to better health outcomes and reduced transmission rates.

Their innovative approach revolutionizes TB diagnosis and management, contributing to a TB-free future and impacting global heal thcare efforts.

10. Psychological health

Woebot Health's innovative AI-powered app transforms mental health care. Acting as a personalized mental health coach, it provides real-time support for stress, anxiety, depression, and personal growth in a safe and non-judgmental environment.

Woebot continuously learns and adapts, offering personalized insights and coping strategies while ensuring privacy and confidentiality.

Accessible anytime, it breaks therapy barriers, making mental health support available to all, empowering individuals worldwide to lead healthier, happier lives.

Tuberculosis

- Trachea
- Lungs
- Infection
- Tuberculosis bacteria

11. Discovery of new drugs

Atomwise leads drug discovery reinvention using cutting-edge tech. Their AI algorithms virtually screen billions of compounds, accelerating the process and identifying promising drug candidates with higher success potential. This approach allows exploration of novel targets and rare diseases. Collaborating with academia, pharma, and biotech, Atomwise tackles diverse health challenges. Their commitment to AI-driven innovation advances medical research for groundbreaking therapies.

12. Assistance in decision-making

IBM Watson Health's AI system transforms healthcare decision-making with advanced machine learning and natural language processing. It analyzes vast medical data and literature to provide evidence-based insights and recommendations, aiding clinicians in diagnosing diseases, identifying treatments, and predicting outcomes. This decision-support tool enhances human expertise, offering personalized and precise treatment plans based on patients' history and condition. Continually learning and improving, IBM Watson Health's AI system empowers better patient care and improved clinical outcomes. Its potential to revolutionize healthcare decision-making promises a data-driven, patient-centric future with precision medicine.

13. Real-time monitoring of patients

AthenaClinicals: Revolutionizing healthcare with its state-of-the-art EHR system. Its user-friendly platform streamlines workflows, providing quick and secure access to patient data for informed real-time decisions.

The standout feature is its AI-powered clinical decision support system, optimizing treatment plans and reducing errors. Seamless communication among healthcare teams ensures a patient-centric approach.

Data security is paramount, and AthenaClinicals prioritizes safeguarding sensitive information through industry-leading protocols. Scalable and cloud-based, it's a trusted EHR solution worldwide, enhancing collaboration and improving patient outcomes.

14. Genetic analysis

Microsoft Healthcare's AI-powered Genomics made significant strides in personalized medicine. Efficient and accurate analysis of genetic data empowers providers to identify variants, assess disease risks, and find precision therapy targets, saving time and effort.

The AI-driven solution ensures high accuracy, actionable insights, and data privacy. It advances personalized medicine, leading to tailored treatments for better patient outcomes, transforming AI-driven genomics and healthcare understanding.

15. Smart pill dispensers

The Philips Smart Pill Dispenser is an innovative solution designed to help individuals manage their medication more effectively. This smart device utilizes advanced technology to ensure the right pills are taken at the right time, reducing the risk of missed doses and medication errors.

The smart pill dispenser is equipped with features such as reminders and notifications, which can be programmed to alert users when it's time to take their medication. It also provides real-time tracking of medication usage, allowing caregivers and healthcare professionals to monitor adherence and intervene if necessary.

16. Smart hospital beds

Stryker's ProCuity bed is a groundbreaking advancement in hospital beds, leading the charge in transforming patient care and safety. As the world's first completely wireless hospital bed, it revolutionizes the healthcare industry with its innovative features and cutting-edge technology.

A significant concern in hospitals is patient falls, affecting nearly a million patients each year. ProCuity rises to this challenge with its intelligent design and advanced AI technology, aiming to reduce the risk of in-hospital patient falls and related injuries.

The bed's low height and intuitive patient positioning play a pivotal role in minimizing fall-related incidents, while its ergonomic side rails, adaptive bed alarms, and motorized drive for easy patient movement provide comprehensive safety measures and enhanced comfort.

17. IoT-equipped ambulances

Zoll Medical's IoT technology transforms ambulances into advanced healthcare units. IoT devices monitor vital signs in real-time, transmitting crucial data to hospitals for immediate preparation and informed decisions. This integration improves patient care quality, saving lives in critical situations. Zoll Medical's IoT solution revolutionizes emergency medical services, bridging the gap between pre-hospital and hospital care, and advancing towards a more efficient, data-driven, and patient-centric approach.

18. Smart refrigerators

Haier Biomedical revolutionizes medical storage with IoT-enabled refrigerators. Constant monitoring and automatic adjustments ensure precise temperature control, preserving medicines' effectiveness. Insights into storage conditions optimize inventory management, minimizing wastage. This game-changing solution enhances patient care and healthcare efficiency.

