The Application Analysis of Medical Chatbots and Virtual Assistant

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Abstract: With the gradual improvement of China's medical insurance policies, the scale of the market of medical devices has become more large, and people pay more attention to their own health. Based on the issue, this paper mainly carries on the industry investigation on the medical institution chatbots. It analyzes the application of four kinds of medical chatbots in the actual medical institutions, which makes a detailed elaboration on their future development trend. This paper makes a conclusion that it is as a synergistic effect when clinicians and medical chatbot work together, producing better results than either alone.

Keywords: Medical chatbots, Virtual assistant, Artificial intelligence, Synergistic effect, Health care

1. Introduction

Artificial intelligence technology is developing rapidly in the medical field, but it has not become a reality in the actual clinical application. Recently, artificial intelligence has experienced an era of explosive growth in many fields, and the medical industry is no exception. Many medical professional studies have used chatbots to simulate a doctor's diagnostic abilities. It is expected that chatbots will be able to provide medical care to humans[1]. However, while these technologies are evolving rapidly, their use in settings such as patient care has not been widespread..China leads the world in chatbots. With the largest population in the world and a relatively centralized health care system, the data used to train and validate ai algorithms is enormous. Due to the uneven distribution of urban and rural resources, medical equity has always been a major issue. Thus, medical chatbots represent an opportunity to overhaul China's health care system. Medical chatbots can perform a variety of functions, such as pre-consultation, medical institution customer service, mental health consultation and elderly care companion. This paper will explain the development status of chatbot from four aspects.

2. Four Intelligent Medical Robots

2.1 Pre-consultation robots

2.1.1 What it is

After the registration of patients and before the doctor's reception,pre-consultation robots will help doctors to collect the symptoms, signs, medical history and other information of patients in a standardized and comprehensive way through intelligent guided consultation, so as to realize the optimization of the diagnosis and treatment process[2].

2.1.2 How it works

The intelligent pre-consultation chatbot is just like a robot doctor. Patient can tell it about his/her symptom and it can collect patient's information and send it to the doctor, so that the doctor can know the patient's situation in advance. In the process of pre-consultation, the chatbot system will simulate the doctor to carry out relevant inquiries according to the patient's symptom[3]. For example, it will ask the patient when they begin to feel uncomfortable, and the cause, location, color and frequency of `their illness. It can also ask about the patient's past medical history and allergy history.

Then the patient can know about some situation about himself/herself and do the relevant examination in advance, which save both doctors' and patients' time for reducing the repetitive

consultation work of the doctor. In this way, the work efficiency will be improved.

2.1.3 General example

2.1.3.1 Lantone

(1) General information: Founded in 2004，Lantone Information Technology Co. Ltd is a high and new tech enterprises focused on artificial intelligence and map of medical knowledge construction. Lantone medical strives to build a diagnosis and treatment knowledge base (diagbot) based on in-depth medical text understanding, with the goal of improving doctors' diagnostic service ability, realizing doctors' homogeneous diagnosis and treatment, and preventing misdiagnosis. With the purpose of promoting the intelligent transformation of the medical industry, Lantone Medical Co.Ltd. cooperates with China's authoritative hospitals to develop and launch a series of intelligent medical auxiliary products, including digbot intelligent auxiliary diagnosis and treatment system, self diagnosis / triage, pre consultation, etc.

(2) How Lantone's pre-consultantion chatbot works

1) Guided Q&A: If you are uncomfortable and want to see a doctor，you can first log in this chatbot system and it will guide you to finish some questions about your syptoms. Then it will send your situation to the doctor before you go to the hospital.

2) Upload of existing inspection results: You can upload some diagnostic results about yourself to make sure the doctor know your condition better.

3) Review of Patient's illness: Patient can check their own result after see a doctor，and all the results will be recorded.

4) How successful it already be

Until April, 2019, Lantone medical had been applied to 150 community health care, 5 best hospitals of china, 300 private chain clinic and 3000 community service station in China.

