Artificial Intelligence in Healthcare: A New Technology Benefit for Both Patients and Doctors

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***Abstract*—Artificial Intelligence (AI) is arguably the most exciting robotics industry and it is recently emerging in healthcare. Most of the researches have been focusing on prediction algorithms of patients' diseases such as cancer, cardiology, breast pathology, etc. Some findings increased computer intelligence as the main application of AI which called deep or non-deep machine learning. The gap from previous models is using one function or one type of AI to analyze, forecast diseases rather than helping patients and doctors in surgery. There are rarely white papers using AI for patients approach to training them to know more about their diseases or surgery. Therefore, with developing of more than one function of AI, the paper builds a diagrammatic conceptual model of artificial intelligence on medical app running Blockchain technology as a friendly assistant for both patients and doctors to communicate them during pre-surgery, surgery and post-surgery. First, AI as an assistant checks free appointment from doctors and patients' available time. Second, AI reminds doctors' schedule of up-coming surgery list and training patients before taking surgery. Third, deep learning AI analyses patients' healthcare record and suggesting the solutions for patients after surgery under the doctor's review. This paper hopefully will contribute to AI application in healthcare in which not only doctors using it but also patients, drug companies, insurance companies and hospitals can approach.**

I. Introduction

A. Overview of AI

AI can be defined as an industry of computer science related to the automation of intelligent behaviors and it must be based on applying theoretical principles as well as the operation of applicable models. Each type of artificial intelligence is currently stopped at the level of computers or supercomputers used to handle a certain kind of work such as controlling a house, studying image recognition, processing data of patients to provide treatment regimen, data processing to self-study, ability to answer questions about diagnosis, answer customers about a company's products, etc.

According to Buchanan, B. G. [5], AI originally is created from fantasies in the 19th century, when science fiction writers had used the prospect of intelligent machines to foster the non-human's intelligence, thence to make us think about our own human characteristics. Some writings of Jules Verne Isaac Asimov, and L. Frank Baum had inspired many afterwards AI researchers. From 1950 – 1965, scientists such as John McArthy, Marvin Minsky, Allen Newell and Herbert Simon, together with their students wrote programs to help computers solve the algebraic problems, prove determinations and be able to speak English. Some of the achievements in this period include the Checkers-playing Program of Lee Samuel, a "thinking machine" called the Logic Theorist of Newell and Simon, the Geometry Theorem Machine of Gelernter (a program demonstrating geometric theorems).

In the 1960s, AI studies focused mainly on the representation of knowledge and the mode of communication between people and computers in natural language. However, all failed because the progress of informatics at that time had not reached the level where it could be done. Thanks to the historic battle between the chess champion Garry Kasparov and an IBM's supercomputer named Deep Blue in 1996 and 1997, the hope of AI was revived.

In 2015, the development of the cloud computing basis at an affordable cost, along with plentiful data sets, free or cheap software development tools have greatly supported researchers. As a result, studies of computer learning technology, also called neural networks, have become relatively cheap. All have helped the land of AI attracted a lot of great companies such as Facebook, Google, and Microsoft participate in researching and developing, hence it has opened a new era for artificial intelligence. One of the most remarkable events happened in March 2016, when a professional human Go player (a Chinese cardboard game) was beaten by a computer which runs software called "AlphaGo".

B. Types of AI

Currently, there are 3 ways to approach AI called Machine learning, Cognitive computing and Deep learning [17]. A few researchers in the radiology field also define the hierarchy of AI in 3 techniques which have the same way to name except Cognitive computing would be Representation Learning [25].

Supervised Machine Learning (ML) refers to the algorithms which analyze data, learn knowledge from that data and apply what they have learned to make appropriate decisions. In healthcare, the ML algorithms would be trained to detect any disease on lung when checking a chest radiographic by analyzing numerous previous radiographic from both normal cases and abnormal cases [25]. The more data are collected and saved, the more efficient ML can run. However, it requires a supervisor for dealing with inaccurate results that ML returns. At that time, data scientists and data engineers need to analyze the cause and adjust the algorithm accordingly.

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Unsupervised Representation learning (RL) refers to ML without the intervention of humans, i.e. the algorithms learn the way to classify provided data itself, then use it to analyze. This method let RL eliminate jamming information so that it can achieve better efficiency [25]. As for Krittanawong et al. [17], cognitive computing refers to the imitation of the operations of human thinking through ML together with pattern recognition and natural language. The objective of cognitive computing is excluding human assistance and generating solutions by itself. Consequently, the structure of cognitive computing basically is the same as RL.

Deep learning (DL) (or Reinforcement Leaning) refers to a technique for implementing ML in which the algorithms automatically learn from their mistakes or failures and adjust themselves accordingly. The operations of DL is more complicated when it learns to imitate the human brains by approaching the issues through multiple layers of neuronal networks, then automatically take form predicted decisions from input data [17]. According to Robertson and his colleagues [21], all layers have their own data tier and missions. The first layer absorbs the raw input data, the middle layers receive the information from the previous layer and transform it to the next layer after operating some simple matrix, and the last layer provides the requested output.

II. Literature Review

A. White paper of AI application

A thousand of AI researches or AI models have been conducting in different areas, especially in healthcare such as radiology, medicine management, breast cancer, cardiovascular, cardiology, etc. The current study only focuses on AI model in surgery; however, it provides a good framework of the literature review to find the gaps from previous researches as a basic of new AI model.