19. Smart Bandages

Researchers have developed a "smart dressing" called DermaTrax that can monitor patient wounds continuously, reducing the need for frequent visual inspections. The smart dressing contains temperature, moisture, and pH sensors to track the wound's condition and relay information wirelessly to the nurses' station. This technology aims to improve patient comfort and convenience while enabling doctors to respond quickly to any complications, such as infections. DermaTrax has the potential to save healthcare costs by shortening hospital stays and reducing clinical inspection time for wound healing.

20. Wheelchair equipped with IoT

Permobil's SmartDrive MX2+ is a groundbreaking power assist device that attaches easily to manual wheelchairs. With Bluetooth connectivity, users can effortlessly navigate various terrains using wristband or switch control. The mobile app allows customization, usage tracking, and real-time data on battery life and distance covered. Safety features adapt to terrain changes, providing a secure ride. This user-friendly and durable device revolutionizes mobility solutions, empowering wheelchair users worldwide.
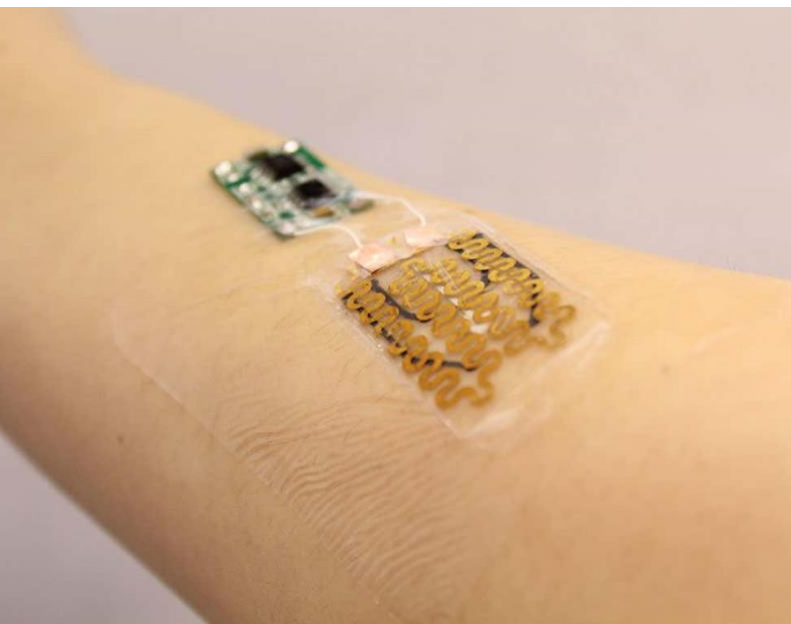
21. Monitoring of hospital equipment

Siemens has developed IoT-based sensors that enable real-time monitoring of device locations in hospitals. This innovative technology not only helps reduce theft cases but also minimizes the time spent searching for devices when they are needed urgently. With improved device tracking and security, hospitals can enhance operational efficiency and ensure vital equipment is readily available for patient care.

22. Data collection

In the field of healthcare, data collection is crucial, and wearable technologies play a significant role in this process. "PysIQ," a company specializing in cloud-based Internet of Things platforms, has developed a sophisticated system for data collection from wearable devices. This platform allows seamless aggregation of data from each patient, which is then stored in a centralized database. The availability of this comprehensive database simplifies the process of building AI models for various healthcare solutions, leading to improved diagnostics, personalized treatments, and better patient outcomes.

23. Virtual treatments

The telemedicine platform by "InTouch Health" utilizes Internet of Things (IoT) technology, incorporating devices and sensors, to deliver remote medical care to patients. This advanced platform offers a range of services, including virtual consultations and remote patient monitoring, enabling healthcare professionals to provide efficient and effective care to patients in hospitals and clinics from a distance. With the integration of IoT devices and sensors, the platform ensures seamless and real-time connectivity, facilitating timely and accurate medical assessments and interventions for improved patient outcomes.

24. Automation of foot health control

Siren Care's IoT-enabled diabetic socks revolutionize foot health monitoring for individuals with diabetes. Advanced temperature sensors detect potential issues, like foot ulcers, allowing for early intervention. These non-intrusive socks provide continuous monitoring and prompt alerts for timely preventive measures. By empowering users to manage their foot health proactively, they reduce the risk of complications and improve overall well-being.

25. Automatic regulation of diabetes

Smart lenses revolutionize diabetes management with continuous glucose monitoring. They eliminate painful finger pricks and detect glucose levels in tears, offering a comfortable experience. Real-time insights enable informed decisions on diet, exercise, and insulin dosing, leading to better glycemic control. These discreet lenses wirelessly transmit data to apps for seamless tracking and analysis. Millions with diabetes gain freedom and improved quality of life. Smart lenses signify a leap forward in diabetes care, promising a patient-centered approach to management.