2.1.3.2 Lefthand doctor

(1) Genaral information: Beijing Zuoyi science and Technology Co., Ltd. was founded in 2015, with core personnel from Baidu natural language processing department, Tencent and the national health and Health Commission. Its core product, left hand doctor, is to integrate advanced technologies such as deep learning, big data processing, semantic understanding, medical interactive dialogue with medicine, enable all sectors of the medical and health industry, and realize intelligent medical upgrading.

(2) How Left hand doctor's pre-consultantion chatbot works

1)Automatic collection of medical history: It can help users accurately describe their own conditions and collect disease information in a guided way, which improves patient's participation, letting patients know their own conditions, and prepare for the next doctor-patient communication.

2) Help doctors to know the user's condition in advance: The collected medical history information is automatically matched to the hospital's electronic medical record system to provide a preliminary medical history information for doctors. When doctors ask for diagnosis, they only need to ask for a little more points.

3) Save time for doctors to write medical records: The user's answer will automatically generate the standard medical record, and the doctor only needs to modify it to complete the medical record writing.

(3) How successful it already be

The open platform for left hand doctors has covered more than 6000 common diseases in 35 departments, and is equipped with five functions of intelligent self-diagnosis, intelligent guidance, intelligent pre diagnosis, intelligent medicine and intelligent Q & A, which can be accessed if required. So far, the left-handed doctor open platform has served more than 300 industry customers, serving nearly one million people every day.

(4) Prospect & Problems

In our opinion, the emergence of pre consultation robots has brought great convenience to patients and doctors. People no longer need to spend a long time waiting for doctors as before, and doctors do

not need to repeat some simple work every day, such as establishing medical records. And the pre consultation does not need too difficult professional knowledge and terminology. It only needs to help doctors establish patient files and record the patient's codition. But even though the current pre-consultation chatbot has developed well, it still needs to be improved. For example, the query database needs to be improved continuously. Moreover, how to promote the pre-consultation robot in a large scale is still a problem. Although it is convenient, as far as I know, there are still many people don't know what it is. In addition, there is a risk of leakage of people's privacy. Companies who develop pre-consultation robots still need to invest more in network security.

2.2 Medical Service Chatbots

2.2.1 What is medical service chatbots

People will find that it is very difficult to obtain the consultation with the doctor in case of any health issues., so it is very necessary to have our medical service chatbots This medical chatbot can diagnose the disease and provide the basic details about the disease before consulting a doctor，which can reduce the health care costs and get more access to medical knowledge that the medical chatbot is built[4]. Certain chatbots acts as a medical reference books, which helps the users know more about their disease and give their more advice. What's more, the user can ask all kind of diseases and provides a personalized diagnosis based on their symptoms. Hence, people will have an idea about their health and have the right protection.

2.2.2 How it works

Once patients get sick, they can consult the chatbot, which will ask the user a series of questions about their symptoms to diagnose the disease. It gives suggestions about the different symptoms to help patients to make clear their condition. According to the user's reply, the chatbot would suggests the doctor who can be consulted in case of major disease. The system keeps the answers from the past and raises progressively more specific questions to obtain a good diagnosis.

2.2.3 General example

Microsoft Healthcare chatbot

Healthcare bot service not only has built-in medical content and language understanding model from medical resources, but also allows developers to customize and extend functions. In addition,this service meets industry and global recognized security and compliance standards. The chabot can help patients in this hospital find the location they want to go, schedule appointments, and provide answers to non-medical questions. If the user is not satisfied with the answer given by the robot, the robot will send the user's needs to human experts.

2020 is a special time for the new coronavirus. Centers for disease control and prevention use Microsoft's healthcare BOT service to create a covid-19 assessment chatbot to screen Americans who may not be sure if they want to see a doctor [5].The coronavirus self-examination robot raises a series of questions based on the CDC guidelines for symptoms (such as shortness of breath or dizziness) and risk factors, and proposes the next step, including whether users should be isolated, consult a expert online or go to the emergency room. The robot appears to be a possible way to make people who have so-called "very worried" symptoms may not require medical treatment, which in turn could free doctors and emergency rooms for certain patients suffering from coronavirus. So you can see that medical service chatbots helps us a lot during this period.

