



Rahai: An AI-powered chatbot to support healthcare infrastructure

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Abstract

A Chatbot(Rahai) is developed to support the existing healthcare infrastructure and improve the quality of treatment given to the patients, Initially the regions being identified where the quality of treatment is hindered due to the lag in infrastructure to support the present infrastructure in the healthcare industry . the primary target are the zones where the number of doctors to that of the number of patients is very low. To bridge this gap and enhance the Quality of treatment given to patients (Rahai) is being introduced, with Rahai aim is to reduce the time span of patient and doctor's interaction so that more patients can be screened in less time and improving the overall efficacy and quality of treatment.

Introduction

Existing Indian healthcare Infra -

Following the commencement of the Ayushman Bharat programme launched by Government of India in order to promote the healthcare infrastructure and policies in the country, Sub Centers and Primary Health Centers are being strengthened by transforming them into advanced Health and Wellness Centers, which would provide full Primary Healthcare services as well as advanced Healthcare services. In a gradual approach, SCs and PHCs will be turned into Health and Wellness Centers."There are a total of 160713 Sub Centers (SCs) operating in India as of March 31, 2019 (157411 rural + 3302 urban)". Furthermore, In rural areas, 7821 centres have been transformed to Health and Wellbeing Centers (HWCs), whereas in urban areas, 3302 centres have been converted to healthcare wellness centre. There seem to be 30045 Primary Health Clinics (PHCs) operating in India (24855 rural and 5190 urban). Furthermore, out of 24855 rural PHCs, 8242 PHCs in rural areas have been converted to HWCs, whereas 1734 PHCs in urban areas have been converted to HWCs. There seem to be 5685 Local Medical Clinics (CHCs) in operating across the country (5335 rural + 350 urban). The number of HW (F) / ANM at Subsidiary Centers and PHCs has increased by 75.9% from 133194 in 2005 to 234220 in 2019.. According to IPHS regulations, there is a 3.9 percent gap in HW (F) / ANM positions at SCs & PHCs as of March 31, 2019. There are 5335 rural + 350 urban Community Health Centers (CHCs) operational in the country. The number of specialized doctors in CHCs has dropped somewhat from 4074 in 2018 to 3881 in 2019. "In the states of Andhra Pradesh , Rajasthan , and West Bengal , there has been a decrease . There has been a drop in the states of Andhra Pradesh, Rajasthan, and West Bengal. However, there has been an increase in the states of Uttar Pradesh and Telangana Surgical specialists (85.6%), obstetricians and gynaecologists (75%), physicians (87.2%), and paediatricians (87.2%) are all in short supply (79.9 percent). In 2019, there seems to be an overall lack of 81.8 percent specialists in CHCs as compared to IPHS criteria. At the Community Health Centers, surgeons, obstetricians and gynaecologists, physicians, and paediatricians provide specialised medical care. Since about March 31, 2019, 79.5 percent of surgeon, 64 percent of gynecology and obstetrics, 77.5 percent of physicians, and 69.7% of paediatrics at CHCs were vacant".¹

Healthcare Industry has been one of India's most prominent Industry with significant businesses in terms of generating the wealth and jobs in the country. The healthcare sector includes a number of components such as hospitals, medical equipment, clinical trials, outsourced, telehealth, healthcare services, medical coverage, and medical equipment. As a consequence of greater coverage, services, and higher investment from both public and private organisations, the Indian health system is quickly increasing. India has long suffered with insufficient facilities, particularly in the form of a scarcity of well-equipped healthcare facilities." Furthermore, in comparison to the urgent need, the rate of development of these clinical teaching or training facilities remains low. Srinath Reddy, head of the Global Health Association of India, an India research group, spoke of the lack of decent monitoring tools in India." "The NRHM [National Rural Health Mission] is monitoring some quality factors, namely in maternal and child health. "Composite metrics of the health system as a whole, however, are lacking," he stated.

Private medical institutes were required by government rules to be established on a minimum of four acres of land for a long time. As a result, a number of local colleges have popped up in rural areas since it has become harder to obtain properly licensed, full-time doctors due to a lack of adequate living circumstances and poor pay rates. **2**

Lack of infrastructure –

One of India's most significant issues is a continual shortage of medically qualified personnel, such as physicians, midwives, paramedics, and basic health workers. India's rural areas, which account for about 66 percent of the total population, remain a source of concern.

When compared to the doctor to patient ratio specially in public hospitals where the footfall of the patients is enormously huge, it becomes a task to provide quality treatment to the patients.

As per a report produced by WHO, on an average it takes around 15-20 mins to monitor a patient, to take the history of the patient and then come up with the right set of solution for the patient

Manpower shortages: skilled and efficient employees are in short supply. The doctor-to-patient rate remained at an all-time low of 0.7 doctors per 1,000 people. According to the World Health Organization (WHO), 2.5 physicians per 1,000 people are necessary. This is a long process that will become better over time. **3**

Patient burden that is unmanageable -

Before the Covid-19 pandemic, healthcare facilities were already under strain because to an overburdening patient load. Managing health facilities for a population of 1.4 billion people is also a Herculean task in and of itself.

Healthcare organisations must use technology to optimise operational and clinical processes in order to manage optimal patient flow.

It's also difficult to move further than the obvious and promote virtual care procedures and telecommunication services, which might significantly reduce patient load stress.

Public health policy and proactive healthcare -

The most recent National Health Policy (NHP) 2017 emphasizes the 'Health for All' strategy, which promises to provide everyone with high-quality, low-cost healthcare. However, under the NHP 2017, there is indeed a lot more that can be done. In an ideal world, public health policy would focus on preventative rather than reactive healthcare. **4**

Although government hospitals provide care for free, many are overloaded, underequipped, and mostly located in urban areas, thus high out-of-pocket costs remain a concern. It is commonly agreed that affordable and accessible socialized medicine might greatly reduce dependence on private institutions. Government structures, on the other hand, force people

to seek treatment through private firms and pay expensive out-of-pocket charges. As a result, private hospitals provide the vast bulk of health-care services, and Indians pay for 65 percent of their own healthcare. Both the government and private entities must collaborate in this respect.

The primary issue with the healthcare service is the government's complete lack of responsiveness to the vertical. For years, knee-jerk reflex work has been recognized as important in the growth of service quality.⁵

The Existing Gap

Existing U-PHCs will be transformed to Health and Wellness Centers to enable that delivery of Comprehensive Primary Health Care (CPHC) services (HWC). Community outreach, the Medical Assistance Unit, health fairs, home visits, and group participation may be used to supplement services, but the ultimate objective should be to build a seamless care coordination that assures equality, quality, universality, and financial sustainability.

Many good and negative views on the use of healthcare chatbots were addressed, highlighting the value of individuals controlling their own health and the advantages to physiological, mental, and behavioral health outcomes.