26. Pain management

Virtual reality therapy is a cutting-edge approach in healthcare for pain management. This innovative technique utilizes VR technology to create immersive experiences that distract patients from their pain. By engaging multiple senses, patients are transported to virtual environments that reduce the perception of pain. VR therapy is versatile and can be used in chronic pain management, postoperative recovery, and medical procedures. Patients can choose personalized environments, making the experience therapeutic and enjoyable. VR therapy's potential extends to alleviating stress, anxiety, and PTSD symptoms. As technology advances, VR therapy holds promise to become a standard component of pain management and improve patient care. Ongoing research aims to understand its efficacy better, making it a transformative tool in healthcare settings.

27. Smart glasses

Vuzix offers sleek smart glasses and AR solutions for consumers and enterprises. They provide hands-free access to digital information through transparent displays and voice commands.

For consumers, Vuzix smart glasses offer an immersive experience with apps, videos, and virtual objects.

In the enterprise sector, they enhance productivity by providing real-time information to workers in various industries.

As AR pioneers, Vuzix is recognized in the wearable technology industry.

Vuzix partners with industry leaders to create tailored applications.

28. Smart stethoscopes

Eko Health's smart stethoscope revolutionizes auscultation with digital technology. High-quality acoustic sensor captures precise sounds, transmitted wirelessly to a device for analysis. AI algorithms detect heart and lung conditions, enabling early detection. Facilitates telemedicine and education, enhancing diagnostic skills. Emphasizes data security for confidential patient information. A remarkable advancement in healthcare, empowering professionals for personalized and efficient care.

29. Regulation of blood pressure

Blood pressure monitors are essential devices for measuring and tracking blood pressure levels. They empower patients to actively manage their health by providing valuable data to healthcare professionals. Modern smart monitors sync with mobile apps, allowing easy data transmission to doctors for remote monitoring and timely interventions. Regular monitoring helps prevent complications, especially for those with chronic conditions. These user-friendly devices enable better compliance and accessibility, benefiting elderly and homebound patients. As telemedicine grows, blood pressure monitors play a crucial role in remote patient monitoring, optimizing cardiovascular care and improving overall health outcomes.

30. Prediction of cardiovascular risk

Apollo Hospitals faced high cardiovascular disease mortality rates in India and developed an AI-powered risk stratification algorithm called AICVD. It outperformed conventional risk scores and offers tailored health actions for patients. The algorithm integrates lifestyle data and ensures privacy and accuracy by using data from wearable users. AICVD's success has led to global adoption and expansion into other non-communicable diseases.
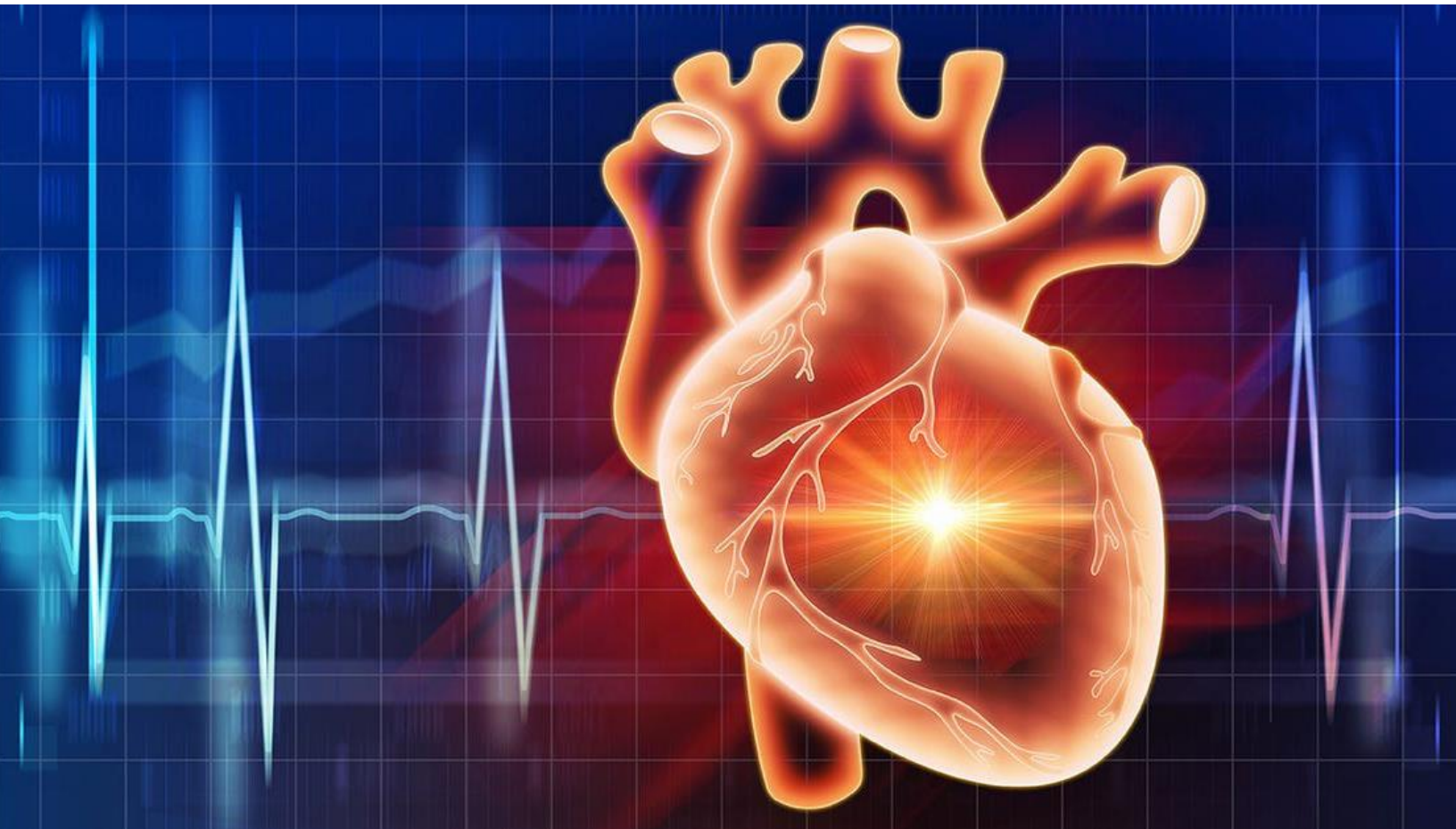
# 31. AI detects outbreaks earlier and predicts future

