Review on Smart Healthcare prediction system and Efficient Monitoring using logistic regression in Artificial intelligence

Author
G SRINIVASAN
Computer Science and Engineering
srinivasgopalan@aiet.org.in

Student 1
SOUMYA
Computer Science and Engineering
nsoumyagouda@gmail.com

Student 2
SPANDANA SHETTY
Computer Science and Engineering
spandanashetty07216@gmail.com

Student 3
SRINIVASA M
Computer Science and Engineering
srinivasmsoppin@gmail.com

Student 4
SRINIVASA L V
Computer Science and Engineering
senusrinivas769@gmail.com

Alvas Institute of Engineering and Technology, Mijar, Moodabidri, Karnataka, India

Abstract- **Now a days smart healthcare for physicians, nurses, radiologists, researchers, pharmacists, emergency medical services, and many other healthcare workers, artificial intelligence is becoming more essential. In order to effectively address issues facing the healthcare sector and to enhance patient care plans, this study suggests building a smart healthcare system with artificial intelligence. The suggested AI- assisted system demonstrate its ability to aid a patient who is admitted to the hospital via emergency medical services, handle the patient's data with simplicity, and provide early disease diagnosis. It has the ability to automatically identify complex patterns that radiologists have provided, analyze all genetic and molecular data in the clinic, and assist physicians by generating reports from clinical laboratories, AI-generated radiologist reports, and many other sources.**

Keywords IoMT, NLP, EHR, Logistic regression, Augmented Reality.

I. INTRODUCTION

The definition of artificial intelligence (AI) is the intelligence possessed by machines as opposed to that of humans or other living things. The study of "intelligent agents," or any agent or device that can sense and comprehend its environment and take appropriate action to maximize its chances of accomplishing its goals, is another definition of artificial intelligence (AI). AI also describes scenarios in which machines are able to learn and analyze like human minds and, as a result, we can solve many day life problems. Machine learning (ML) is also plays a very important role in all the sectors [1].
The COVID-19 pandemic has suddenly spread, raising concerns throughout the whole healthcare system. The situation has led to many new technologies thanks to the Internet of Medical Things (IoMT). In addition, COVID19 has inspired scientists to create a new, "smart," healthcare system that prioritizes early diagnosis, treatment, education, and facilitating adjustment to the new normal [6].

In addition to providing a brief overview of many new technologies that support IoMT and the difficulties in creating a smart healthcare system, this review seeks to determine the role that IoMT applications play in enhancing the healthcare system. It also analyzes the current state of research demonstrating the benefits of IoMT to patients and the healthcare system [16].

A fundamental component of digitally transformed businesses, information and communication technology (ICT) can improve competitive advantage and operational efficacy. Modern digital devices and advanced technologies are widely used in the industries for value generation and innovation in the Fourth Industrial Revolution. The healthcare sector is very important. In order to improve care quality and operational efficiency, hospitals and other healthcare facilities worldwide, particularly in developed economies, are aggressively implementing digital technologies, including artificial intelligence (AI), machine learning, big data analytics, smart sensors and robots, and the Internet of Things (IoT) According to a Hewlett-Packard Enterprise research, Aruba found that over 60% of hospitals globally had integrated IoT into their operations [2].

- At the Radiological Society of North America (RSNA) conference in Chicago in December 2018, dozens of new and established image device companies gave presentations about their AI initiatives that support precise and dependable diagnosis and appropriate patient

treatment based on the data obtained from clinical examinations.

- Miyashita and Brady [21] gave an example of discharged patients they were given an armband with Wi-Fi capability to remotely monitor vital signs from a group of hospitals serving 500,000 people in the southeast England, including rate of respiration, oxygen saturation rate, pulse rate, blood pressure, and body temperature. In this instance, AI systems that evaluate patient data in real-time greatly decreased the rates of hospital readmissions and ER visits. There was also a 22% decrease in the necessity of costly house calls.