According to many professionals, chatbots would be most beneficial for scheduling doctor visits (78 percent, 78/100), locating health facilities (76 percent, 76/100), and giving prescription information (71 percent, 71/100). However, many doctors believe that chatbots can't realistically care for all of a needs of the patient (76 percent, 76/100), didn't display human feeling (72 percent, 72/100), and can't provide comprehensive diagnosis and treatment even though they do not even understand all the patient's personal details (71 percent, 71/100).⁶

Chatbots are an excellent tool for triaging patients. Chatbots are computer programmes that converse with humans in order to provide information or services. A matrix can range from real AI to basic predicate logic systems with prepared responses, comparable to a survey or quiz on the internet. Chatbots have grown commonplace in retail and customer relations, although they are still new to health care. Despite their youth, chatbots are often used in health care for a variety of purposes, including nursing quality, clinical judgment for providers, directing staff and patients to appropriate resources, and even mental wellbeing apps like cognitive behavioural therapy and suicide interventions.⁷

Background

The idea of using virtual assistants in healthcare isn't new; it's been in the works since the inception of the technology. The demand for these advanced solutions is rising as a result of population growth and the associated strain on health systems. Digital assistants are becoming more widely employed in health, and their debut in this field has the potential to boost health-care efficiency and serve as a means of providing everyone with high-quality medical care. This research examines the current state of virtual assistant adoption and growth in health and identifies which healthcare practitioners are most in need of intelligent solutions.

In 1950, Alan Turing developed the concept of a chatbot while posing a question, "Do machine think?" The first versions were supposed to relay the Turing machine while sounding as natural as possible. ELIZA (MIT Artificially Intelligence Library) was the first known chatbot to function as a psychotherapist, and it employed predictive modelling and template-based answers to talk in a question-based manner in 1966. By adding another character to PARRY (created by Kenneth Colby) that resembled a paranoid patient, improvements were made to create a more lifelike and customized monster.

One topic that will dominate technical development in health informatics is the extent to that which artificial intelligence's promise in healthcare coverage, as well as the social and ethical challenges that come with it, will be fulfilled. The application of the Turing test to user-facing intelligent technologies in health care is an intriguing thought experiment (such as chatbots or conversational agents). In this work, I suggest that many medical decisions include value judgements, and that the physician interaction requires compassion and understanding in order to reach a joint agreement, which often entails huge regions of ambiguity and the weighing of competing risks. In medicine, wisdom may be required instead of artificial or natural intelligence. As a result, machine learning must complement rather than replace health-care practitioners, and determining the correct role of AI within healthcare consulting is an important future subject. Artificial

intelligence in health care must dominate the implementation game, not the mimicking game. We can currently distinguish two types of AI applications in healthcare. To begin, information apps employ artificial intelligence (AI) and neural networks to extract novel information from massive datasets, such as increasing radiograph and other image diagnostic performance. Second, intelligent agents and consumer apps interact with the public in real time, using inferences to provide advice or assistance based on probabilities that perhaps the instrument can compute and improve with time. Chatbots have several potential advantages, including the ability to provide clinicians more time to provide compassionate, individualised treatment. Determining the acceptable use of AI technology healthcare, and specifically in doctor visits, is an important problem for the future. We need to figure out how to combine the precision and strength of AI methodologies and technology with the doctor-patient relationship's knowledge and empathy. In the field of health care, surviving the implementation game is more crucial than finishing the imitation game.⁸

In the last decade, chatbots have been utilized to improve funding for mental health care services. The acceptability of chatbots in healthcare coverage is influenced by patient perspectives and attitudes. Patients' perspectives and attitudes around psychological health chatbots have been studied in several research.

Several companies also specialize in the treatment and management of certain tumours based on an individual's genetic traits. Because many malignancies have a genetic basis, understanding all genetic variations in cancers and their response to novel medications and regimens has become more difficult for human doctors. This approach is specialised by companies like Foundation Medicine and Flatiron Health, both of which are now owned by Roche.

Machine learning (AI) has aroused widespread fear that it may result in widespread job automation and labour displacement. According to a research conducted by Deloitte and the Oxford Martin Institute²⁶, AI might automate 35 percent of UK jobs in the next 10 to 20 years. Although some job mechanisation is feasible, other studies have indicated that a multitude of environmental factors, such as the expense of automation, labour market growth and costs, advantages of intelligent automation beyond simple labour substitute, and regulation and people, could limit actual loss of employment to 5% or less.

3. Why Chatbot?

A conversational agent, often known as a chatbot, is a software program that can speak with humans using natural language. One of the most difficult problems in AI and NLP is conversation modelling. Since the advent of artificial intelligence, creating a clever chatbot is the most challenging task. Although chatbots may do a variety of tasks, their primary job is to understand and respond to human speech. Previously, chatbot architectures were built using simple statistical methods or written by hand templates and rules. Because of their greater learning capabilities, end-to-end neural nets took over the job of these systems around 2015. Insurance, finance, and retailing are just a handful of the industries where chatbots will have a significant impact. Without a doubt, the medical profession might profit from the very same cost savings pertaining to customer service. Healthcare chatbots will be able to do more automated jobs and functions than ever before, giving them is among the most intriguing healthcare technologies to watch.⁹

AI technology (AI) is transforming the way we analyze data and enhance judgment through dilemma, reasoning, and learning, which is modernizing many aspects of our lives. Machine learning (ML) is a subset of artificial intelligence (AI) that enhances performance by feeding data to a general algorithm based on past experience rather than setting rules as in conventional methods.

With the rise of "virtual therapists," chatbots are increasingly being employed in mental health care. The usefulness of a chatbot dubbed iHelpr was evaluated in this study. iHelpr was created to offer guided self-assessment and advice in the areas of stress, anxiety, depression, sleep, and self-esteem. The usability of iHelpr was evaluated using a questionnaire created by Chatbottest and the System Usability Scale. The participants in this research considered the chatbot to be enjoyable to communicate with and simple to use. The research did, however, point out areas where considerable improvements are needed, such as Error Management and Intelligence. To improve the usefulness of the iHelpr chatbot, a list of suggestions has been compiled.¹⁰

Insurance companies, claims, and medical expenditures are all things that no one likes to deal with. AI chatbots in healthcare, thankfully, can assist with these tasks. A chatbot for healthcare might check your existing coverage, help you file a claim, and track the status of your claim. In the healthcare industry, AI technologies can help doctors with pre-authorization and billing problems.

Healthcare and artificial intelligence are converging to enhance the patient and provider experience. Though the functions of a chatbot in healthcare are now restricted, their promise for use as diagnostic tools and other applications is undeniable. They are contributing in the reduction of staff burden and administrative expenditures, as well as the improvement of patient services and the availability of a 24/7 conversation outlet, even at this early stage.