The COVID-19 pandemic has emphasized the need for better pandemic readiness and infectious disease intelligence. BlueDot is a pioneer in this field, using global data and experts to estimate disease burden, predict spread patterns, and identify vulnerable populations. They gained international recognition for early alerts on COVID-19 and accurate forecasting of its spread. Leveraging AI and machine learning, BlueDot's global surveillance engine tracks infectious diseases worldwide in 132 languages, ensuring constant situational awareness. Beyond COVID-19, they detect and track other outbreaks and model climate change's impact on disease patterns. BlueDot's innovative approach enhances pandemic preparedness and global public health protection.

32. H1 helps pharma companies to conduct more efficient clinical trials

AI has revolutionized clinical trials, even before the surge of generative AI technologies in 2022-23. Predictive AI identifies optimal trial sites and investigators based on past data, while NLP synthesizes medical literature for trial design. Now, generative AI quickly produces potential trial sites, saving time and resources.

H1, a US-based tech company, empowers pharma companies and CROs with AI solutions to expedite decision-making and patient recruitment. For one pharma company, H1 swiftly identified alternative trial sites with higher patient enrollment potential, preventing delays and cost overruns.

AI's impact on clinical trials is evident in efficiency gains and accelerated decision-making, transforming the healthcare landscape.
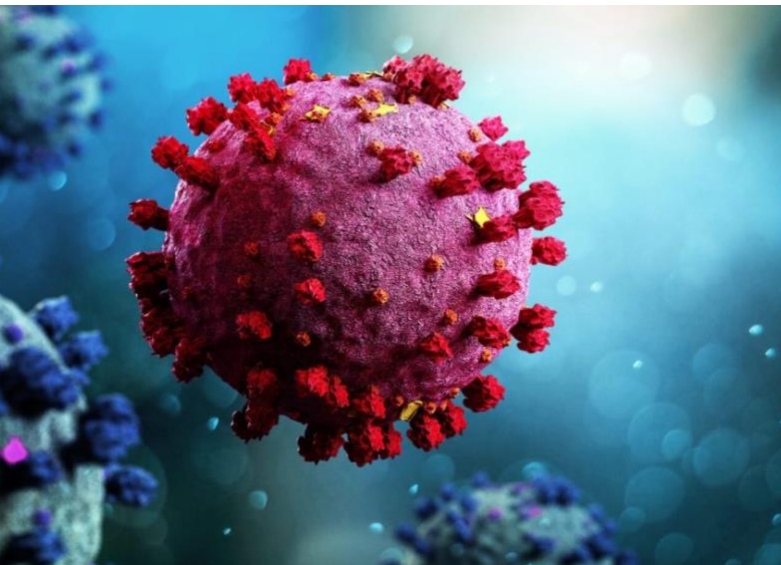
33. Using AI to triage patients in a healthcare facility

The healthcare industry is transforming with robotics, chatbots, AI, and machine learning. AI's predictive, proactive, and data-based approach is crucial in this shift. One significant application is automating patient triage, especially in regions with limited healthcare resources. AI-powered chatbots assess patients' needs, avoiding unnecessary ER visits and providing accurate decisions.