  Over time, the treatment plan's adherence rate rose to 96% from the industry average of 50%. Another example is the $4 million in savings that Grady Hospital, a public hospital in Atlanta, USA, achieved over a two-year period from a 31% decrease in readmission rates because of decrease in readmission rates over a two-year period because of the usage of AI enabled tool to identify patients who are "at risk"[18].

Because AI has the potential to bring many revolutionary advancements in the treatment of human diseases and public health, it has drawn interest from researchers, clinicians, technology and program developers, and consumers in a variety of disciplines. By 2021, hospitals will spend $6.6 billion a year on AI-related technology, predicts Accenture. "AI applications could create up to $150 billion in annual savings for U.S. healthcare by 2026," according to Safavi and Kalis

II. Significant role of AI in healthcare sector

Normally by using artificial intelligence and machine learning we can design our own health condition prediction system and as we know ai is ruling whole world and it entered all the fields not only health field but also many other fields like business, marketing education, IT industries etc. Health field is one of the major fields where usage of AI is more because all the tools or healthcare kits can be converted into ai generated and AI controlled one.AI generated tools or healthcare kits performs the task more efficiently and speedly when compared to the tools controlled by human beings.no of errors occurred by the AI generated kits are less [4].

Precision medicine, which predicts which treatment regimens are likely to be effective for a patient based on a variety of patient features and the treatment environment, is the most popular use of classical machine learning in the healthcare industry. Supervised learning is the process of using a training dataset for which the end variable (such as the onset of disease) is known. This is necessary for the vast

majority of machine learning and precision medicine applications [3].

There are many AI researchers they started their research from the year 1950 and now they have invented many smart solutions in healthcare sector. Applications in speech recognition, text analysis, translation of language, and other language related fields are included in the field of natural language processing (NLP). Semantic NLP and statistical NLP are the two main methods for approaching it. Recent improvements in recognition accuracy have been attributed to statistical natural language processing (NLP), which is based on the concept machine learning, that specifically on deep learning neural networks.

The development, interpretation, and categorization of clinical documentation and published research are the main uses of natural language processing (NLP) in the healthcare industry. NLP systems are capable of conducting conversational AI, analyzing unstructured clinical notes on patients, and preparing reports (such as those on radiological exams). They can also transcribe patient conversations. In the 1980s, expert systems that relied on sets of "if-then" rules dominated AI technology and were widely employed in both those and subsequent eras for commercial purposes. From the previous few decades AI is extensively used in the healthcare industry for "clinical decision support" and are still in widespread usage today. A set of guidelines is currently provided by several electronic health record (EHR) providers along with their systems.

Given that over 200,000 industrial robots are installed annually worldwide, physical robots are by now well known. In settings like factories and warehouses, they carry out predetermined duties including lifting, shifting, welding, or assembling goods, as well as carrying supplies to hospitals. In the past few years robots are trained to work better with humans and are easier to train by guiding them through a desired activity. Additionally, when additional AI features are included into their brains usually, their operating systems become more sophisticated. It appears plausible that physical robots will eventually incorporate the same advancements in intelligence that we've seen in other fields of artificial intelligence [21].

Surgical robots, which were first authorized in the United States in 2000, give surgeons "superpowers" by enhancing their vision, enabling them to make accurate, less invasive incisions, sutures wounds, and other tasks. But human surgeons continue to make important decisions.
Gynecologic, prostate, and head and neck surgeries and many other surgeries are also performed with the help of robotic assistance.

There are many techniques in Artificial intelligence and Machine learning one of them is logistic regression logistic regression is useful in many ways in health sector and also we will make use of Artificial intelligence and machine learning by using logistic regression.

A. WHAT IS LOGISTIC REGRESSION?

A supervised machine learning approach called logistic regression predicts the likelihood of a result, an occurrence, or an observation in order to complete binary classification problems. The output of the model is binary, or dichotomous, with two possible outcomes: true or false, 0/1, or yes/no.