They are the future and it could be supported with the following points –

1. Effective strategy for the engagement of patients

Chatbots are designed to not only actively attract, but also captivate, patients' attention while they are receiving treatment. Despite the well-intentioned criticism, the correct technology will improve rather than weaken the provider-patient connection. Despite being on the right track, one of the most difficult elements of healthcare is that therapists routinely tell clients to keep a diary and come back a week later. Because most patients do not journal or return for various reasons, this becomes a big source of frustration. However, using AI Chatbots, patient data and instructions may be saved, and patients can be reminded to see their therapists; this can drastically alter patient management.

2. In the area of customer service and administration

A chatbot may now be found on almost any website to aid you with navigation or fixing a minor issue. As a consequence, it's unsurprising that chatbots will continue to help people navigate healthcare services. In this field, chatbots that assist schedule appointments, provide reminders, and replenish prescription medicines may be the way of the future.

3. To provide mental support

Several chatbots offer a highly human-like experience to customers. Giving them the impression that they're chatting with a real person. Many people find that merely talking about how they're feeling and any anxieties they may be having helps them to feel better. Patients in this circumstance can use a conversational chatbot for healthcare to express their feelings. If the patient needs assistance beyond the chatbot's skills, a healthcare professional may readily intervene. All while maintaining tabs on the patient's chatbot interactions.

4. What is a chatbot

Chatbots are a type of machine-learning-based AI system that are also known as chatter robots, cognitive bots, virtual assistants, laptop computers, or intelligent agents. "A computer software that can hold a wonderful conversation, generally through the internet," according to the Oxford definition. They might also be physical things that engage socially with people and other robots. Relevant knowledge is collected after evaluating the user's input, whether written or spoken, to create predetermined replies.¹¹

The trust-building process is influenced by reliability, openness, and explainability. The chatbots' advice and suggestions must be consistent. The "black box" of the chatbot must be opened in order to foster confidence.

To put it another way, consumers need to know how the suggestions were made and what information was used to make them. Furthermore, the chatbots' algorithms significantly rely on data. The data's integrity, correctness, privacy, and security are critical. Users will not disclose sensitive healthcare information to use the health chatbots if this is not the case. For artificial intelligence as a whole, governance and ethical norms are still in the early stages of research in order to allow the growth of trust and acceptance of health chatbots.¹²

Organizations and businesses have been rapidly adopting Artificial Intelligence for the automation of their processes. Artificial intelligence created the groundwork for the development of intelligent agents, which we now refer to as chat bots. Chat bots have transformed business communication and contributed in generating high customer satisfaction across the board.¹³

5. Assessing apps (e.g., Web-based quizzes) and open up opportunities are two types of health applications that examine subjective data (e.g., using diaries to track mood or medicine). It's also becoming evident that AI will not completely replace human doctors, but rather will complement their efforts in patient care. In the future, human physicians may develop jobs and job designs that rely on basically human qualities like as sympathy, communication, and big-picture integration. Some healthcare workers who refuse to collaborate with machine learning may be the sole ones who lose their employment over time. Sedimentary personal decisions are a leading cause of death and chronic illness, and also a potential health hazard Individual action has a big influence on how lifestyle choices turn out. CoachAI, a cognitively agent-assisted healthcare coaching system for providing health treatment to individuals and groups, was developed and implemented in this article. There are few approved Web-based surveys on depression and post-traumatic stress disorder that have psychometric quality comparable to the physical paper when it comes to personal tools that have been translated into a smart phone app. Some applications, like Moodpath, feature questions based on the empirically validated diagnostic criteria of the tenth edition of the Classification Of diseases (icd (ICD). Users of Moodpath are asked three distinct questions three to four times a day for 14 days, according the diagnostic criteria for depressive sickness.¹⁴ Based on the detected symptoms patterns, an algorithm assesses the potential of melancholy (screening) and determines the severity of the condition.

Existing chatbots in the Developed countries making high impact on the healthcare infra and serving patients:

1. One Remission

OneRemission's objective was to raise awareness of cancer and post-cancer healthcare and education among cancer sufferers, fighters, and supporters. It's one of the most widely used approaches in Integrative Oncology, which also covers post-cancer nutrition, exercise, sleep, and managing stress. The OneRemission team's primary priority is the users' physical, social, and psychological well-being.

The app enables cancer sufferers and survivors by providing a comprehensive list of meals, workouts, and post-cancer regimens created by Integrative Medicine experts, allowing them to avoid relying on a doctor all of the time. Experts can, for example, research the cancer risks and benefits of a particular food.

WefightInc takes the data it collects and anonymizes it before hosting it. Users have the right to verify the correctness of information and, if required, rectify, complete, and update it under French and European legislation for information management and personal liberty ("Commission Nationale Informatique et Libertés and Règlement Général pour la Protection des Données"). Consumers can now object to their usage on moral grounds and also have their personal data deleted. You must accept to the terms and conditions of use before using Vik, which are fully mentioned and explained.

A total of 4737 patients were enrolled in the study. Patients and chatbots, Vik, got an average of 132,970 communications every month, according to data. As a result, over the span of 4 week, we employed a prescription reminder function to estimate the average adherence rate, and we noticed that the more people used the chatbot, the much more compliant they were. Patients frequently expressed their gratitude and recommended Vik to their friends. The total and absolute % of responders (900/958) were satisfied. When asked what Vik meant to them and what Vik provided, 88.00 percent (943/958) indicated Vik provided assistance and made their therapy more manageable.¹⁵

2. Youper

Youper's artificial intelligence (AI) tracks and enhances users' mental health. To help individuals enhance their mental wellbeing even more, the programme offers personalised meditations, and also the ability to evaluate mood and track emotional wellbeing. The chatbot will understand more about the users as they engage with it, allowing it to personalise the encounter to their individual needs.

Youper, a mental health app with a chatbot it regards to as a "emotional health helper," has received a \$3 million investment from Goodwater Capital. The money will be used to grow Youper's user base and accelerate the growth of artificial intelligence-based features. Customers spend an average of seven minutes with Hamilton's chatbot throughout each encounter, with 80 percent reporting a reduction in negative feelings after only one conversation. After 30 days, a quarter of individuals that signed up with Youper are still active, according to the business.

Youper is currently free, but the company may test a freemium business model with high- end features in the near future. It develops Youper using anonymized user data for its own research, but it keeps the information and data private and does not distribute or sell it.

Dr. Jose Hamilton co-founded Youper, a San Francisco-based company, in 2016. For nearly a decade, Hamilton worked as a psychotherapist in clinical settings, treating approximately 3,000 patients. While talking with them, he noticed that many people were deterred from seeking therapy sooner, even if they'd been suffering from depression or anxiety for years.