2.2.4 Prospect & Problems

Medical service chatbots really helps us a lot, not only the patients (chatbot can tell us what people need or what people are not sure and save our healthcare costs and time to the hospitals), but also the doctors and resources (chatbot help to save doctors time so that doctors can allocate their time more efficiently and hospital can optimize the allocation of resources). So there is a good prospect for it. However, it is hard to stop the erroneous judgement of chatbots and people who don't answer the question truthfully and so on. These problems are still need to solve.

2.3 Mental health consultation chatbots

2.3.1 What is mental health counseling chatbot

In recent years, the digital health of psychological counseling has become a new direction in the

development of psychological therapy [6]. Generally, the public perception of chatbots is limited to asking a question and the chatbot responds passively. But in fact, the chatbot can also ask and question users based on the situation. This mode is more active, easier to mobilize user participation, improve user stickiness. Chatbots are more interactive than regular web pages.

Cognitive Behavior Therapy has been combined with advanced natural language processing technology (NLP) to help users record their emotions and detect early signs of depression. In addition, it can provide users with interactive cognitive behavioral therapy, and as the conversation deepens, it can discover patterns and suggest ways to relieve bad emotions or negative thoughts.For people with mental illnesses such as anxiety and depression, it's almost impossible to be brave enough to speak your mind.Now, however, researchers have found a solution to this problem, with the development of a health mental counseling, the main function of chatbots is to help patients reduce anxiety and depression symptoms.The chatbot can chat with patients via social networking sites to help them deal with mental health problems[7].

2.3.2 Market analysis

Mental health is also the main application direction of voice interaction in the medical field in the future. The interactive mode of voice can directly stimulate people's hearing sensory system, generate and convey emotional signals to meet spiritual needs. At present, the application of psychological health consultation chatbot is relatively lacking in the domestic market. Current situation of psychological services in China.

In the United States, counseling is a sign of confidence and wealth. According to statistics, 30 percent of Americans get psychological counseling regularly, and 80 percent go to a psychological clinic irregularly. As many as 60 million people, or 24 percent of Americans, receive counseling and psychiatric care each year.

However, this is not the case in China. On the one hand, the public's acceptance of psychological counseling is not high. According to the white paper on the mental health of Chinese urban residents released by the health management branch of the Chinese medical association, 73.6 percent of urban residents are in a state of sub-health, and 16.1 percent of urban residents have different degrees of psychological problems.

2.3.3 General examples:

Pengcheng psychology chatbot

(1) Introduction:

Pengcheng psychology chatbot is a mobile Internet platform one of the chatbots focusing on public mental health. The founding team members are from the fourth military medical university, sino-german psychological hospital, alibaba and other related institutions. The core members have more than 10 years of professional psychological service experience or Internet service practice. Relying on digital services, pengcheng psychology provides popular and professional psychological knowledge popularization, psychological testing, online psychological counseling, offline activities and special training services, providing support for the mental growth of more Chinese people, and providing more opportunities for psychological professionals to show their personal abilities and serve the society.

(2) The target

The goal is save lives. Group power construction, staff psychological counseling, enterprise psychological courses, staff crisis intervention and other services. With the goal of improve Chinese people's living quality, mental health consultation chatbots will continue to unite all social forces, constantly explore new models of psychological services, and play its role in building a harmonious society.

2.3.4 Risk and future

In the past few years, there has been a large influx of apps in the field of Internet health care (over 30% of these apps use medical robots), and most start-up teams are still looking for more mature and sustainable business models.More than half of doctors (53%) agree to some degree with the challenges associated with using health care chatbots, most notably, 76% of these doctors believe that chatbots are not effective in taking care of patients' overall needs; In terms of risks, the most prominent problems are that patients use chatbots to diagnose themselves too often (71%), while chatbots cannot provide

specific interpretation of patients' diagnosis (71%), and patients cannot accurately understand the diagnosis (74%). Based on the above feedback, the risks listed are mainly focused on diagnosis. The list of existing weaknesses and risks is more a reality to be accepted than a challenge to be address ed. Instead of taking a lot of trouble to overcome these challenges, it is better to adopt the strategy of m aking the best of the advantages and avoiding the disadvantages.