TABLE 1. SUMMARY OF LITERATURE REVIEW PAPERS

Author	Output	Finding gaps
Bini, S. A. [3]	Providing a basic understanding of three types of AI to support, take care of patients and amplify human cognitive functions. Stating that the bigger data-set inputs to AI, the more accurate output.	No model of AI impact healthcare.
Liew, C. [24]	A roadmap for implementation of AI in radiology was drawn. AI could reduce the overall cost of imaging to the patients or payer by increasing the productivity of radiologists which automated cognitive value activities and low time-consuming.	The concerns about safety, privacy, moral and ethicality once again were stated in this paper. AI was on the purpose of achieving a smooth transition through the practice of augmented radiology. No model of AI in radiology.
Starikov, A., at el [24]	Clinical imaging approach had more advantages than the traditional approach. A model compared the traditional approach and AI approach for radiologic image interpretation. AI could scan breast cancer, provide treatment decision and prognostic, data-based analyzed, particularly deep learning can "learn" and modify the structure of artificial neural networks.	A model is applied for radiologic and support doctor analyze breast cancer, not support patients.
Tang, A., at el. [25]	Explaining the hierarchy of AI fields. Building the AI structure and governance to address specific challenges or issues of interest in AI. Advising on corporate partnerships, liaise and support many working groups such as research and development, technique and apps, education, legal and ethics, writing group and industrial partners. Delivering rapidly improving performance in image recognition.	This paper suggested the link between AI and management structure. AI model without payment function among these working groups.
Houssami, N., at el. [15]	The larger storage capacity for hundreds of thousands of digital medical imaging, the more accurately AI scan. AI could not detect breast cancer from the early phase due to the numbers of unexplored issues.	No model of AI in breast cancer detection. Extremely large data-sets of imaging examinations linking to clinical factors and cancer outcomes which were needed to train and validate robust AI model.
Hamet, P., & Tremblay, J. [13]	Deep leaning information management through a model of data trust pipeline flow integration. Targeted nanorobots and a unique new drug delivery system also embodied in a virtual branch of AI in medicine in general and electronic medical records in specific.	The concerns about surpassing human brain capabilities and controlling human life of AI was stated in this paper. A hope of creating ethical standards, developing it successfully and efficiently and making it popular was brought out for solving those concerns.
Krittanawong, C., at el. [17]	A model of deep learning AI was mainly applied to Cardiovascular medicine imaging for prediction, diagnosis and treatment. Validation data by other data-set was necessary. All other data-set included lifestyle, genetics, gut microbiome, social media, omic data, wearable technology linked to EHRs and big data to create three kinds of AI: cognitive computing, deep learning, machine learning.	The limitation is manually labelled and inaccurate if data-set is biased. This model supports doctors predict disease by exploring novel genotypes and phenotypes in existing diseases, does not support patients. AI enables cost-effectiveness and reduces readmission and mortality rates.

Chang A.C [6]	Bringing up the connection between big data and AI as a genomic data-clinical medicine synergy in pediatric cardiology. Giving the name of biomedical big data which could strategically utilize methodologies in AI.	No model of AI for cardiology. Potential limitations of biomedical big data: -Overwhelmed data which were not relevant directly to disease. -Unrelatable, incomprehensible or invisible data which were inconvenient to both medical caretakers and patients.

In general, many pieces of research of AI on healthcare investigated in radiology, breast cancer, medicine, etc. One common point of these findings is that a model of implementing AI is rarely built and applied in surgery. Few AI model was built with the payment function and most of AI applied to support doctors rather than patients.

B. *Empirical Evidence of AI*

In 2003, AI was applied to create a method for determining tea flavors as well as predicting tea quality. In this method, an electronic nose would be established to classify different sets of tea samples based on the trained categories. If a new and untrained category turned up, it could track the nearest patterns which were already known, then classify them into the instrument [10]

In 2015, *the project DeepDream* as AI system that simulates the human nervous system developed by Google engineers was released (https://deepdreamgenerator.com/). When Google asked for an artificial neural network to "dream", this AI system began to produce bizarre images. They might look weird but they all were in the Google plan outlined to solve a major problem of ML: identifying objects in photos. The purpose of this program is to enhance the ability of pattern recognition for the computers which have not done well. At first, engineers would "teach" the neural network to identify certain objects by uploading 1.2 million images which are clearly classified to the computers in such a way that they can be read [24]. In Gurkaynak and his colleagues' findings [12], it could define concepts through thousands of images from input data, then use these definitions to identify them by itself, for example, what a house looks like or what a cat would be in a photo. However, Google engineers would like to go even further with the Deep Dream project that allows neural networks to add hallucinogenic properties to photos. Google wants their neural network to be "good" enough to see an image of an object required even if the image does not contain that object such as recognizing a dog's silhouette in the cloud. Deep Dream allows the machine to change the image rules and parameters to identify images that are not directly presented on a particular image (Natalie, 2016). That is why even with an image of a tree, the neural network can analyze each pixel to identify the details that look like an eye or a face.

In 2018, Alibaba, the Chinese tech giant has created an AI tool which allows writing 20,000 ads per second. Accordingly, the e-commerce platforms of Alibaba such as Tmall, Taobao, Mei.com and 1688.com would be inserted a toolbar that allows "creating smart ads in a form". According to Christina Lu, head of Alibaba's Alimama marketing department, the content written by AI is the result of DL. It relies on a large amount of high-quality human content. Therefore, AI will not be able to completely replace the person in the job that requires this creativity [15].

In the transportations area, the on-demand transportation firm Uber has applied AI to clarify whether the user's demand is about working or pleasure based on a feature called Profile Recommendations. Due to a large number of users who have two profiles for two demands as well as the mistakes of using a business account to pay for personal activities, Uber developed this function on app helps users switching between two types of purposes. By applying ML models, the app would predict the correct profile of users and provide the appropriate payment method to them [8].

In the field of medicine and health care, the application of AI algorithms would help doctors establish better strategies and treatment plans for patients, as well as provide doctors all the information they need to make the most appropriate indication. Many worldwide technology companies have been developing AI applications aimed at many different aspects of the field of medicine. The most obvious application of AI in this field is information management, in which collecting, storing, standardizing and tracking information paths are the first step in revolutionizing the medical system today.

A program called Watson for Oncology was announced by IBM Watson in 2016 (https://www.ibm.com/us-en/marketplace/ibm-watson-for-oncology). This program provides cancer therapists with different treatment options based on evidence from structured and unstructured data which combine information from patients with data of external studies and evaluation of clinical experts. The clinicians who are supported by leading oncologists' deep expertise in cancer care through Watson for Oncology would bring out correct cancer treatments for their separate patients. Although the program has not completed its mission in beating cancer because of the complication of cancer treatment as well as the inconclusive researches of scientists, AI still brings hopes to crack the code of individualized diagnosis and treatment [11].

In 2018, *The Deepmind Health project of Google* exploits medical record data to help provide faster and better health care services (https://deepmind.com/applied/deepmind-health/). This project also collaborated with Moorfields Eye Hospital NHS Foundation Trust to improve the treatment of eye diseases. Thanks to the research published on Nature Medicine's website of Moorfields and the UCL Institute of Ophthalmology, the signs of eye disease are detected by thousands of historic de-personalised eye scans by the ML technology. Based on the result of scanning, patients are recommended the proper ways of caring for their eyes. The accuracy rate of this system can come up to 94% so that it helps to recommend accurately conclusion for over 50 eye diseases [9]. This project brings hope to the professionals to perform the eye tests, assist them to find out early the issues related to eyes so that they can specify which situations should

be prioritized to diagnose and treat. From that point, irreversible damages happened to patients would be decreased.

Babylon, online health care and medical consulting service provider from the UK, has partnered with Samsung to develop a medical consultation application using AI technology based on personal medical history and common medical knowledge and launched in 2018 (https://www.babylonhealth.com/). It gave advice about healthcare ways, reminded patients to take medicine, monitored and detected the patient's feelings. If AI could not understand the patients, it would not give them correct and reasonable information. Hence, aiming to shorten the gap between AI and patients, Babylon's developers used a system called Natural Language Processing (NLP). This system helped computers clarify, understand and communicate with the human by language patterns. In order to implement these activities, NLP divided speech and text into shorter factors, then analyzed what every factor means and how it contributed to the general meaning by linking them with the medical terms in Babylon's Knowledge Graph – one of the largest structured medical knowledge bases in the world. ML are applied to undertake numerous tasks on Babylon. The inference process was sped up by combining ML and DL in establishing probabilistic models, hence the developers of Babylon forecast new relationships between medical concepts based on reading medical literature.