A study was conducted with the goal of data analysis from 4517 paying Youper users who consented to their data being used for research (N=4517). To determine the app's acceptability, we asked users to rate it on a five star scale and observed retention numbers during the first 4 weeks of membership. To evaluate how effective it was, we tracked symptoms of anxiety and depression over time. To investigate the cumulative regulation hypothesis, we used the proportion of successful emotion regulation efforts to predict symptom reduction.**16**

3. Babylon Health

Customers with modest health difficulties who are technologically literate and can consult a doctor for periodic and well-defined demands at convenient times can use Babylon Health. The majority of those who are helped, such as the elderly, sick, technologically illiterate, and that those who require care at home, are instead left out. It is legitimate to seek alternative solutions to decaying health systems, but technologies cannot replace the physician relationship. It will take the new contextual approach to sit down and write the relationship between technologies and ongoing care, as well as a redefinition of priorities, the excellence and fair treatment of care, and giving opportunities to people's requests in order to provide answers based on a worldwide approach that focuses on identifying important values, meaning, and goals.

Babylon Health, a premium account online health consultation and healthcare system located in the United Kingdom, was founded in 2013 and is now valued at more than \$2 billion. The startup provides AI consultations based on a patient's medical history and general knowledge, and also live stream consultations with competent practitioners as needed.

Individuals explain their symptoms to the app, which employs speech recognition to compare them to a library of ailments and then recommends a treatment plan. In the second scenario, doctors carefully listen to and examine the patient in order to make a diagnosis the patient, and it is already beyond the chatbot's regular function, and then write prescriptions or send the patient to a medical expert if necessary.

During a trial phase in 2017, the National Health Service (NHS) in the United Kingdom deployed the chatbot to provide medical advice.**17**

4. Florence

Hospitals are the most typical place for sick people to acquire health-related analysis, illness diagnosis, and drug prescriptions. This has practically become the standard for everyone on the planet. Hospitals are regarded as the most dependable and major source of diagnosis. The proposed concept is to make it easier for individuals to check on their health, as opposed to the traditional method of standing in line for hours to acquire their prescription. This study intends to employ the RASA framework in order to create a chatbot.**18**

5. Healthily

This free website provides people with useful health information from credible sources to assist them in making the best health appropriate decisions. It's just an artificial intelligence-driven symptom checker. The programme works on almost all possible operating systems and is compatible with all types of devices.

Healthily is another great resource for finding online medical service providers, whether you're searching for pharmacists, testing centers, doctors' offices, or psychological health app suggestions.

We deemed the condition checker to be a consumer utility in our evaluation, but one that might quickly overload the user with potential issues.**19**

6. Ada Health

Including over 11 million active users and 24 million completed assessments, Ada is among the most popular symptom assessment programmes on the market. The health buddy app may analyse the patient's health based on the aforementioned symptoms using its huge AI-based database. We tried this one as part of our broad symptom checker review and discovered it to have the most capabilities of the ones we looked at.

Daniel Nathrath, CEO of Ada Healthcare, told The Medical Futurist, "Ada will become a routine diagnostic tool for physicians." That is already the case; in the United Kingdom, customers may share your health assessment with their doctor or speak with a registered GP.**20**

7. Sensely

Molly, the virtual medical assistant, may use speech, text, graphics, and video to examine the patient's symptoms. It may communicate by text or speech, depending on the user's preferences. Sensely evaluates a person's symptoms and produces a diagnostic based on data collected and information provided to its advanced algorithm. Molly determines the seriousness of a scenario using the colours of the triage method, which is commonly employed in emergency treatment. In the context of Sensely, symptom triage refers to deciding if self-care is sufficient or whether the patient need medical treatment. A local service directory is also offered, as well as self-care information.

In recent years, as people's awareness of health, lifecare, and illness has grown, hospital healthcare has shifted from a curative to a prophylactic and health management focus. Special deals for health and wellbeing initiatives are being developed by the medical business. As a consequence of enhanced life expectancy, age, lifestyle adjustment, and money, this transition reflects a fundamental revolution in healthcare, and the notion of a smart medical system has arisen as a significant concern. As a result of smart health, traditional therapeutic medical services, which also are generally provided by big hospitals, have evolved into distant healthcare care that employ personal health information in small groups.**21**

8. Buoy Health

The company's algorithm was purportedly educated on clinical data from 18,000 medical publications by a group of physicians and computer engineers through the Harvard Innovation Laboratory to duplicate the literature used by clinicians. Only a few instances of data include 5 million persons and 1,700 ailments.

You may evaluate your symptoms online or use Buoy Health's big database to figure out what's wrong regarding your health. The chatbot questions you a series of thorough questions regarding your medical problem before offering you a variety of alternatives and specific actions to take.

Working partnership is a concept that refers to a crucial connection between healthcare workers and patients that would be linked to treatment efficacy. Due to the limited resources of health specialists, working partnerships could always be promoted merely and everywhere. We investigate the direct and indirect effects of message medical chatbots' (THCBs) interpersonal closeness cues on attachment relationship from the professional relationship construct, as well as the willingness to continue engaging with THCBs, to solve this scalability issue.²²

9. Infermedica

Machine learning technology underpins Symptomate, Infermedica's symptom-checker chatbot. The platform enables both especially in online phones as a chatbot or vocal style software. It assesses the patient's health and, based on the symptoms, generates a likely diagnosis and provides useful suggestions.

To date, Infermedica is now doing over 8 million health exams, and its services are accessible in 19 languages. During the first year of the pandemic, the company developed a COVID-19 risk assessment tool, and has been used from over half a million patients and implemented by 300 organisations, including two national governments.

Symptomate is a desktop AI chatbot that works similarly to Ada. Isabel, a small girl who had chickenpox, prompted a team of volunteers to create Isabel differential diagnoses, a chatbot that can help others in similar situations. Like the other three bots, the Isabel Symptom Checker is machine and the most user-friendly. Isabel Symptom Checker requires less time to enter a patient's condition and produce a diagnosis; yet, this bot's responses are less accurate.²³

10. GYANT

GYANT is a health bot that asks users to explain their ailments and then sends the information to doctors, who diagnose and prescribe in real time. According to the company's website, their "empathic, intuitive A.I. technology" in Spanish, Portuguese, or German "assists patients through the intricacies of their healthcare journeys." Gyant.com is a bot that focuses on non-emergency diagnosis and treatment. It leads the user through some kind of series of straightforward questions. Emojis, jokes, and a good sense of humor are frequently employed. The chatbot appears to be human and has a good sense of humor. It may be used to determine the cause of an issue.²⁴

Mosquito-borne viruses, such as Zika.

The company reported in March 2019 that it has conducted a from before the testing with over 785,000 population of The Americas. Following that, and over 174,000 at-risk people in low-income regions were given weekly glucose testing as part of their treatment at local pharmacies.

11. Woebot

Woebot describes itself as "the destiny of mental health," as stated in the introduction, and it surely looks to be. Anyone seeking help from either the chatbot can use Behavioral Therapy Therapy (CBT) techniques to listen and coach them. It interacts with Fb, so you'll be quizzed about your locations on a frequent basis after you start using it.