By examining the correlation between one or more independent variables, logical regression divides data into distinct groups. It is often applied in predictive modeling, in which the model calculates the mathematical likelihood of an event falling into a particular category or not. For instance, the numbers 0 and 1 stand for negative and positive classes, respectively. In binary classification issues, where the outcome variable reveals one of the two categories, (0or 1), logistic regression is frequently utilized.
Here by using Logistic regression we can create a logistic model about the heart condition. That logistic model helps to monitor the condition and working of the heart and we can create logistic model to monitor the whole body of a human being and we can predict the diseases. This logistic model will help the doctors to know about the working condition of the human body

Importance of logistic regression in prediction of heart attacks: The likelihood of heart attacks: Using a logistic model, medical professionals can ascertain the correlation between an individual's weight, level of exercise, and other variables in order to forecast the likelihood of a heart attack or other medical issues [5].

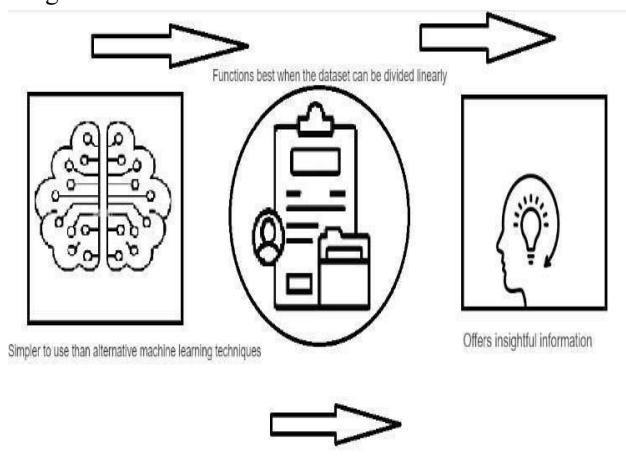A Diagram representing the key advantages of logistic regression:

Fig 1: Key advantage of logistic regression

B. Equation, for Logistic Regression with Assumptions

To map predictions and their probabilities, logistic regression employs a logistic function known as a sigmoid function. An S-shaped curve that transforms any real value into a range between 0 and 1 is known as the sigmoid function. Moreover, the model predicts that the instance belongs to that class if the estimated probability produced by the sigmoid function exceeds a predetermined threshold on the graph. The model anticipates that the instance does not belong in the class if the calculated probability is less than the predetermined threshold.

For instance, the output of the sigmoid function is regarded as 1 if it is more than 0.5 Conversely, the output is categorized as 0 if it is less than 0.5. Furthermore, the expected value of y will be 0 if the graph continues to the negative end, and vice versa. In other words, if the output of the sigmoid function is 0.65, it implies that there are 65% chances of the event occurring; a coin toss, for example.

For logistic regression, the sigmoid function is known as an activation function and is described as follows:

$$f(x) = \frac{1}{1 + e^{-x}}$$

where,

- e = base of natural logarithms

- value = numerical value one wishes to

    transform

Logistic regression equation is represented as following equation:

$$y = \frac{e^{(b_0 + b_1 X)}}{1 + e^{(b_0 + b_1 X)}}$$

here, x = input value   y = predicted

output   b0 = bias or intercept

term   b1 = coefficient for input(x)

This equation is comparable to linear regression, in which weights or coefficient values are used to mix the input

values linearly in order to predict an output value. Nevertheless, the output value described here is a binary value (0 or 1) rather than a numeric value, in contrast to linear regression [5].
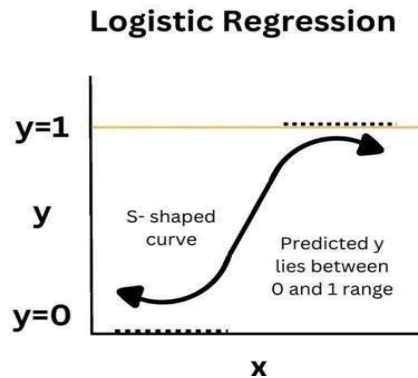

Fig 2 Logistic Regression Graph

There are many important aspects for implementing Logistic Regression into Practice because it plays an very important role in the construction of a prediction model.