The banking industry in general and the financial technology sector (FinTech) in particular is one of the sectors with drastic changes under the impact of core technology in this 4.0 industrial revolution. AI plays an important role in changing FinTech by applying ML in several ways of serving customers [26]. Some AI applications in FinTech can be mentioned as data analysis and proposing results for leaders to get better decision making, supporting customers automatically through chatbot, detecting fraud and managing complaints, assisting users in making financial decisions through the automatic financial assistants, and the predictive analysis in financial services. In 2016, Bank of America developed the chatbot called "Erica" and demoed it at the Money 2020 conference in Las Vegas. Erica was designed to learn the nuances of communicating with humans, then react more usefully so that it would tend to help the bank looking for an easier way to talk to their customers [7].

The startup http://www.sensely.com/ has created a digital nurse Molly to organize patients' symptoms and follow up treatment with doctors' advice. Thanks to speech recognition, Molly can listen to the patients and delivers an appropriate response. Three main tasks of Molly are symptom triage, service locator and self-care, however, this AI on mobile platform focuses on chronic illnesses only.

A smartphone's webcam is partnered with AI AiCure application (https://aicure.com/) to confirm patients' prescriptions and manage their condition. Some patients could take serious medical conditions and they tend to against doctor advice, and participants in clinical trials. Therefore, Aicure app was created by the National Institutes of Health with the fundamental function of medication management.

AI nowadays is applied in life in two ways: using computers to mimic human handling processes and designing smart computers independent of human thinking. Obviously, we cannot deny the success of amazing famous AI using in over the world such as Siri of Apple as a personal assistant, Alexa of Amazon that can help us scour the web for information, shop and a million other things, self-driving Telsa in which Elon Musk is building its own AI chips (2018)[1]. Surprisingly, the world has seen the state-of-the-art AI named Sofia who is the first robot and was given Saudia citizenship in 2017. Hanson Robotics (https://www.hansonrobotics.com/) developed cognitive architecture and AI-based tools Sofia who laughs, smiles and frowns just like us.

In summary, most of findings and applications have been using AI to create hit songs in music, to support customers in the financial technology sector, to predict tea quality as a virtual chef, to support people as personal assistant, etc. From the doctors' viewpoint, many papers created AI model or application in healthcare especially treatment design, digital consultation, medicine management, precision medicine, health monitoring. As a result, AI helps doctors analyzing results more exactly and saving time to give patients the treatment. In healthcare management, AI model is very complicated and contains insight knowledge for doctor as the main beneficiary rather than for patient.

C. *Identify the gaps of using AI*

Although many papers and application created AI in healthcare with one basic function, this paper found that rarely findings allow the patients to read their own diseases, particularly supporting both patients and doctors in payment. Here are some gaps from previous white papers and applications.

- Few AI is created in surgery, most of AI using in one specific disease.
- Few simple AI model was created for helping patients in the surgery process or educating patients to know more about their health problems.
- Few AI helping doctors as an assistant to remind doctors about their schedule.
- Few AI supporting patient's pre-surgery or post-surgery, communicate with patients and let them know what they should do before taking surgery, training them to understand more their disease.
- Few AI has been applying for payment in healthcare while most cases are involved in many stakeholders such as insurance companies, drug companies, hospitals.
- Few types of research built or corporate many functions of one AI in one model to satisfy the increasingly high requirements of the Fourth Industrial Revolution.

Mostly AI has been using for doctors to analyze the disease's symptom. Besides that, we are building AI model in

[1] Elon says that whereas Telsa's computer vision software running on Nvidia's hardward was handling about frames per second, https://techcrunch.com/2018/08/01/tesla-is-building-its-own-ai-chips-for-self-driving-cars/

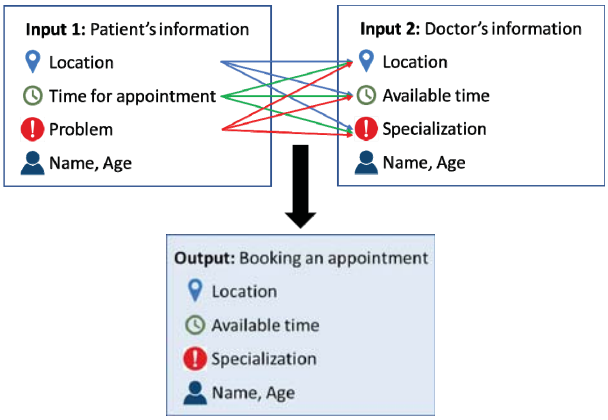
order to create a mobile application which helps patients know more about their health problem. Moreover, with the combination of AI and Blockchain to have the function of payment on the application, AI as a virtual nurse could communicate to doctors, insurance companies, drug companies, hospitals to let them know how much they have to pay for the patients, what kind of medicine the patients take. Hence, the target reader is the relevant stakeholders such as doctors, patients, drug companies, hospitals, insurance companies.

Therefore, a multi-task AI will be appropriate to support many parties involving in surgery and payment. Absolutely time and cost savings are the most benefit for patients since the payment process is not a separate step in healthcare (2018)[2].

III. Conceptual Model

From the gap of previous findings and model of Blockchain in healthcare by author (2018)[3], this paper will build three models of AI with three main functions of AI: booking an appointment, analyzing the results of surgery, announcing patients and stakeholders know how much they have to pay the fee of surgery. At the end of three models, some screens on mobile app can demonstrate these AI functions as a nurse for patients and an assistant for doctors.

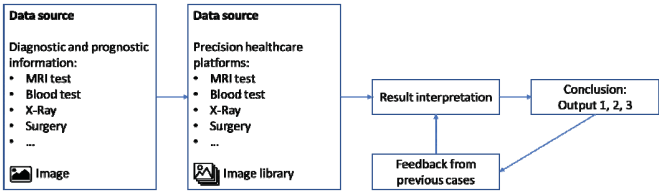
Model 1. Booking an appointment



Before booking an appointment, AI will talk to users and find out which case they are facing: emergency or non-emergency. In order to do so, AI asks users some questions with a combination of scanning other patients' electronic medical records. As a result, an available list of doctors will be shown for patients to contact immediately if it is an emergency. Otherwise, an appointment is booked by users' options of time, location, etc.

Patients can book an appointment from the mobile app by choosing a location, available time for both patients and doctors. Moreover, patients can also choose the doctors who are expert in the field that patients are having the problems, for example, eye surgery doctors, heart surgery doctors, etc. This AI is unsupervised learning machine because the output will be presented in case of matching all the requirements from both parties.