Woebot isn't meant to be a professional solution, but it can help with mental health concerns and teach you how to cope with them. It's absolutely free to do and can be found in the app store on your smartphone.²⁵

12. Cancer Chatbot

Dedicated to charitable causes Cancer Chatbot is a Facebook Chat bot that provides support to cancer patients, caregivers, friends, and family members. The chatbot delivers a lot of information to sufferers, ranging from chemo advice and procedures to free treatments. It provides caregivers with resources to assist them manage their tasks and making their lives easier. It also gives advice to family members and friends on what to speak and how to help cancer patients successfully. It's a well-considered and intelligent response. The main purpose is to collect crucial patient datasets to free up medics' time so they can focus on educating and assisting patients during phone calls. The Chatbot's usefulness was tested inside a sub-sample of unselected individuals before it was broadly distributed and pragmatically appraised.

6. Introducing Rahai - A Chatbot

AI and statistics are gaining popularity as machined surface in a range of sectors, from finance to government policy, as well as from personal safety to global defense. The healthcare industry and medical practices have seen substantial changes as a result of AI/analytics technologies and learning algorithms. Indeed, not only in the innumerable academic published papers each year, as well as in the excellent applications that have already been implemented throughout the world, machine learning and statistics have delivered a bevy of hopeful outcomes.

The publication gathers the most current articles on Healthcare analytics over the past five years and highlights the most recent advancements in this trying to cut technology's applications.

Because of the epidemic, AI chatbots in healthcare are a relatively new concept in the medical field, and they are moving the medical industry toward automated healthcare. The goal of this study was to see if Chatbots might help individuals figure out what medical problems they could have before seeing a doctor.

Text-based chat bots are by far the most common, according to our research, with only a few apps adopting language as their primary means of contact. Because some people find typing on tiny keypads on devices complex and time-consuming, certain demographics, such as the elderly, may choose to engage by speech.

7. Utility of this chatbot, The areas that this chatbot will be targeting

Gathering Patients Information in Advance: Gathering patients information at the moment of the visit may appear to be convenient, however this is an illusion. It clogs up a clinic and increases wait times since some patients take more time than others to finish paperwork. You'll save quite a lot of time if you prepare paperwork for next week's patient appointments even before end of today.

Adding some slack to the schedule -

A busy schedule results in long patient wait times. Overbooking can appear to be a clever way to increase revenues, but it really leads to a busy, uncomfortable practice with a lot of waiting and angry patients.

Small, pre-programmed blocks of buffer time almost never go unused, leading to more efficient, smooth-running practise with more revenue.

Patient portal adoption: Medical practices are becoming increasingly popular as a way to streamline much of the process of data collection. Patients can access personalized health information at all times of day or night using portals, which are secure online services. An intuitive portal that allows patients to receive educational materials, arrange non-urgent consultations, and update personal medical history online might save time for medical workers.

A survey is used to identify existing bottlenecks: You may not even be aware of the factors that lead to high long waits, and a little information could help. A simple survey might be given to determine how much practiced . the same action spends in the reception desk with their doctor, according to eVisit.

Creating beneficial chances in the waiting room: What if the reception area had a function other than waiting? Researchers believe that rather than being a barrier, the waiting room might be an opportunity. Consider adding a new role to the medical team: a reception area manager who transforms idle awaiting into active care. In the waiting area, this person might filter, supervise, and educate patients. Rethinking the waiting room as an opportunity is the first step in utilizing it to improve patient happiness and health outcomes.

Using a chatbot to offer all of the options may be really beneficial. It's also becoming clear that AI will not entirely replace the human doctors, but rather will supplement their efforts to heal patients. Human physicians may establish activities and job designs in the future that rely on fundamentally human characteristics like as empathy, persuasion, and big-picture integration. Some people in the health profession who refuse to collaborate with AI may be the only ones who lose their jobs over time.

8. Development of chatbot –

In the discussion box, the chatbot might provide users with information or direct them to other websites (user-initiated). If the purpose is to transmit broad information, such teaching aids should be obtained from trustworthy sources such as the CDC and other public health institutions. If the chatbot's objective is to link patient 's specific services, the user could be given a phone number, email address, or online URL to call to get that assistance.

The user can be connected with a human agent who can help them complete a task (provider-initiated).

This can be done in real time by passing the call to a staff person, or it can be done later by gathering the patient's contact knowledge and ensuring staff people call them.

A chatbot can launch a procedure in another system or program, such as appointment booking or medicine replenishment (system-initiated). This was the most technically difficult alternative, and it is unlikely to be suitable for emergency deployment.²⁶

Methodologies

Algorithm 27-30

Algorithm Inspection Techniques

The algorithm inspection technique investigates the chatbot's inner workings and ensures that each algorithm is performing as planned. Developers may utilise this data to not only evaluate the chatbot's efficacy, but also to identify particular problems and make necessary changes. This method overcomes the difficulties of output testing by being thorough, thorough, and exact.

Traditional Chatbots employ a range of approaches, including Nave Bayes, Decision Trees, Support Vector Machines (svm), Recurrent Neural Networks (rnn), Markov Chains, Long-Short-Term Memory (LSTM), and Language Processing (NLP).

Natural Language Processing is the most essential of these approaches, and possibly the most important strategy in chatbots (NLP). Natural language processing improves a chatbot's ability to understand human language and respond appropriately (NLP). If the chatbots is to have meaningful discussions both with the user and the bot, this algorithm must have been working well. Despite its subjective nature, several variations of the renowned Turing Test are extensively used to assess the competence of NLP-based Chatbots. In this scenario, a user attempts to speak with both a chatbots and a human in order to discern between the two.

When it comes to diagnosing hazardous tumours and supporting researchers in the creation of cohorts for expensive clinical trials.

Cross validation

Cross validation starts with separating data into two sections: training and testing (the split is usually approximately 70-30). The test set is used to evaluate an algorithm, whereas the learning algorithm is being used to train it.

The system develops predictions and performs intent categorization depending on the evidence it receives. The accuracy and performance of an individual are measured by the percentage of favourable forecasts. K-fold cross-validation is a typical cross validation approach that evaluates the model learned on the training data k times on the test data set.

Different type of algorithm to be screened are as follows -

1. Naive Bayes Algorithm

The Naive Bayes algorithm tries to categorise text into any of these categories so that the chatbot can discern the user's intent and so reduce the range of potential answers. This algorithm must perform effectively since intent identification is one of the first and most important phases in chat bot interactions. The technique is based on the idea of commonality, which asserts that certain phrases in specific categories should be given greater weight based as to how frequently they exist within that category.

K-fold cross validation is the most basic way for testing this approach. This includes retraining your chatbot with specific inputs and classifications, followed by a test set to see how often the chatbot properly classifies each input.

A flaw in the Naive Bayes classifier is the usage of a 'bag of words' method. To identify the input class, the algorithm evaluates all of the phrases and picks the most essential ones. This indicates it doesn't care about the sequence in which the words occur. This might be a concern since some word rearrangings can cause inputs and classes to diverge. Get around this, approaches like n-gram could be used to maintain the word sequence. Furthermore, Explainable AI (XAI) is a revolutionary way for 'attempting to describe' machine learning techniques and understanding the logic behind their discoveries based on the data collected.