C. Important characteristics of the logistic regression formula

The logistic regression equation's typical characteristics include:

1. The dependent variable in logistic regression adheres to the "Bernoulli distribution."
2. The "maximum likelihood" is the basis for estimation and prediction.
3. he coefficient of determination, often known as R squared, is not assessed in logistic regression as it is in linear regression. Instead, a concordance is used to evaluate the model's fitness.

There are many techniques in ALML including logistic regression which are useful to monitor the body hence the usage of AI in healthcare field is increased drastically.
Some Strategies For Implementing AI Technology In Healthcare

A. ENHANCING THE ORGANIZATION OF PATIENTS

The amount of time and effort it takes for patients to receive the correct medical practitioner is a problem that is often highlighted in the healthcare industry. AI can help speed up and improve the accuracy and efficiency of the triage process, ensuring that patients receive the resources and care they actually require and that their medical needs are addressed as quickly as possible by qualified professionals [24].

In order to efficiently minimize time spending and lengthy waiting periods for patients, medical personnel must also prioritize their patients depending on the urgency of the care that is needed. This extra layer of priority is crucial [8].

B. RAISING THE BAR FOR TELEMEDICINE

Even when we made the gradual switch back to in-person care, telemedicine has only increased in popularity, despite experiencing a significant surge during the Covid-19 outbreak. Having said that, there is still more to be done to enhance the way that remote care is now provided, as telemedicine is a popular option for patients all over the world, especially those who live in distant places.AI has the potential to advance telemedicine to a point where it is predicted to expand too quickly, enhancing the quality of care that patients receive from a distance with increased personalization, quicker response times, tailored advice, and research and educational materials to assist the medical professional before or during the patient provider relationship[19].

C. INCREASING PERSONALIZED MEDICINE'S SCALABILITY

Scalability has always been a challenge with personalization, but AI can truly push the envelope in this area by rapidly analyzing and synthesizing individualized data sets to offer solutions that are required to the patient need.
Artificial Intelligence (AI) has the potential to address the primary obstacle impeding the rapid advancement of personalized medicine, which is the lengthy process of creating a customized treatment plan that takes into account a patient's genetic information and medical history [17].

D. MAKING PREVENTIVE CARE POSSIBLE

AI's capacity for quick data analysis and eventually the development of predictive analytics skills are Quickly responding to significant health issues that people bring to the attention of clinicians.

Efficiently shifting from reactive to preventative care as standard practice, guaranteeing that some illnesses and disorders are identified and treated in advance because of the help of AI. As we watch the natural growth of AI's capabilities and its impact on the industry, executives must continue to closely monitor the tremendous progress that AI has already achieved in accurately identifying and treating unusual illnesses[15].

E. ELIMINATING LINGUISTIC BARRIERS

AI can offer the best solution to issues with cross-border assistance and communication hurdles between patients and providers that have existed for as long as time. Language barriers can be readily overcome by professionals with the use of technology, so eliminating yet another obstacle that impacts the regularity and quality of care that patients receive. In addition to making, it easier for physicians to give

patients the help they need, this can also provide easy access to patients about medical details that leads to quality medical care, irrespective of their language or place of residence.

F. VIRTUAL NURSING ASSISTANTS

According to a survey, 64% of patients feel at ease using AI to get responses from support nurses around-the-clock. AI virtual nursing assistants, or chatbots, apps, or other interfaces driven by AI, can aid with drug inquiries, report cases to physicians or surgeons, and help patients make an appointment with a doctor. Routine tasks like these can relieve clinical staff members of some of their workload so they can focus more of their time on patient care, which is mostly a human interaction and judgment call[25].