Model 2. Analyze the test results



After booking an appointment, the patients need to do some test before taking surgery such as MRI test, blood test, X-Ray test, etc. The results could be scanned from the app and analyzed by AI's image library. If this case happened for the first time in the app, the output needs a doctor's comment. If this case happened exactly 100% as same as previous cases, the output would be given automatically. If this case happened with more than 1% differently, the output will use the treatment from the previous cases and doctor's supervision to give the output. Thereby, we have three options of output with three different levels of AI:

Output 1: Supervised learning: Conclusion with doctor's comment

Output 2: Unsupervised learning: Automatic conclusion if diagnostic and prognostic information is 100% as same as Precision healthcare platforms

Output 3: Reinforcement learning: Compared to feedback/ results of post-surgery to make the conclusion more exactly.

In fact, AI in model 2 has two functions which can be learned from electronic healthcare records (EHRs).

First, AI talks to users and scan previous EHRs from many other patients to find out the user's health problem

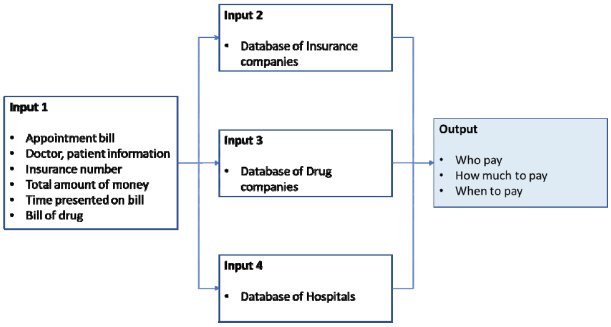
Second, from previous EHRs, especially doctors' comment, prescription, solution with a comparison of more than 90% as same as previous cases, AI can recommend a brief of conclusion, send it to doctor for checking before putting a notice to patients.

Moreover, this paper aims to create AI with payment function involved in many stakeholders such as insurance companies, drug companies, hospitals.

[2] Researchers from NYU Langine Health found that AI could find and match specific lung nodes (on chest CT images) betwwen 62% to 97% faster than a panel of radiologists, https://hbr.org/2018/05/10-promising-ai-applications-in-health-care

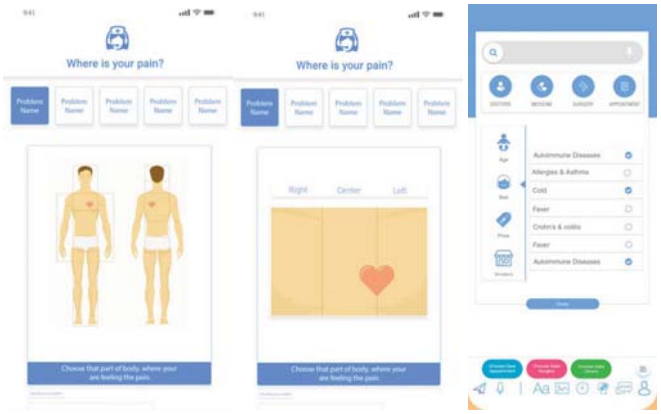
[3] In *Blockchain in healthcare: a new technology benefit for both patients and doctors*, (Tran Le Nguyen, PICMET 2018), author created model using Blockchain to store and manage data of surgery more effectively and facilitate many related parties access data quickly and safely.

Model 3. Supporting in payment



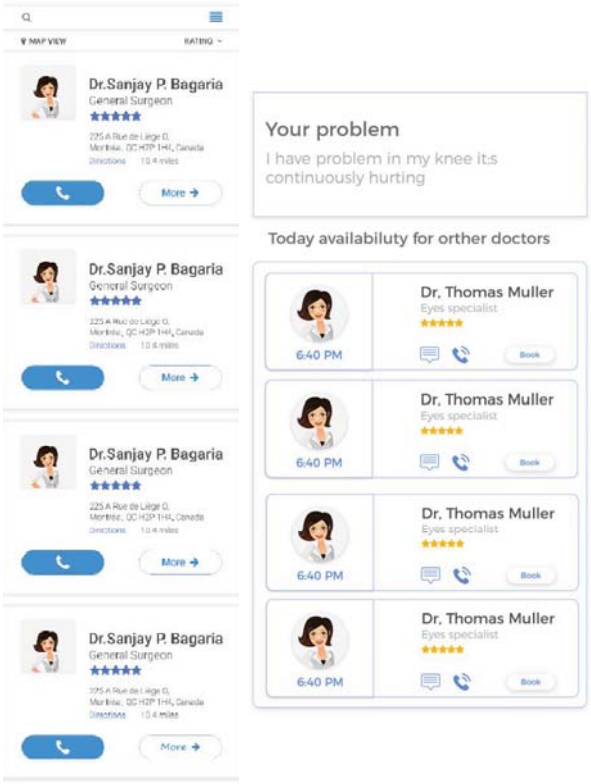
Normally a healthcare bill will be shared by insurance companies and hospitals in the United States. Therefore, continuous data updating before and after taking a surgery is very crucial. Thanks to Blockchain and AI, all data from booking an appointment and surgery in which it includes name, insurance number, drugs for treatment… will be presented by AI to remind patients how much they have to pay or when they will receive from insurance companies. Moreover, drug companies will also receive notices from AI.

Here are some screens we paid for designers to make a mobile application and demonstrate three models. Some other screens we put on appendix in the end.



First, patients communicate with a virtual nurse to let her know their problems by touching on the body, zooming in or out the parts of the body. Patients have to answer a few questions from the virtual nurse or talk by a voice button function at the end of the chat screen. When AI find out the problem, a virtual nurse can recommend the list of some specialists in the field that patients have the problem.

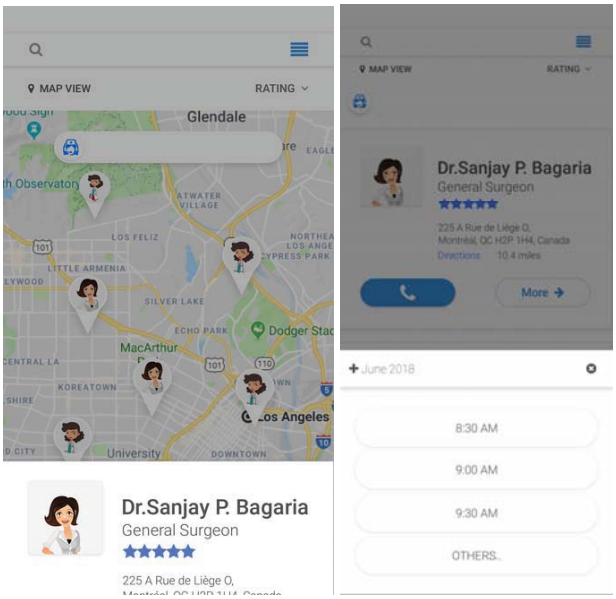
The patients can scroll up and down the list of doctors, tap on one available doctor in order to text message or call her/him directly or voice message. Then patients book this doctor for an appointment.