2.4 Elderly care companion robots

2.4.1 Introduction

Facing the increasing strain on healthcare service because of the rapidly ageing population all around world, people find that robots can be super helpful in medical care, especially for elder people. Elderly care companion robots emerge as the times require: they timely production of illustrating how robots can help care for the elderly in life, providing suitable physical help and ethical companion. However, in today's market, elderly care companion robots are still facing big challenge because of the bad customer using and complex operation[8].

2.4.2 Current market

Current elderly care companion robots can achieve most easy function of helping improve the quantity of life for elder people. According to a discussion essay introducing the development of elderly care companion robots in ZHIHU named Understanding the Past, present and future for elderly care robots, the author Mingjie Duan pointed out, early in 1980s, robots started to be used in elderly care. But most work is still helping elder people with defecating, turning over, and health monitoring. Until 21st century, with the development of AI technology, robots started concentrated in meeting the psychological needs, especially for empty nesters. But until today, most companion robots are still in the beginning stage.

2.4.3 Signature companies

Several companies have some features to recommend them, and one of the precursors is Critical Signal Technologies (CST). CST is a health services company with an innovative approach to remote patient monitoring. Like what they said on their official website, CST helps patients live independently, avoid unnecessary hospital visits, manage chronic disease, and coordinate care. They have built their own health caring system since 2006, which not only have Telemonitoring (aka RPM), In-Home PER, Medication Management Systems to help elderly people know better, and do well in their body health, but also includes Social Work Services for consulting, and Senior Living Safety System for the whole family. According to third party validated data, PMPY savings for mental and behavioral disorders has been as high as $6600 until 2018. The average annual interactions per patient has reach 23 times. Which means CST did bring a huge change for mental and behavioral disorders, and convenience elders a lot by providing their services.

Elderly care companion robots had become a hot issue in china as well. On 2019 panoramic Phoenix camp. Bay area science and technology innovation competition in Hangzhou, China, an elderly care companion robot designed by Shengying Zhicheng attracted everyone's attention and become a hot spot for the Chinese public rapidly. Their design group is small and immature, but they already have their first robots come out in June. So far, their robot can communicate with elders and simulate human emotions in order to bring a sense of company. Hopefully, in the future, their robots can solve a lot of problem for elderly care.

2.4.4 Shortage and future

Similar as phycological, biggest problem considered is lack of emotion. Moreover, most existing ap plications in nursing care for old people need complex setting and uploading of data. It is too hard for o ld people learning how to use new applications. With the development of the concept and technology of intelligent pension solutions, the future pension model will be more diversified, user-friendly and efficient. Chatbot has led the new fashion of intelligent pension development. Various kinds of pension chatbots are numerous and complicated. And it can easily understand human language and store information to the elderly diagnosis of the disease of the nursing robot. Accompany the elderly talking, teasing the elderly happy[9]. And fitness robots that help the elderly with physical exercises. At present, the functions of the elderly chatbots are mainly sports status monitoring, health care, mobility assistance, communication entertainment, housekeeping services and so on. In the future, elderly care robots will have higher IQ and EQ, and can undertake more detailed, more complex, more interactive and more humanized elderly care services.

3. Conclusions

Medical chatbot may also function in a replacement situation, While unlikely to replace human healthcare providers entirely, AI may perform certain task more consistently, quickly and and reproducible than humans such as pre-consultation, medical institution customer service, or mental health consultation and elderly care companion. Perhaps the most powerful role for AI will be a supplement to human providers. Studies have demonstrated a synergistic effect when clinicians and medical chatbot work together, producing better results than either alone. Medical chatbot technologies could also increase real-time clinical decision support, bringing about improved efforts toward precision medicine. Development of a workforce that is cross-trained such as communication and cooperation are possible between physicians and healthcare providers, data scientists, computer scientists, and engineers will be crucial. While these technologies hold promise for increasing productivity and improving outcomes, it must be remembered that they, just like their human creators, are not infallible. It is necessary to evaluate and implement them with a critical eye, keeping in mind their limitations and educate policymakers to do the same.

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