AI-driven predictive analytics improve patient outcomes, streamlining triage and prioritizing patients effectively. AI models for mass casualty incidents optimize triage and classification.

AI innovations are gaining momentum in healthcare. Stanford uses ML to identify high-risk patients, while NinesAI detects intracranial haemorrhaging. Infermedica raised funding for symptom-checking.
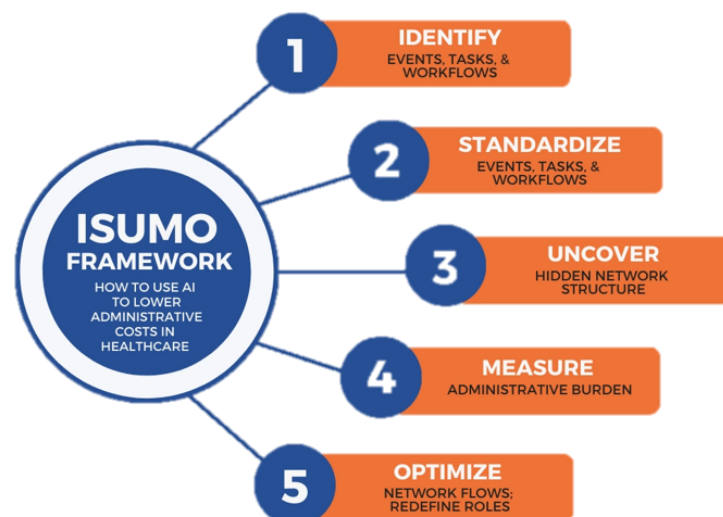
AI triage tools will significantly impact healthcare, complementing professionals and improving service delivery. Proxet embraces AI and ML to revolutionize healthcare.

34. Administrative task management using AI

Healthcare providers face increasing administrative burdens, impacting systems and costs. AI and ML can automate repetitive tasks, but data management challenges remain. Integrating AI into EHR platforms can generate insights and improvements.

The ISUMO framework aims to reduce administrative burden and optimize health systems through five steps, leveraging AI algorithms for data analysis, process mapping, network analysis, and optimization.

AI enables meaningful data on healthcare tasks, improving workflows and reducing complexity. Implementing AI-driven systems and optimizing network flows can efficiently allocate resources, streamline tasks, and improve patient care while saving costs.

ISUMO FRAMEWORK
HOW TO USE AI TO LOWER ADMINISTRATIVE COSTS IN HEALTHCARE

1 IDENTIFY — EVENTS, TASKS, & WORKFLOWS

2 STANDARDIZE — EVENTS, TASKS, & WORKFLOWS

3 UNCOVER — HIDDEN NETWORK STRUCTURE

4 MEASURE — ADMINISTRATIVE BURDEN

5 OPTIMIZE — NETWORK FLOWS; REDEFINE ROLES

35. Powering next-gen biosecurity using AI

Ginkgo Bioworks developed ENDAR, an AI-based platform for biosecurity. It rapidly detects genetic engineering in biological samples, enhancing existing infrastructure. ENDAR is vital for responding to engineered threats, deterring biotech misuse, and safeguarding intellectual property in the bioeconomy. It complements biodetection networks and showcases AI's transformative potential in this field.

Ginkgo continuously evolves ENDAR to match advancements in biotech and AI. They use AI-based large language models to analyze genetic datasets. Ginkgo aims to create a thriving bioeconomy while addressing biological risks.

ENDAR's collaboration with IARPA represents a new generation of detection tools, providing early alerts to anomalous samples. The human-in-the-loop process ensures expert analysis, bolstering ENDAR's

36. Robot-assisted surgery using AI

AI Surgery is an emerging field that leverages AI systems to aid surgeons during procedures, aiming to improve the quality, safety, and efficiency of surgeries. AI algorithms, such as machine learning, computer vision, and deep learning, are utilized to analyze data, detect abnormalities, and assist in decision-making during surgery. This technology has the potential to significantly improve patient outcomes, reducing medical errors and enhancing surgical accuracy. AI-enabled robots can perform complex tasks and repetitive actions, allowing surgeons to focus on more critical aspects of the procedure. The integration of AI in surgery represents a transformative advancement with the promise of faster, safer, and more effective surgical interventions.