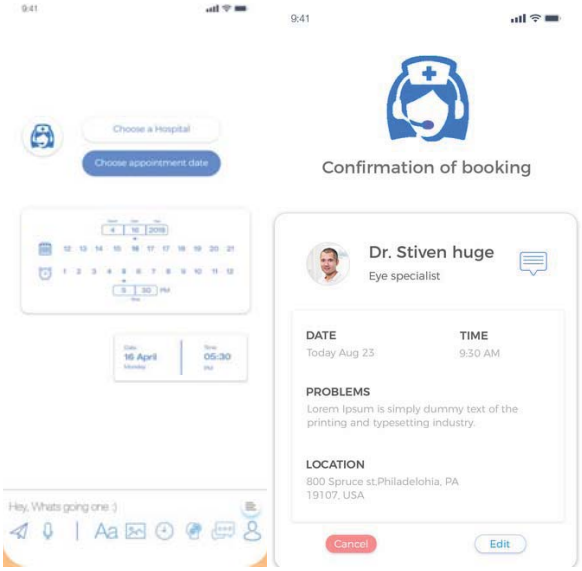
(scroll up and down the list of doctors)

The patients can scroll up and down the list of doctors, tap on one available doctor in order to text message or call her/him directly or voice message. Then patients book this doctor for an appointment.

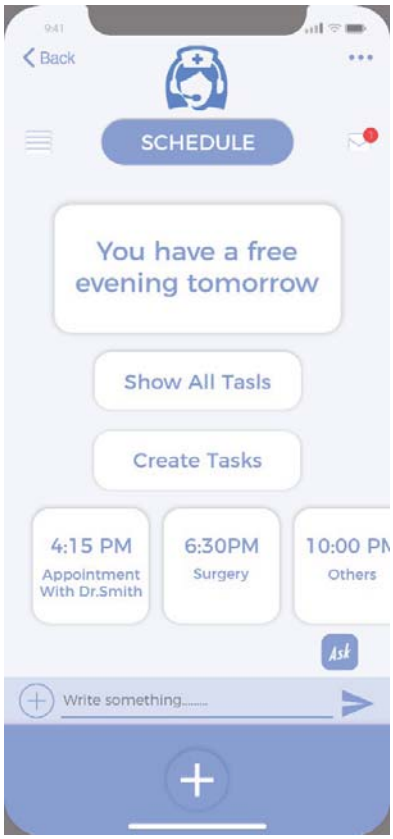
Moreover, patients can search by location or hospital where they wish to have an appointment or surgery.



In addition, patients can choose an appointment at the available time from the doctors who have a free schedule. AI has to scan and find the matching between input 1 and input 2 as the first model. Finally, an appointment is confirmed.

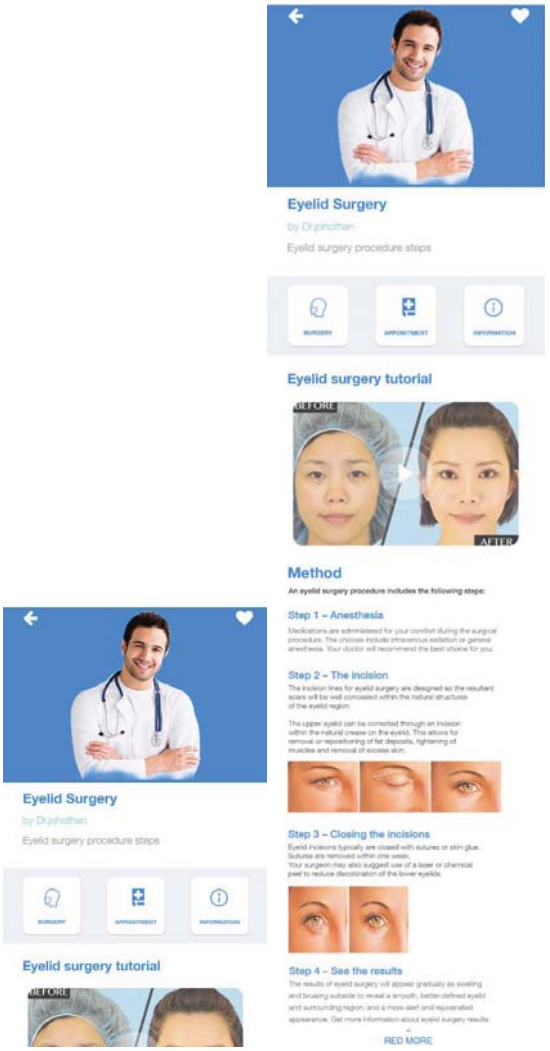


In the meanwhile, AI is not only a virtual nurse for patients but also an assistant to inform the doctor about their schedule. Doctors also have the options of time and date for an appointment. Whenever doctors change their timetable, doctors can edit and send messages back to patients.



The above screen shows the profile of a doctor with three functions: doctor's latest schedule, the schedule for a whole month or whole week which depends on doctors' setting, create more event on doctors' schedule. At the bottom of the screen, "plus" button with many options for doctors to adjust their schedule by typing or voice recording. Doctors also can ask AI anytime by touch "ask" button.

Furthermore, a virtual nurse can train patients to know more about their disease and what they should do before taking surgery. There are some videos of surgery process or overview knowledge of what happens before and after surgery such as what they should eat, wear, prepare before surgery, what kind of foods the should avoid after surgery, which exercises they can do in post-surgery.



(scroll up and down the information of their problems)

Due to time and investment limitation for these screens in order to build the mobile application based on AI, the authors have not finished the screens to demonstrate payment process yet. Many screens authors have to cut down because writers are focusing on conceptual AI model, not the application in this

research. One of the best features of these screens is we are using AI educate patients to know more their issues, let them know what happens after they have an appointment with doctors. This is a very crucial problem in some poor countries, especially poor patients who do not have enough chance to talk to very busy doctors in Vietnam. While other previous AI focused on analyzing the results of healthcare test and support the doctor before giving a final conclusion of the disease.

IV. Conclusion

The AI application is increasing sharply, not only in general sectors but also in healthcare. Many different interdisciplinary pieces of research with different AIs and its functions suggest the fundamental and necessary gaps of AI support patients. Continuing to develop AI in supporting doctors a better analysis, it is the authors' intent to show the need for training patients their disease and helping payment process in surgery. Throughout this article, the authors built three models of a virtual nurse in assisting patients booking an appointment, giving them the tests' results and advising them the time as well as the amount for healthcare payment. The virtual multi-task nurse could inform the doctors about their schedule of upcoming appointments, surgeries daily. Finally, this article recommended some screens on a mobile platform to present these models of AI. Some stakeholders such as insurance companies, drug companies and hospitals can get benefits from these models of AI in somehow.