G. REDUCTION OF DOSAGE ERRORS

AI has the potential to detect mistakes made by patients when self-administering their own drugs. Research published in Nature Medicine provides one example, revealing that up to 70% of patients do not take insulin as directed, An AI enabled background-operating device, similar to a Wi-Fi router, might be used to detect errors the patient makes when using an insulin pen or inhaler

[4].

H. PREVENTION OF FRAUD

Fraud in the healthcare sector costs the taxpayer $380 billion annually and drives up out-of-pocket and medical premium costs for patients. Artificial intelligence (AI) can help spot odd or dubious trends in insurance claims, like charging for high-priced treatments or procedures that were never provided, unbundling which is the practice of billing for each step of a procedure separately and ordering pointless tests in order to profit from insurance reimbursement.
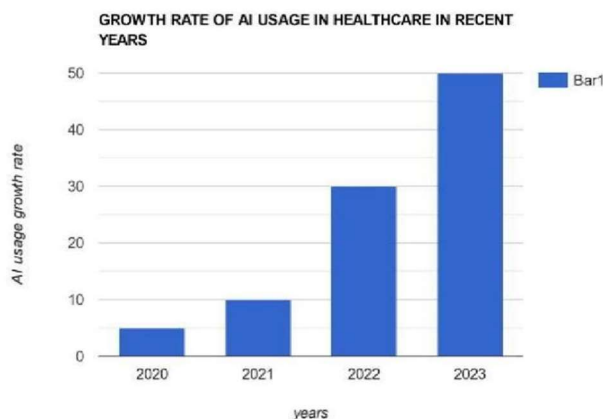

Fig 3 Growth rate of AI Usage in Healthcare

III. APPLICATION:

a. helping in Disease Diagnosis:
AI reduces errors in jobs like cervical cancer screening and eye disease diagnosis, hence assisting in the proper diagnosis of diseases [10].

b. Support for Nursing & Management:
AI streamlines paperwork, interacts with patients via chatbots, anticipates their requirements, and oversees hospital operations to provide quicker care and more efficient procedures [9].

c. Real-World Examples:
AI increases the accuracy of cancer diagnoses in India. Depending on the type of cancer, AI helps with treatment decisions in South Korea. AI is helping doctors in China diagnose pediatric illnesses with promisingly high accuracy rates

d. Advantage and Difficulties of AI in Healthcare:
* **Possibilities**: Improves disease treatment, patient involvement, decreases errors, boosts efficiency, and generates new employment prospects [22].
* **Difficulties**: The need for ethical standards in AI development, patient-AI trust concerns, and accountability for AI failures.

IV. ADVANTAGES:
- Augmented Reality (AR) Surgical Assistance: Using AI algorithms and AR, this technology gives surgeons access to real-time patient data while they do procedures, improving accuracy and lowering risks [12].
- It is notable for its ability to use cutting-edge visualization and guidance to transform surgical procedures and enhance patient outcomes.
- Integration of Music Therapy: AI-driven music therapy systems generate customized playlists by analyzing emotional & physiological reactions, encouraging emotional and physical well-being. This novel strategy makes use of music's therapeutic properties to improve conventional therapy approaches and provide cutting-edge support for a range of medical ailments [23].
- Community Health Monitoring: AI-powered social listening tools track changes in community health in real time by analyzing social media and other data sources [13].
- Public health and crisis management campaigns are helpful to spread awareness among the people with customized actions and resource allocation plans. It is notable for its capacity to handle health issues.

V. FUTURE SCOPE:

- **AI-powered virtual assistants:**

These intelligent virtual assistants scan patient histories, symptoms, and lifestyle data to make recommendations about diagnoses and point patients in the direction of qualified healthcare professionals. This improves patient navigation of the healthcare system and increases accessibility to care [7].

- **Augmented reality surgery:**

Surgeons using augmented reality overlays to guide and provide real-time anatomical information during treatments, potentially reducing complications and shortening patient recovery periods [11].