37. AI Algorithm for Corpus Callosum Assessment

This project aims to create an automated, accurate, and scalable solution for identifying prenatal fetal brain anomalies using ultrasound images and deep learning. By combining advanced computer vision with deep learning, medical professionals can make well-informed decisions and offer timely interventions, ultimately improving patient outcomes.

Utilizing ultrasound imaging and advanced deep learning, the prenatal fetal brain anomaly detection project holds promise for transforming prenatal care. Timely and accurate detection of brain pathologies empowers healthcare professionals to provide interventions that may save lives and enhance outcomes. This innovation could revolutionize prenatal diagnostics and advance healthcare practices and research.
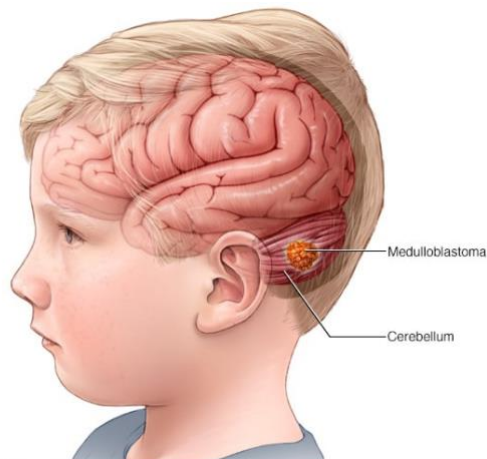
Medulloblastoma

Cerebellum

38. Prediction of brain tumor

The number of brain X-ray examinations in Turkey's healthcare system has exceeded 15 million, so Turkey's Brain Project was implemented by Turkey's Digital Transformation Office to help doctors and reduce their workload. Within this project, systems based on AI perform various analyzes on X-ray images of the brain. As soon as an X-ray image is acquired, the AI-based system automatically performs the analysis and sends the results to the hospital's appropriate imaging system. This AI-powered system prioritizes X-ray images based on analysis results and presents them to doctors for evaluation. This project was implemented in order to intervene more quickly in patients who may need urgent medical intervention and to reduce the possibility of a number of complications.

"Turkey's Brain Project" was initiated by the coordination of the Digital Transformation Office of the Presidency of the Republic of Turkey, Gazi University Hospital and Gazi University Faculty of Engineering and was first implemented in Gazi University Hospital. Within the framework of the project, various AI models were developed using the infrastructure of the Digital Transformation Office. Various anomalies (stroke, tumor, etc.) can be detected in X-ray images using models.

39. Application of "Micromedex" in healthcare

Micromedex is a leading provider of evidence-based clinical information and drug databases, revolutionizing healthcare access. Its vast drug information database contains accurate details on medications, enabling informed decisions. Micromedex's evidence-based approach improves patient safety and treatment outcomes.

Decision-support tools facilitate efficient clinical decision-making, including drug interaction checkers and dosage calculators. The user-friendly interface ensures easy access on desktop or mobile devices, streamlining workflow and enhancing care delivery.

Micromedex's commitment to innovation led to patient education materials, disease-specific guidelines, and multimedia content, fostering communication between providers and patients, empowering active participation in treatment decisions.

40. Application of "Merge" in healthcare

Merge offers comprehensive and flexible imaging solutions for radiology, cardiology, and other medical imaging needs. With cutting- edge technology, healthcare professionals access powerful tools for enhanced diagnostics, streamlined workflows, and improved patient care.

For radiology, Merge's PACS ensures efficient image retrieval, enabling quick reviews from anywhere, supporting emergencies and remote collaborations.

In cardiology, specialized solutions provide comprehensive image analysis and reporting, facilitating accurate diagnoses and seamless data exchange with EHRs.

Merge's imaging solutions extend to other areas like MRI and CT scans, ensuring smooth data management across medical imaging.

The user-friendly interface maximizes efficiency, while robust encryption ensures patient data security and regulatory compliance.
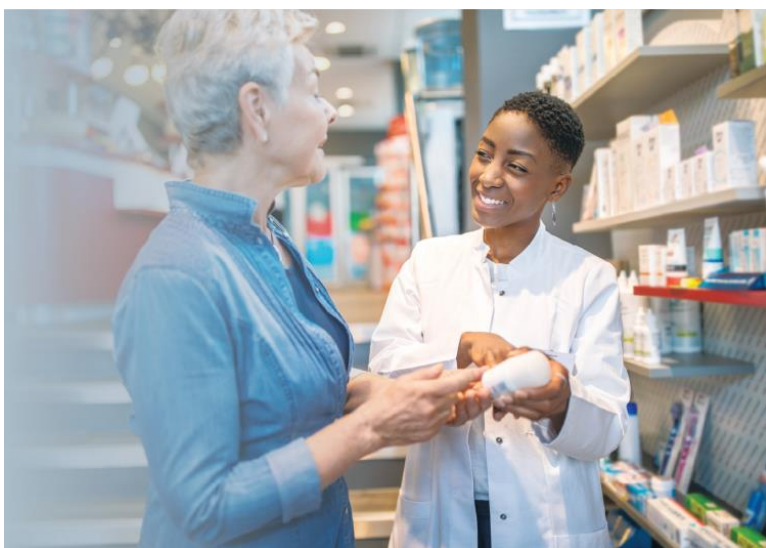
41. Automation of Physical Therapy