2.Support Vector Machines

The Supporting Architectural Prudent Risk management Principle is used to create Vector Machines. Because of the high-dimensional feature input space produced by the vast number of text features, lower-dimensional data, and the preponderance of sparse matrices, SVMs function well with text information and Chatbots. It's a widely used text categorization and intent identification approach.

It enables us to determine the probability of a data falling into most of the two different groups. The most frequent method of evaluating this technique is cross-validation validation, which determines how accurate the created sample using this strategy is based on training and testing sets. This model's performance is also evaluated using precision and recall criteria.

3. Deep Neural Networks

The human brain inspired neural networks, which are mainly composed of layers of linked neurons that interact with one another. These cells take in information and process it to create a useful output. Neural networks are data-intensive, requiring enormous amounts of data to understand patterns and trends. We must establish if the chatbot creates appropriate responses to inputs, keeps the conversation going, fits the needs of the user, and can adequately reproduce the linguistic aspects of a human in order to evaluate this software. This might suggest that a Turing test adaptation is a valid testing technique. Neural networks are modelled just after human brain and are made up from layers of interlinked, coupled neurons that interact with one another. These neurons take in information and evaluate it to come up with something useful. Because neural networks are data-intensive, they require massive amounts of data to detect patterns and trends. To evaluate this programme, we must see if the chatbot responds appropriately to data, keeps the discussion going, satisfies the demands of the customers, and can properly replicate human language attributes. This might indicate that altering a Turing test is a valid testing strategy. One of its major disadvantages is the difficulty in comprehending neural networks. Furthermore, neural nets rely on a variety of a large quantity of data to go through a suitable learning process and guarantee that their responses are as exact as feasible.

4.Markov Chains

Markov Chains, for example, are a type of algorithm. Markov chains are commonly utilised in text production as well as chatbots. They calculate the likelihood of transitioning from one level to the next. Because it can be stated as matrices, this model is straightforward to use and describe. These chains ignore the path that lead to a certain state and instead rely on the prior state to identify the current one.

The order of the chains determines the amount of words clustered together in each chain, with first ordering existing models one phrase and third-order models containing a team of three words.

Syntactic parsing, output analytics, and usability assessment testing may all be used to evaluate the efficacy of Markov chain-based Chatbots. Markov chains operate by creating replies that are more statistically credible and realistic.

5.Natural Language Processing

NLP is critical for chatbots because it influences how the bot perceives and comprehends text input. The ultimate chatbot knows how to communicate with both the user suspends belief that now the user has no idea they're talking to a computer. This software attempts to understand the intricacies of human language using ml algorithms and a significant quantity of conversational data. The bot can understand text data, syntax, sentiment, and purpose with the use of natural language processing (NLP). This is due to NLP's many characteristics, which would include text require more space, word vectorization, topic modelling, PoS tagging, n-gram analysis, and sentiment polarity analysis. Because NLP techniques

are supposed to mimic human interaction, evaluating this algorithm is essentially an assessment of the chatbot's ability to communicate. There is no objective morality or benchmark against which to analyze the algorithm's performance when testing a text analysis system. Two of the most prevalent and accepted techniques to evaluating NLP systems are definitely an advantage and feedback analysis.

Although it is simple to do machine learning and information extraction on user satisfaction ratings, it does not provide enough insight into the study and is hence not advised.

The Turing test may be used to see how well an algorithm mimics real-world human interactions and language. As part of the test, users may be asked to identify between living thing and NLP-based chatbot conversations.

The user must supply purposely difficult or blunder inputs to analyse how the chatbot replies in order to enable fail-safe testing.

Decision Tree Algorithm

Tree of Decisions It's a tree structure that looks like a flowchart, with each node representing a test on either a data item, each branch representing a check conclusion, and tree leaves representing groups or category distributions. Decision Trees are used to anticipate whether things belong to different divisions (classes) depends on the principles associated with their attributes in theory (predictor variables). The Decision Tree method, as previously said, is one of the most widely used data mining techniques. The DT method, which should be a regression and classification approach and used in predictive modelling between both deterministic and probabilistic features, is provided by Microsoft Sql Analysis Services (SSAS).

They expect that physicians will be able to scan vast datasets for subtle patterns in prognostic markers using ANN paired with DTs, which will aid in the selection of suitable adjuvant therapy for individual patients.

DTs are one of the most widely utilised data mining approaches. A multitude of techniques may be used to create DTs. C4.5, for example, employs information-theoretic measures, whereas CART (Classification and Regression Trees) use statistical approaches. S.S. Moon et al. questioned about DT models for defining smoking tendencies of older persons in one of the most recent studies published this year (2012). A previous study found that those without a college degree are less likely to try to stop smoking than people with a college education, and that there is a negative link between education and life-time nicotine dependency. They employed partial DTs to anticipate Parkinson's symptoms, which is a novel technique to diagnosing and treating Parkinson's disease patients. They demonstrated how to use the PERFORM system's data miner module to construct PD symptom prediction models and find new information in the form of association rules.

Verification and Validation

When we consider verification and validation, we have another option (V&V). Validation is performed to determine whether the strategy is suitable for the task at hand. A Turing test is a type of natural language processing (NLP) testing used to bring AI Chatbots here to be tested. Validation is a method for checking that a procedure is created correctly and produces the desired result. That's possible to accomplish it without running the code or using the function. White box testing seems to be a sort of assurance in which possible solutions are written and then the code is evaluated for expected results. If the results appear to be satisfactory, 'black box testing' is carried out, in which the code is executed and the expected and actual results are compared. The grammar algorithm provides a rigorous specification of a language's system that ensures that the chatbot talks without any linguistic issues. The parsing algorithm employs grammar to analyze the

grammar and syntax of a statement. Linguistics functions can parse a text in a number of ways depending on the available interpretations because of ambiguity. White box testing may be done to determine if the processor will identify alternate interpretations of something like the input by using test cases with ambiguous phrases. In an ideal scenario, the chatbot would prompt the client to re-enter relevant information even though it was unable to comprehend the request. Following this method, black-box testing can also be used to determine if the expected consequence happens after an ambiguous input. When a chatbot gets such unclear information, it will be unable to provide the user with a suitable response since it has not been taught to do so. As a result, the chatbot fails and the discussion breaks down, which is an undesired condition.³¹

Statistical Parsing

Another way for detecting ambiguity is statistical parsing. Every other decoding is given a probability, with the greater likelihood suggesting the correctly spelt interpretation. When a chatbot is working in its intended context, this likelihood is high, but it drops when there is ambiguity and a much smaller range of alternatives. The possibility of contradicting systems can be investigated and assessed, to determine whether ambiguity test scenarios are often below a particular level. If this is the case, bots can be trained to recognize and respond to perplexing input. This helps the avatar to learn why it is unable to interpret a certain input. This serves as a form of feedback, guaranteeing that perhaps the bot continues to operate effectively. If somehow the bot is unable to understand a sentence, this could prompt the client to rephrase the remark in a more intelligible language so that the bot can continue to operate. An ensemble or staged method, which combines the testing approaches outlined above, may be used to thoroughly examine the functionality of a bot across several platforms in order to defend the interests of users. As the chatbot is evaluated and assessed using a number of approaches and settings, its performance will increase. Additionally, Chatbots may benefit from samples of difficult events presented to them in order to better cope with a variety of situations in the future.