- **customized medicine on steroids**:

AI is evaluating each person's unique genetic and molecular profile to determine the likelihood of a disease and customize treatment regimens that maximize effectiveness and minimize side effects. This is a huge step forward to fully tailored healthcare [22].

- **Early disease identification with AI powered wearables:**

By using smart wearables to continuously monitor vital signs and biomarkers, diseases can be detected in their early stages by AI, which changes the game for preventive care by enabling prompt intervention and better results [20].

VI. CONCLUSION:

The review paper provides a comprehensive overview of the application of artificial intelligence (AI) in the healthcare sector, highlighting its potential to revolutionize patient care and operational efficiency. It discusses various AI technologies such as machine learning, natural language processing, robotics, and logistic regression, showcasing their role in disease diagnosis, personalized medicine, telemedicine, and fraud prevention. The paper also outlines strategies for implementing AI in healthcare, emphasizing the importance of improving patient organization, enhancing telemedicine, scaling personalized medicine, and enabling preventive care. The paper emphasizes the significance of AI in improving healthcare outcomes, reducing errors, enhancing efficiency, and creating new opportunities. It discusses real-world examples of AI applications in disease diagnosis and treatment decisions, showcasing its potential to transform healthcare delivery. However, the paper also acknowledges the challenges of AI implementation,

including the need for ethical standards, patient trust, and accountability. In conclusion, the review paper underscores the immense potential of AI in revolutionizing healthcare, offering numerous advantages such as improved disease treatment, patient engagement, error reduction, and efficiency enhancement. However, it also highlights the need for addressing challenges such as ethical concerns and patient trust to fully realize the benefits of AI in healthcare.

REFERENCE:

[1] M. Dhimal, F. Chirico, B. Bista, S. Sharma, B. Chalise, M.L. Dhimal, O.S. Ilesanmi, P. Trucillo, D. Sofia, Impact of air pollution on global burden of disease in 2019, Processes 9 (2021) 1719, https://doi.org/10.3390/pr9101719.

[2] M. Tabaa, F. Monteiro, H. Bensag, A. Dandache, Green industrial Internet of things from a smart industry perspectives, Energy Rep. 6 (2020) 430–446, https://doi.org/10.1016/j.egyr.2020.09.022.

[3] R. De Michele, M. Furini, IoT healthcare: benefits, issues and challenges, in: ACM Int. Conf. Proceeding Ser., 2019, pp. 160– 164.

[4] K. Haricha, A. Khiat, Y. Issaoui, A. Bahnasse, H. Ouajji, Towards smart manufacturing: implementation and benefits, Proc. Comput. Sci. 177 (2020) 639–644, https://doi.org/10.1016/j.procs.2020.10.091.

[5] L. Wang, L. Sha, J.R. Lakin, J. Bynum, D.W. Bates, P. Hong, L. Zhou, Development and validation of a deep learning algorithm for mortality prediction in selecting patients with dementia for earlier palliative care interventions, JAMA Netw. Open. 2 (2019) e196972.

[6] S.S. Vedaei, A. Fotovvat, M.R. Mohebbian, G.M.E. Rahman, K.A. Wahid, P. Babyn, H.R. Marateb, M. Mansourian, R. Sami, COVID-SAFE: an IoT-based system for automated health monitoring and surveillance in post-pandemic life, IEEE Access 8 (2020) 188538–188551.

[7] Lai DTH, Begg RK, Palaniswami M. Computational intelligence in gait research: a perspective on current applications and future challenges. IEEE Trans Inf Technol Biomed 2009;13(5):687–702.

[8] Chin LC, Basah SN, Yaacob S, Juan YE, Kadir AKAB. Camera systems in human motion analysis for biomedical applications. In: Proceedings of International Conference on Mathematics, Engineering and Industrial Applications 2014; 2014 May 28–30; Penang, Malaysia; 2014. p. 090006.