Sword Health, a trailblazing healthcare tech company, uses AI and motion capture to redefine physical therapy. Wearable motion sensors track patient movements, and AI algorithms analyze the data, identifying impairments and monitoring progress. An interactive virtual therapist guides patients in real-time, enhancing engagement and adherence. Remote therapy sessions increase accessibility and provide personalized care. This data-driven approach improves patient outcomes and empowers effective rehabilitation.

42. Automation of Data Management

Remedy Health uses AI to revolutionize medical data sharing and accessibility. Their platform streamlines data exchange among healthcare providers, improving coordination and patient outcomes. Patients benefit from easy access to medical information and an enhanced understanding of their health. The AI-driven platform provides valuable insights for healthcare providers, supporting evidence-based decision-making. Remedy Health's commitment to data security ensures privacy compliance and accurate data management.

43. Automation of sending emergency medical aid

Corti enhances EMS dispatching with AI, leading to faster and more precise response times. Its algorithms analyze emergency calls in real-time, detecting critical indicators of life-threatening conditions. The AI continuously learns and improves, refining its performance over time. This integration accelerates response times and ensures efficient resource allocation, reducing the burden on dispatchers while delivering life-saving measures promptly.

44. Predicting the probably of death of patients

Researchers at the University of Pennsylvania have developed an AI system that can predict which patients are at risk of cardiac arrest. AI algorithms were trained on data from more than 300,000 patients who lost their lives and recovered, and this algorithm was able to predict deaths with 87% accuracy.
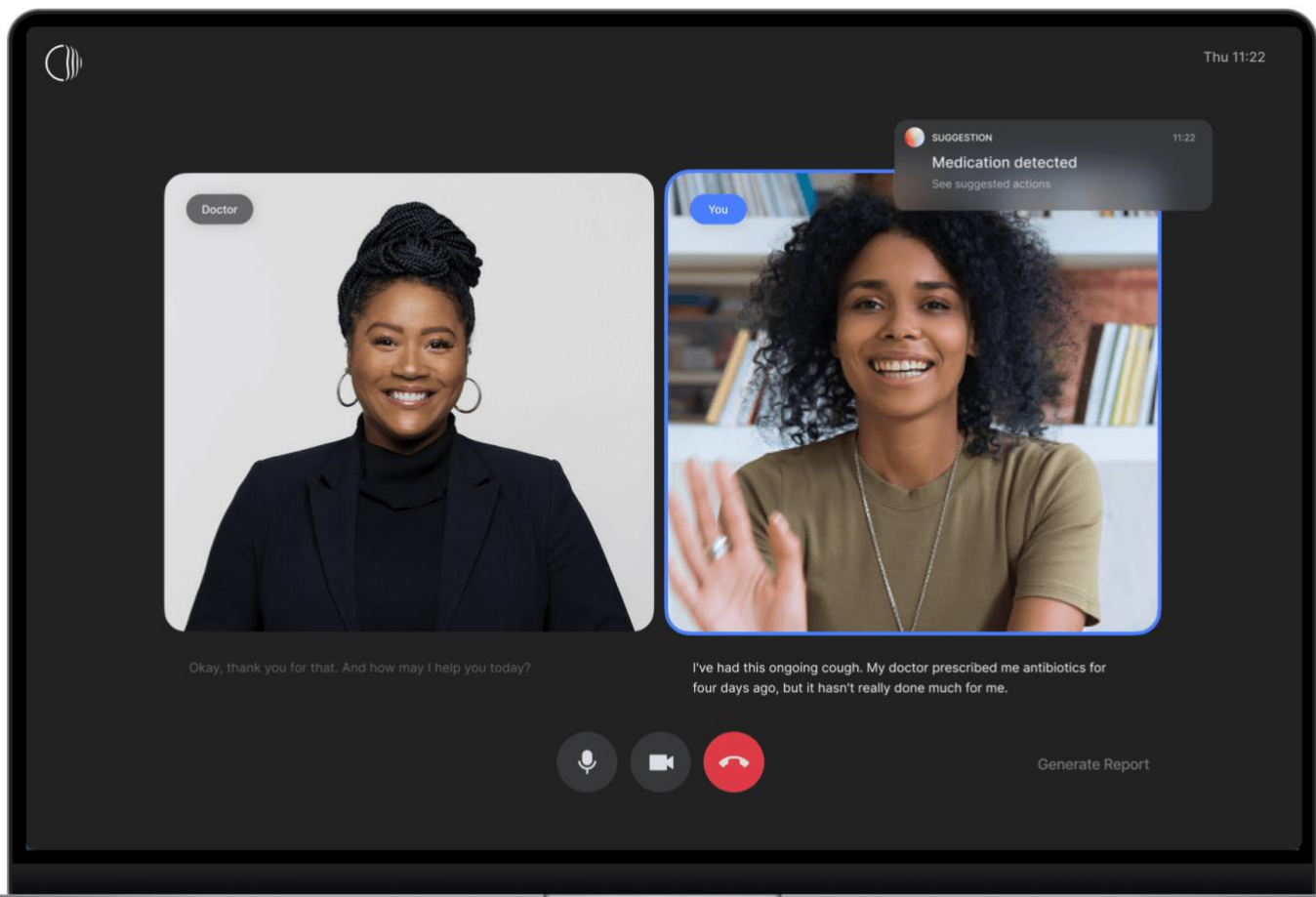
45. Breast cancer prediction