Dataset used: Kaggle dataset, because Kaggle is well-known in the data science field, your accomplishments here will be well-received and acknowledged in the industry.

Proceeding with dataset: Check the dataset descriptions for details on how the data were acquired, the time period to which the data belong, and other information that can assist you in formulating your queries for exploratory data analysis.

Begin by investigating the dataset and recording your findings. Check out the "Tasks" page for further analysis ideas; this is a new feature where people can add interesting things that can be done with the data and others may contribute their solutions to it.

Experiment with diverse types of data, gradually moving out of your comfort zone and becoming familiar with datasets from areas you haven't dealt with before. You may even submit your research and see how it is received by the community.

Platform used

The very first web tool for producing and sharing computing documents is Jupyter Notebook. It has a straightforward, straightforward, and document-focused user interface.

Algorithm

A decision tree topology is a special tree structure that uses a number of fundamental decision rules to split a huge process of data collection into smaller groups of the same type. A decision tree model is a set of rules that may be used to divide a big, varied population onto smaller, more homogeneous, or mutually exclusive groupings. The attributes of the classes might range from conceptual to ordinal via binary for quantitative values; yet, the classes must be categorical, numerical, or binary in nature. In an essence, a decision tree generates a set of regulations that will be used to decide the class based on assessments and class data presented.

Advantages

1. There is no need to scale information in a decision tree.
2. Even if there exist any sort of Missing values in the data provided it will have no effect on the decision tree construction process.
3. Because it is automated, a decision tree model is simple to explain to both the technical team and stakeholders.
4. In comparison to other approaches, decision trees need less work for data preparation during pre-processing.
5. Data homogeneity is not required for a decision tree.

Data Pre-Processing (33,34,35)

The practice for processing original information to be used in a classification model is known as data preprocessing. It's and perhaps the most crucial step in creating a prediction model employing various algorithms in the machine learning process.

Data preprocessing is the process of preparing original information to be used in a machine learning model. It's the most important and first stage in building a prediction model employing various algorithms in the machine learning model.

We don't always come across clean, well-prepared data when embarking on a machine learning project.

Furthermore, data must be cleaned and prepared before any data-related action can be taken. As a consequence, we perform this via a data preparation operation.

In the actual world, Python is used to prepare data. These libraries are utilised in a variety of situations. To prepare the data, we'll utilise the following three libraries:

Numpy: Numpy, a python Programming library, may contain noise, missing information, or be in an incorrect format, making it incompatible with machine learning models.

1. Fetching the dataset

Because a learning algorithm is entirely reliant on data, the most basic necessity for developing one is a dataset. A dataset is a set of data up in a particular format that is utilised for a particular purpose.

The dataset required to construct a classification model for commercial purposes, for example, will be different than that required for a hepatic patient. As a consequence, each dataset stands apart from the rest. We usually save the information as a CSV file to make it easier to utilise in our programmes. In other cases, though, we may need to use an HTML or xlsx file. We can store tabular data as CSV files (Comma-Separated Values files).

2. Adding the required libraries

We must import multiple predefined Python libraries in order to operate data that is necessary to generate code that incorporates any form of mathematical calculation. It is the most important Python package for scientific computations. Massive, multivariate arrays and matrices can also be added.

Matplotlib- The second library is Matplotlib, a Python 2D graphing toolkit that requires the import of a sub-package called pyplot. This library is being used in the Python Pandas code to plot any sort of chart: The last library is Pandas,

that was among the most well-known Python language for loading and processing datasets. It's a statistical data analysis package that's available for free.

3. It's now appropriate to import the datasets we've collected for our computer vision study. Until we can import a dataset, we must first make the existing directory a functioning directory. Follow the instructions below to create a working subdirectory in Spyder IDE.

Duplicate and save your Python file in the datasets directory.

Go to the desired directory using the File Manager option in Spyder IDE.

Press F5 or choose Run from of the File menu to open the file.

The value of something like the given dataset, which is really the name of the object whether we'll save our dataset, has been sent to the procedure. When we run the preceding piece of code, the dataset will be correctly imported into our code.

4. Dealing with Missing Data

The next phase in the pre - processing phase is to deal with incomplete information in datasets. Our ml model may have significant difficulty if any of the data from our dataset is absent. As a result, the dataset's missing values must be addressed.

Missing values can be addressed in several ways, including:

There are generally two techniques to dealing with missing data:

By removing only one row: The first strategy is commonly would use when dealing with null data. We just delete the null values from the selected row or column in this method. However, this technique is inefficient, and deleting data could result in information loss, resulting in incorrect findings.

5. Required data encoding Categorical

Attribute information is collected that has been divided into categories. For illustrate, there are positive inputs variables in our dataset: Purchased and Country. Because a machine learning model seems solely concerned with mathematics and numbers, including a categorical variable in our collection might cause problems with the model's development. As a consequence, these class variables must be converted into integers.

Variables with a range of 0 or 1 are known as dummy variables. The existence of a variable in a column is indicated by a 1 value, while the rest of the elements are given a value of 0.

The sequence number will be directly proportional to the number of subcategories if we use dummy encoding. Because our dataset includes three categories, three lines with 0 and 1 entries will be generated.

6. Division of the Dataset into Two Parts

1. Training set, is the first subset of the main dataset and the main aim is to train the model with the subset, the accuracy and performance can be modulated from training set size and the quality of data that's being fed into the machine.

2. Testing set, is the second subset of the main dataset and the main aim is to test the model with the subset, the accuracy and performance can be evaluated from training set size and the quality of data that's being fed into the machine.

In machine learning data preparation, we partition our dataset into a training set and a test set. This is a vital stage in data preparation since it increases our machine learning mode's performance.

Assume we trained our classification model on one database before applying it to another. As a result, our model will fail to understand the relationships between the models. If we train the model properly and its training accuracy is excellent, but then give it a fresh dataset, its performance will drop. As a consequence, we're always working on creating a machine learning model that works with both training and testing datasets. The below are some dataset examples:

The training set is a subset of the information used to teach the machine learning model, and the output is already known.

7. Scaling of Features

Feature scaling is the last step in the data preparation process in machine learning. It's a method for keeping the dataset's independent variables inside a certain range. We set all of our variables in the same range and scale them so that none of them dominate the others in feature scaling.

9. Result and Accuracy of the chatbot - The accuracy of the chatbot came out to be nearabout 84% with the available dataset.