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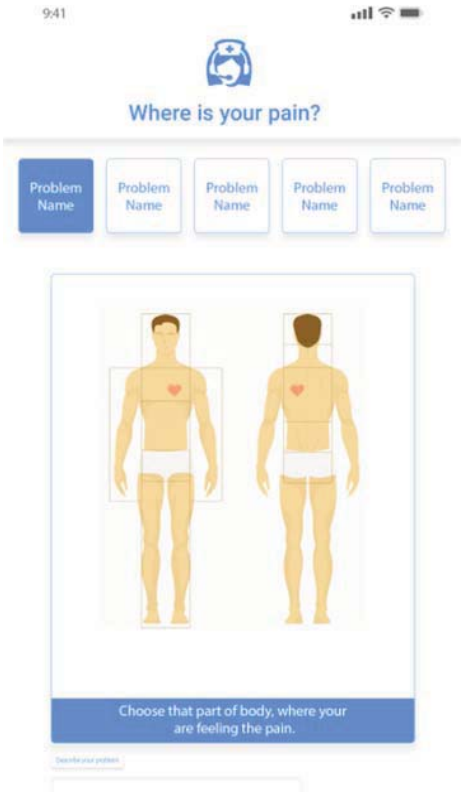
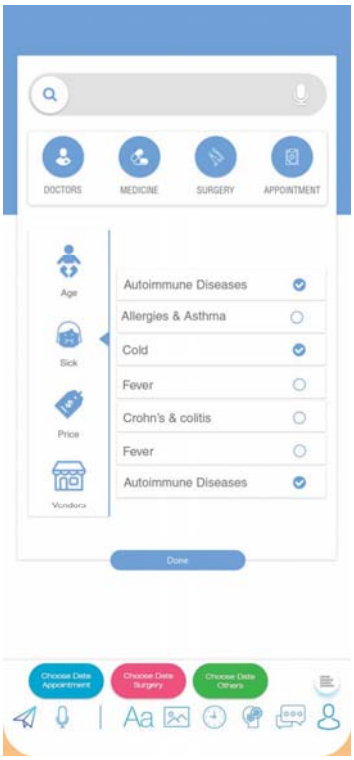
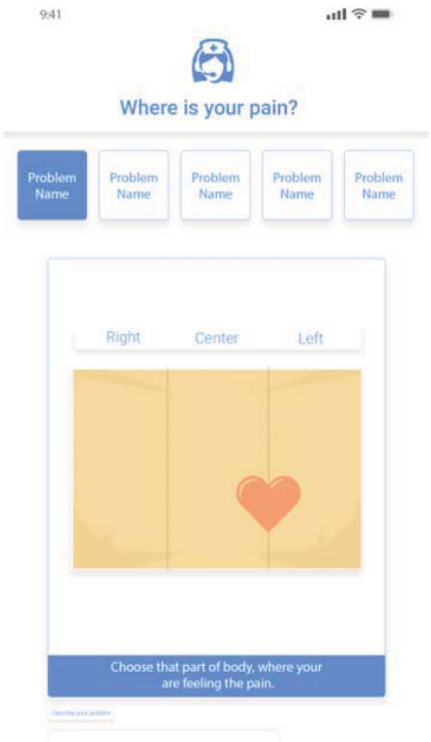
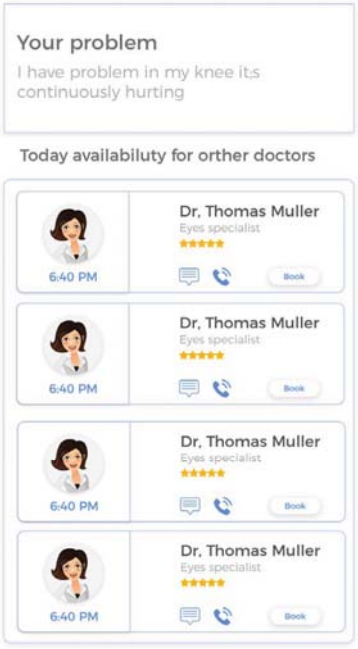
APPENDIX

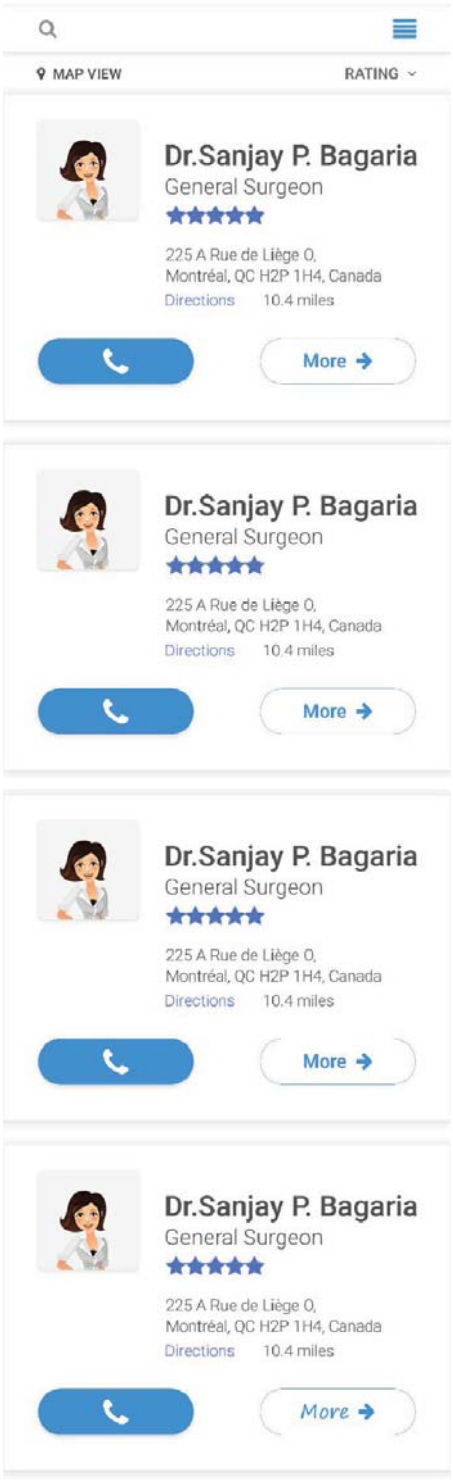
AI communicates users and help them booking an appointment if it is non-emergency