Breast cancer is both the most prevalent type of cancer across the world and a malignant disease with the highest rate of cancer-related mortality among women. According to the 2020 data of the World Health Organization; the treatment of 685.000 women out of 2,3 million who have been diagnosed with breast cancer across the world resulted in death. Breast cancer comes first among the most prevalent types of cancer in our country. In order to reduce the rate of mortality, early diagnosis plays a critical role in the treatment of cancer. Within the scope of this Project; it is aimed to
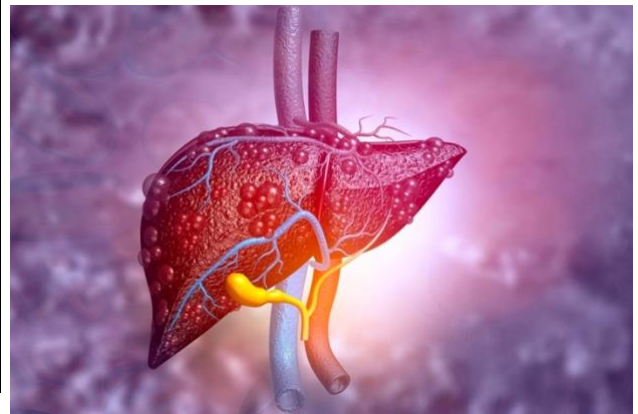
• develop artificial itelligence model which helps radiologists diagnose with a decision support system and for the early diagnosis of breast cancer during the assessment of mammography images,

• increase efficiency and the rate of accuracy of radiologists in reading the mammography films,

• minimize the unfavorable cases which are possible to emerge due to human error during the assessment of the mammography.

This AI system has been subjected to the validation tests in such hospitals as Başkent University Ankara Hospital, Ankara University Faculty of Medicine İbni Sina Research and Application Hospital, and it has been verified by the senior specialist physicians and academics that the performance and model success is over 90%. In addition, the specialist physicians and academics has been maintaining efforts for improving the model success.

46. Liver transplantation

Liver transplantation has an important role in organ transplants. According to the health statistics for 2020 published by the Ministry of Health, approximately 13% of organ transplants and 7% of those awaiting organ transplantation are liver transplants Liver transplantation is the treatment of liver failure and the liver to be transplanted is obtained from cadavers or living donors that fulfill the appropriate conditions. Especially in living transplants, it is of vital importance to calculate the volume and weight of the right lobe of the liver to be given to the recipient and the left lobe to remain in the donor correctly before the operation. Within the scope of this project, it is aimed to

• Accelerate the preliminary preparation processes carried out by radiologists specialized in the relevant field before liver transplantation,

• Develop a decision support system that can be fully automated or semi-automated at any stage before liver transplantation, where the relevant specialized radiologist can make various inputs/edits,

• Develop an end-to-end decision support system that detects the suitability of a potential donor for liver transplantation.

Endnotes

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Our Mission:
To make maximum use of the opportunities created by the Fourth Industrial Revolution and to strengthen the position of our country in this field, to carry out cooperation and coordination with local and international institutions, as well as the analysis and coordination of strategies and projects on the digital economy.

Our Vision:
To support the development of the digital economy and ensure that our country benefits from the technologies of the Fourth Industrial Revolution and ranks among the leading countries in this field.