10. Future aspects of this chatbot

Chatbots are sometimes known as virtual assistants. It's a simple artificial intelligence programme that can mimic human speech. Chatbots may be researched and improved. It may be used in a number of situations, including as education, business, and online chatting. In the subject of education, it might be used as a learning tool. The database might be used to store instructional data, which could then be queried by the bot at any time. It may be used in the business world to offer effective business solutions.

The business can improve and the company's growth can accelerate if the solutions are successful. This Chatbot may be used to have fun when speaking on the internet. offer a knowledge base-based cloud-based chatbot-based healthcare solution A chatbot-based mobile health service is proposed as a method for offering prompt care in the case of commonplace accidents, as well as changes in the conditions of patients with chronic illnesses. Common users may rapidly access and get a variety of health services thanks to linkages with the major social network service messengers. By allowing for fluid human–robot interaction, the proposed design facilitates the effective implementation of the chatbot healthcare service.

Conclusion

Physicians recognised both costs and benefits associated with chatbots, depending on the logistics and specific tasks of the technology. Chatbots might be beneficial in health care for assisting, inspiring, and guiding patients, as well as completing administrative tasks; in other words, chatbots could operate as a substitute for nonmedical caretakers. However, concerns regarding chatbots' inability to grasp human emotions, as well as areas where professional medical competence and intelligence are required, remain.

The chatbot has been a huge success for us: patients appreciate the conversational interface and how simple it is to use. Many patients consider it a big benefit to be able to ask a question and obtain a fast, scientifically sound, and concise response.

A group of patients participated in focus groups. They claim that the fact that each of Vik's responses is followed by two actions' contextual information is very popular with users since it allows them to access information they may not have considered. This combination of asked inquiries and contextual actions (conversation scripting) is particularly appealing since it increases the flexibility of the interaction: the user does not have to enter a phrase in order to acquire relevant information.

Chatbots are a novel form of technology that hasn't been properly tested for use in health care. The bulk of virtual assistants documented in the literature are text-based, machine-learning powered, and available through mobile app. Future research should look at the practicality, acceptability, safety, and efficacy of different conversational agent types that are suited to the needs and preferences of the target audience. There is also a need for greater guidance on the development and evaluation of health-care-related chat bots, as well as more study on the role of conversational agents in current health systems.

11. Making this chatbot accessible to the general public

Because they can be used on email, the web, social media, and SMS, chatbots are a wonderful method to reach a large number of people in a short amount of time. During COVID-19 and other infectious disease outbreaks, chatbots may screen patients, provide information, and direct them to the proper health-care choice (in-person appointment, telephone triage, telehealth appointment). For example, Providence Health employed a COVID-19 chatbot built on the Microsoft platform to assist patients in finding their telehealth services.

12. What additional features can be given to this?

Another study pitted two embodied virtual agent chatbots against a text-based chatbot (one interacts to the user through verbal and nonverbal empathic reactions, while the other does not). According to the research, empathetic chatbots are more acceptable, entertaining, empathic, understanding, nicer, sociable, truthful, realistic, intimate, expressive, animated, intelligent, socially influential, kinder, and safer than non-empathic and message bots. According to the study, consumers are more likely to provide information to a text-based bot than to sympathetic or quasi bots or a person counsellor. Participants were also more inclined to employ empathic bots than non-empathic chatbots or text-based chatbots, according to the poll. Artificial intelligence (AI) will, we believe, play a significant role in future health solutions.³⁶ Precision medicine is generally acknowledged as a much-needed advance in therapy, and it is a crucial competence that underlies its progress. Although initial attempts at diagnostic and treatment suggestions were difficult, we believe AI will ultimately conquer that field as well. Thanks to considerable advancements in AI for imaging analysis, most radiology and pathology pictures are expected to be assessed by a computer at some time in the future. Speech and text recognition have already been used for patient interactions and preserving clinical notes, and this trend is projected to continue. In many healthcare companies, the most challenging obstacle for AI is ensuring its adoption in routine clinical practise. ³⁷AI systems must be authorised by regulators, connected with EHR systems, standardised to the point that similar solutions perform similarly, taught to doctors, paid for by publicly or privately payer organisations, and modified in the field over period in order to gain broad adoption.

With an AI Chatbot, you can improve customer service and administration: Almost any website today has a chatbot ready to assist you in navigating the site or resolving a minor issue. As a result, it should come as no surprise that chatbots will continue to assist consumers in navigating healthcare services. Chatbots that assist plan appointments, provide reminders, and refill prescription drugs might be the way of the future in this area. Before such technology becomes commonplace, there will be certain privacy and HIPAA hurdles to overcome. It's not unreasonable to believe that administrative and customer service responsibilities are just around the corner.

Engagement of patients: Chatbots that are meant to not only actively catch but also captivate patients' attention in their care raise the question of whether the technology may be used to further engage patients and enhance outcomes.

Despite the well-intentioned criticism, the correct technology will strengthen rather than undermine the relationship between physician and patient.

One of the most difficult aspects of healthcare is that therapists frequently instruct clients to journal and then return a week later. People who are used to utilizing phones, computers, and other electronic devices will not sit down and write down something that will be addressed in a week.³⁸ People will do it if you make it easy for them by offering them something that is already in their hands, engaging, and relatable.

Mental health benefits: There are some bots that provide consumers with an extremely humanized experience, making them feel as if they're conversing with a real person. Many individuals find that simply being able to talk about how they're feeling and any fears they may be experiencing is really beneficial to their mental health.

Patients in this situation can talk about their feelings with a conversational chatbot for healthcare. If the patient's demands exceed the bot's capabilities, a healthcare expert may quickly step in and take over, all while keeping track of the patient's interactions with the chatbot.³⁹

In the field of Research and development :Another possibility that is already being taken advantage of is using data – notably machine learning – to evaluate data and research more quickly than ever before. It's difficult to keep track of the experimental remedies offered with the steady influx of fresh cancer studies.

A doctor treating cancer patients does not have the time or resources to read and keep up with every new piece of research, but a machine can. A system with artificial intelligence (AI) capabilities can sift through all of the data and provide specific suggestions to doctors and their patients. This use case may be more about the machine learning advancements to come, but the extraction of that information might and could well be in automated forms of outreach and assistance.⁴⁰⁻⁴²

In the areas of Claim and Billing:

Nobody wants to deal with insurance companies, claims, or medical costs. Thankfully, AI chatbots in healthcare can help with these chores. A chatbot for healthcare may check current coverage, assist with claim filing, and follow claim status. AI solutions in healthcare can also assist doctors with pre-authorization and billing questions.

Artificial intelligence and healthcare are merging to improve the patient and provider experience. Though the functions that a chatbot may perform in healthcare are now limited, the potential for them to be employed as diagnostic tools and other applications is clear. Even at this early level, they are assisting in the reduction of staff workload and administrative expenses, as well as the improvement of patient services and the provision of a 24/7 discussion outlet.

Basics of data science, different algorithms of AI that can power the chatbot, basics of data visualization.

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