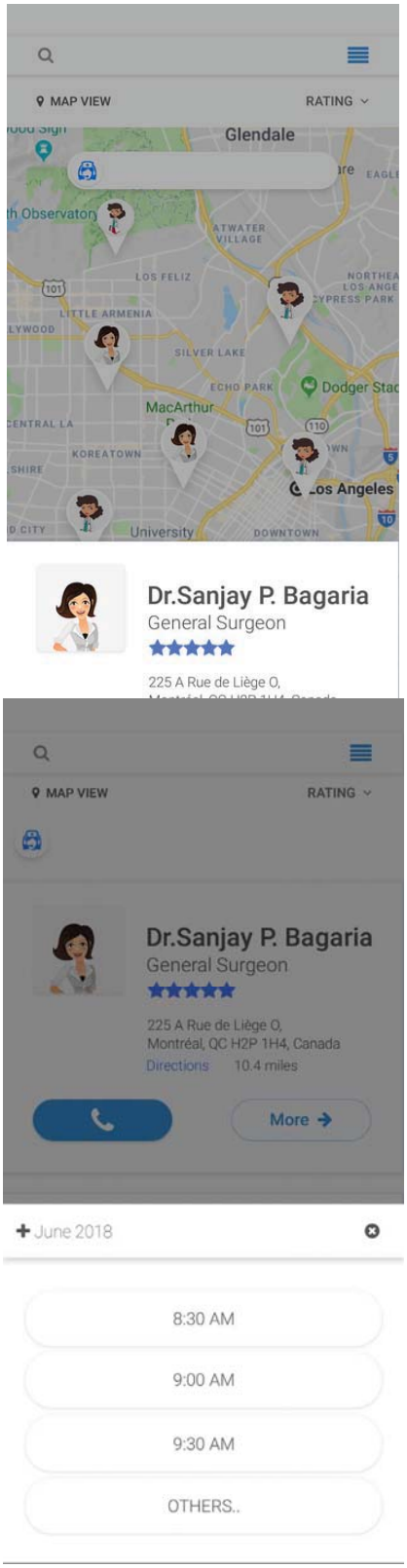


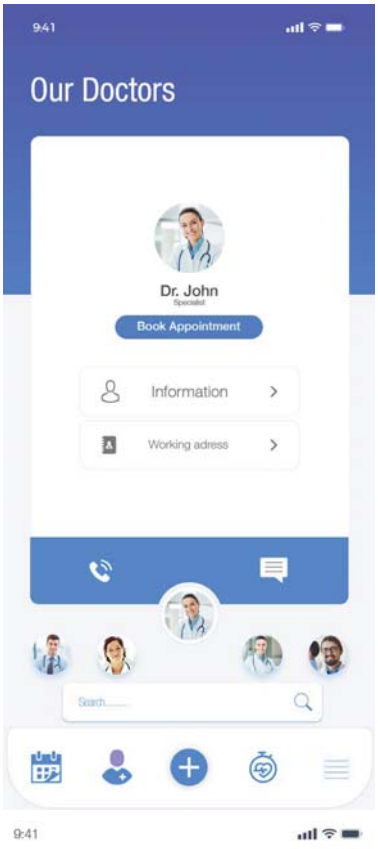


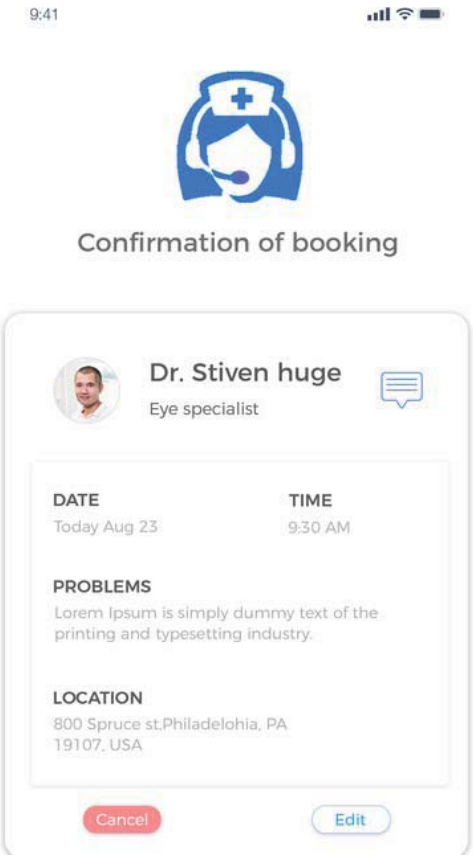




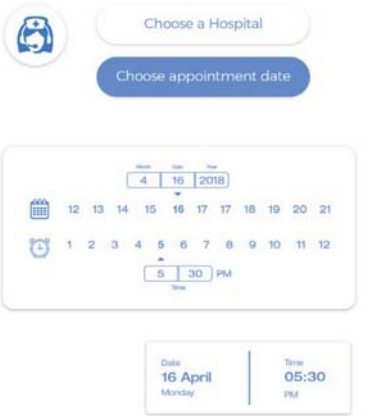


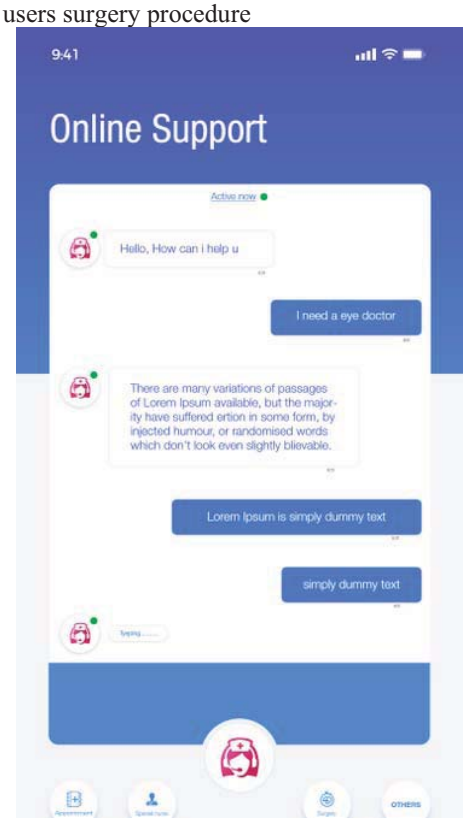


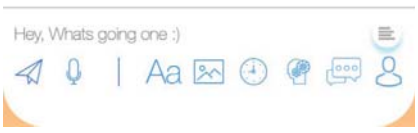




Educate users surgery procedure







Eyelid Surgery

by Dr.johothan

Eyelid surgery procedure steps

SURGERY | APPOINTMENT | INFORMATION

Eyelid surgery tutorial

Method

An eyelid surgery procedure includes the following steps:

Step 1 – Anesthesia

Medications are administered for your comfort during the surgical procedure. The choices include intravenous sedation or general anesthesia. Your doctor will recommend the best choice for you.

Step 2 – The incision

The incision lines for eyelid surgery are designed so the resultant scars will be well concealed within the natural structures of the eyelid region.