[9] Man DWK, Tam SF, Hui-Chan CWY. Learning to live independently with expert systems in memory rehabilitation. Neuro Rehabilitation 2003;18 (1):21–9.

[10] Ben Abacha A, Zweigenbaum P. MEANS: a medical questionanswering system combining NLP techniques and semantic Web technologies. Inf Process Manage 2015;51(5):570–94.

[11] BouAssi E, Nguyen DK,Rihana S, SawanM.A functionalgeneticscheme for seizure forecasting in canine epilepsy. IEEE Trans Biomed Eng 2018;65(6):1339–48.

[12] Gagliano L, Bou Assi E, Nguyen DK, Rihana S, Sawan M. Bilateral preictal signature of phase– amplitude coupling in canine epilepsy. Epilepsy Res 2018;139:123–8.

[13] Dinkelbach HU, Vitay J, Beuth F, Hamker FH. Comparison of GPU- and CPUimplementations of mean-firing rate neural networks on parallel hardware. Network Comput Neural Syst 2012;23(4):212–36.

[14] D Lee J, Lee K, Kim D, Kim K. Development of smart toothbrush monitoring system for ubiquitous healthcare. In: Proceedings of the 28 IEEE EMBS Annual Conference, New York. Sept. 2006:6422– 6425.

[15] Lee KH, Lee JW, Kim KS, et al. Tooth brushing pattern classification using threeAxis Accelerometer and magnetic sensor for smart toothbrush. In: 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society. 2007.

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 10, Issue 5, May 2024

https://doi.org/10.1109/IEMBS.2007.4353265.

[16] Tabatabaei SM, Kasrineh MR, Sharifzadeh N, Soodejani MT. COVID-19: an alarm to move faster towards "smart hospitals. Online J Public Health Inform. 2021;13(1):e7. https://doi.org/10.5210/ojphi.v13i1.11515.

[17] Van der Putte D, Boumans R, Neerincx M, Rikkert M, de MM. A social robot for autonomous health data acquisition among hospitalized patients: an exploratory field study. In: 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI); HRI'19; March 11-14, 2019; Daegu, Korea (South), Korea (South). 2019.

[18] Shah amabadi MS. A network mobility solution based on 6LoWPAN hospital wireless sensor network (NEMO-HWSN). In: Proceedings of the 2013 Seventh International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing. July 2013:433–438. Taichung, Taiwan.

[19] Groves M. Philips receives FDA clearance for the use of its ultrasound portfolio to manage COVID-19-related lung and cardiac complications. Available online: https://www.philips.com/aw/about/news/archive/standard/news/ press/2020/2 0200513-philips-receives-fda-clearance-fortheuseofits-ultrasound-portfolio-to-manage-covid-19 relatedlung-andcardiac complications. html. Accessed May 11, 2021.

[20] Gulshan V, Peng L, Coram M, et al. Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. J Am Med Assoc. 2016;316(22):2402–2410. https://doi.org/10.1001/jama.2016.17216.

[21] Mesko, B. Artificial Intelligence Will Redesign Healthcare. 2016. Available online: https://www.linkedin.com/pulse/artificialintelligence-redesignhealthcare-bertalan-mesk%C3%B3- md-phd (accessed on 10 May 2020).

[22] Aabo, G. Being Patient-Centric in a Digitizing World; McKinsey and Company: New York, NY, USA, 2016.

[23] Lee, S.; Lee, D. Healthcare wearable devices: An analysis of key factors for continuous use intention. Serv. Bus. 2020, 14, 503–531. [CrossRef].

[24] Lee, D. Strategies for Technology-driven Service Encounters for Patient Experience Satisfaction in Hospitals. Technol. Forecast. Soc. Chang. 2018, 137, 118–127. [CrossRef].

[25] Lee, D. Effects of Key Value Co-creation Elements in the Healthcare System: Focusing on Technology Applications. Serv. Bus. 2019, 13, 389–417. [CrossRef].