The upper eyelid can be corrected through an incision within the natural crease on the eyelid. This allows for removal or repositioning of fat deposits, tightening of muscles and removal of excess skin.

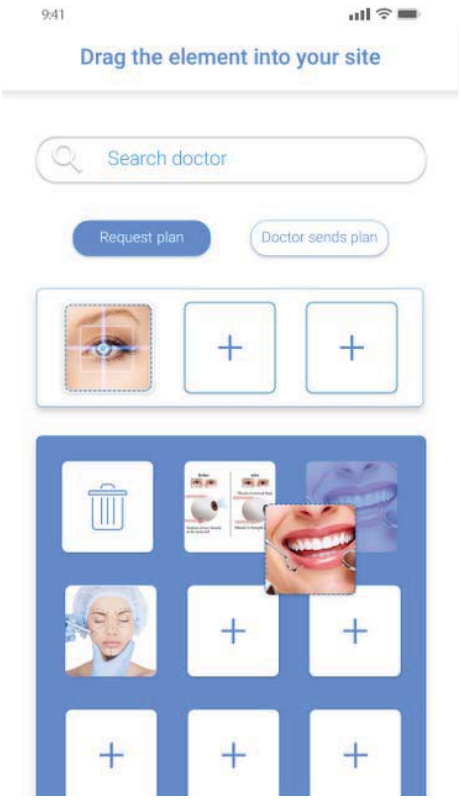
Step 3 – Closing the incisions

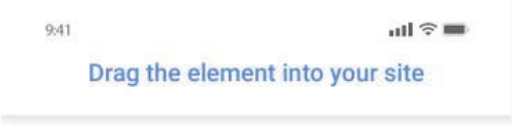
Eyelid incisions typically are closed with sutures or skin glue. Sutures are removed within one week.
Your surgeon may also suggest use of a laser or chemical peel to reduce discoloration of the lower eyelids.

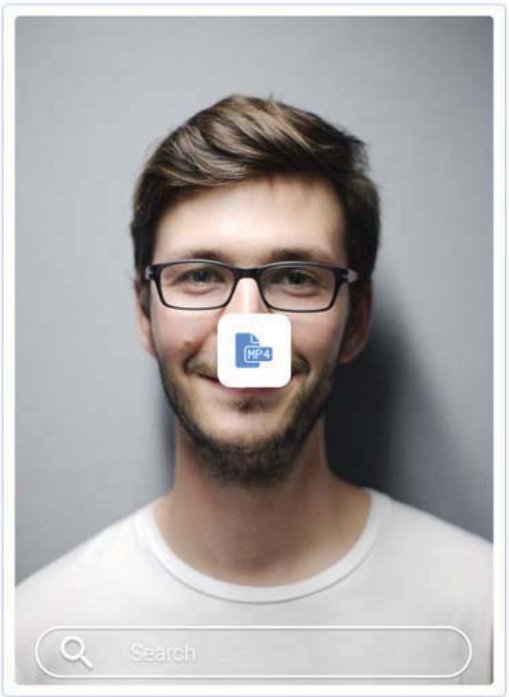
Step 4 – See the results

The results of eyelid surgery will appear gradually as swelling and bruising subside to reveal a smooth, better-defined eyelid and surrounding region, and a more alert and rejuvenated appearance. Get more information about eyelid surgery results.

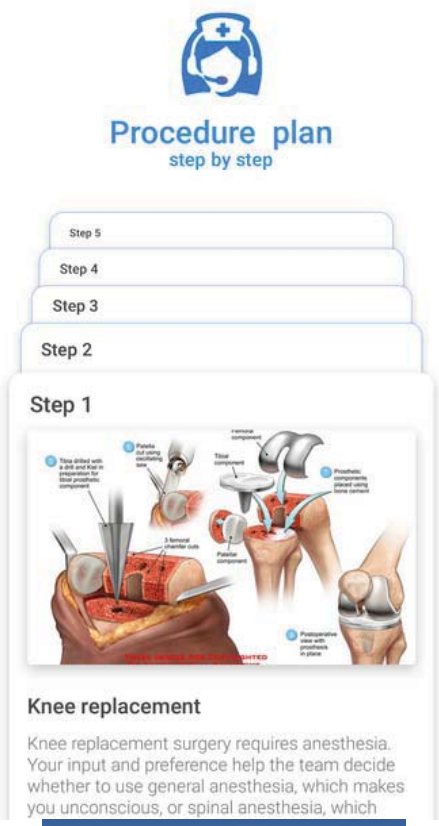
RED MORE

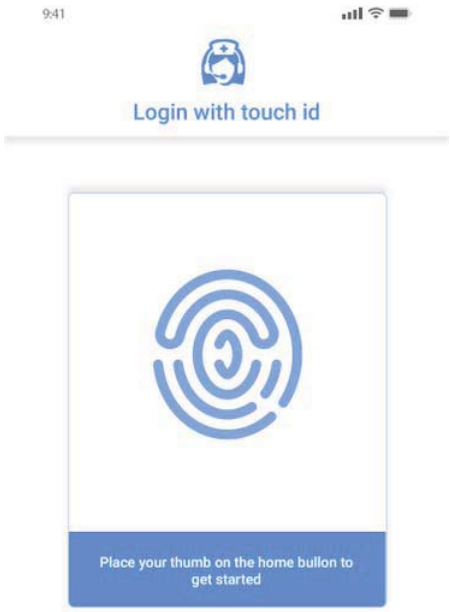


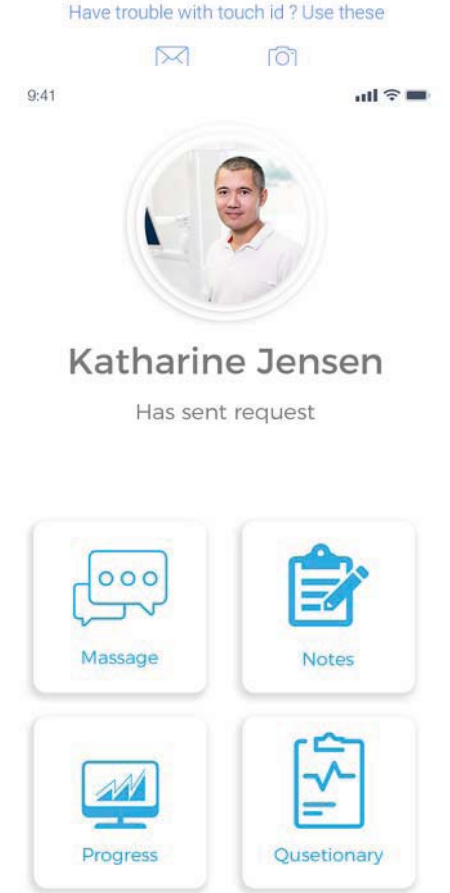




AI as an assistant for doctors







AI takes care patients after taking a sugery