

COVID
DETECTOR AND
DOCTOR
RECOMMENDER

By
Priyanshu

Abstract

Health care is conventionally regarded as a very important determinant in promoting the general physical and mental health, and well-being of people around the world. Nowadays, a vast amount of clinical data scattered across different sites on the Internet, hinders users from finding helpful information for their good health and improvement. Besides, the overload of medical information (e.g., on drugs, medical tests, and treatment suggestions) have brought many difficulties to medical professionals in making patient-oriented decisions. These issues raise the need to apply recommender systems in the healthcare domain to help both, end-users and medical professionals, make more efficient and accurate health-related decisions. The medical field is one where much detailed research is currently being conducted on recommender system utility. Also, coronavirus disease (COVID-19), with a starting point in China, has spread rapidly among people living in other countries and is approaching approximately 3.22 crore cases worldwide according to the statistics of World Health Organization. There are a limited number of COVID-19 test kits available in hospitals due to the increasing cases daily. Patients nowadays are more aware and look for answers to healthcare problems online because they prefer to stay inside and safe. This has resulted in a dire need of an effective reliable online system to recommend the diagnostician that is best suited to a particular patient in a limited time and also a detector system for COVID for patients that are not willing to go for RT PCR Test.Hence, in this project we have created a recommender system that can suggest optimal doctors to patients efficiently. The proposed system for Recommendor addresses the issue of personalization through analyzing the patient's interest towards selecting a doctor. The system thoroughly gets to know the patient's requirement and proposes a suitable suggestion based on that and also we have built a feature called COVID Assessment where users can self assess themselves based on certain COVID related questions.

Introduction

The world is going through a very tough time now, where we see that the COVID-19 pandemic has shaken up everyone. The virus is so deadly that it has cost a lot of lives and many are still struggling to get hold of themselves in such a situation. Health related worries have become more common and prevailing than ever before. With the new variant of the virus spreading like wildfire, it has become increasingly important to be safe and protected as a precaution. Along with it, as a cure. If people face any symptoms of the virus they are immediately asked to take a test, scan or consult their doctor. Delaying these might result in people's health reaching a very unfortunate state. In such a scenario, online doctor consultation is the best way to eradicate fears regarding the disease, ensure each person is safe and if not, take immediate action without any delay. Also, for COVID Detection, Chest radiography (X-ray) is one of the most important methods used for the diagnosis of pneumonia worldwide. Chest X-ray is a fast, cheap and common clinical method. The chest X-ray gives the patient a lower radiation dose compared to computed tomography (CT) and magnetic resonance imaging (MRI). However, making the correct diagnosis from X-ray images requires expert knowledge and experience. It is much more difficult to diagnose using a chest X-ray than other imaging modalities such as CT or MRI.

By looking at the chest X-ray, COVID-19 can only be diagnosed by specialist physicians. The number of specialists who can make this diagnosis is less than the number of normal doctors. Even in normal times, the number of doctors per person is insufficient in countries around the world. In case of disasters such as COVID-19 pandemic, demanding health services at the same time, collapse of the health system is inevitable due to the insufficient number of hospital beds and health personnel. Also, COVID-19 is a highly contagious disease, and doctors, nurses and caregivers are most at risk. Early diagnosis of pneumonia has a vital importance both in terms of slowing the speed of the spread of the epidemic by quarantining the patient and in the recovery process of the patient.

Hence, we have proposed an automatic CAD prediction of COVID-19 using a convolutional neural network-based pre-trained transfer model and chest X-ray images. For this purpose, we have used three pre-trained models to obtain higher prediction accuracies for four different binary datasets including X-ray images of normal (healthy), COVID-19, lung opacity and bacterial pneumonia patients and along with that online doctor recommender system recommends suitable doctors for people to choose from based on their convenience and need. It is not only the most comfortable, easy, and quick way of choosing and getting medical consultation, it is also the safest way, since there is

no direct contact involved and hence no one needs to fear contacting the virus. In the lockdown situation, where people are restricted to their houses unless it is an emergency, this kind of a model and a system will be very useful to ensure everyone's good health and well-being without having to take the trouble of moving around to find a specialist. The system can also help covid positive patients to access medical professionals whenever they feel like, to get proper guidance and be monitored to take care of themselves better after giving a Self Assessment Test.

Literature Review

An analysis of the existing recommender systems and models, gives a better perspective of the project proposed.

A Hybrid Recommender System for Patient-Doctor Matchmaking in Primary Care, proposed by students of the University of California, focuses on providing a mechanism to match patients with family doctors in primary care. The matchmaking process is defined for several distinct use cases given different levels of available information about patients. The hybrid recommender system then presents each patient a list of family doctor recommendations. In particular, the system models patient trust of family doctors using a large-scale dataset of consultation histories, while accounting for the temporal dynamics of their relationships.

Another recommender system uses a doctor-in-the-loop approach to mitigate some difficulties like, drastically differing end-user groups, enormous context-complexity of the medical domain., risk perceptions towards data security and privacy as well as trust in safe technical systems play a central and specific role, particularly in the clinical context. These aspects dominate acceptance of such systems combining both human expertise with computer efficiency. A three-part research framework is provided to access health recommender systems, suggesting to incorporate domain understanding, evaluation and specific methodology into the development process.

Looking at yet another recommendation system which is also an online medical consultation website to assist patients to find appropriate doctors, this project puts forward recommendation suggestions of finding the right hospital and doctor to promote the rapid integration of Internet technology and traditional medical services. A new recommendation model called Probabilistic Matrix Factorization integrated with the Convolutional Neural Network (PMF-CNN) is proposed. Doctors' data has been extracted from an online available dataset, which was used to evaluate the performance of the said system. The model improves the performance of medical consultation recommendations by fusing review text and doctor information based on CNN (Convolutional Neural Network). Specifically, CNN is used to learn the feature representation of the review text and the doctors' information. Furthermore, the extended matrix factorization model is exploited to fuse the review information feature and the initial value of the doctors' information for recommendation. The proposed PMF-CNN achieves better recommendation performances than the other state-of-the-art

recommendation algorithms. And the recommendation system in an online medical website improves the utilization efficiency of doctors and the balance of public health resources allocation.

Proposed Methodology And Model Description

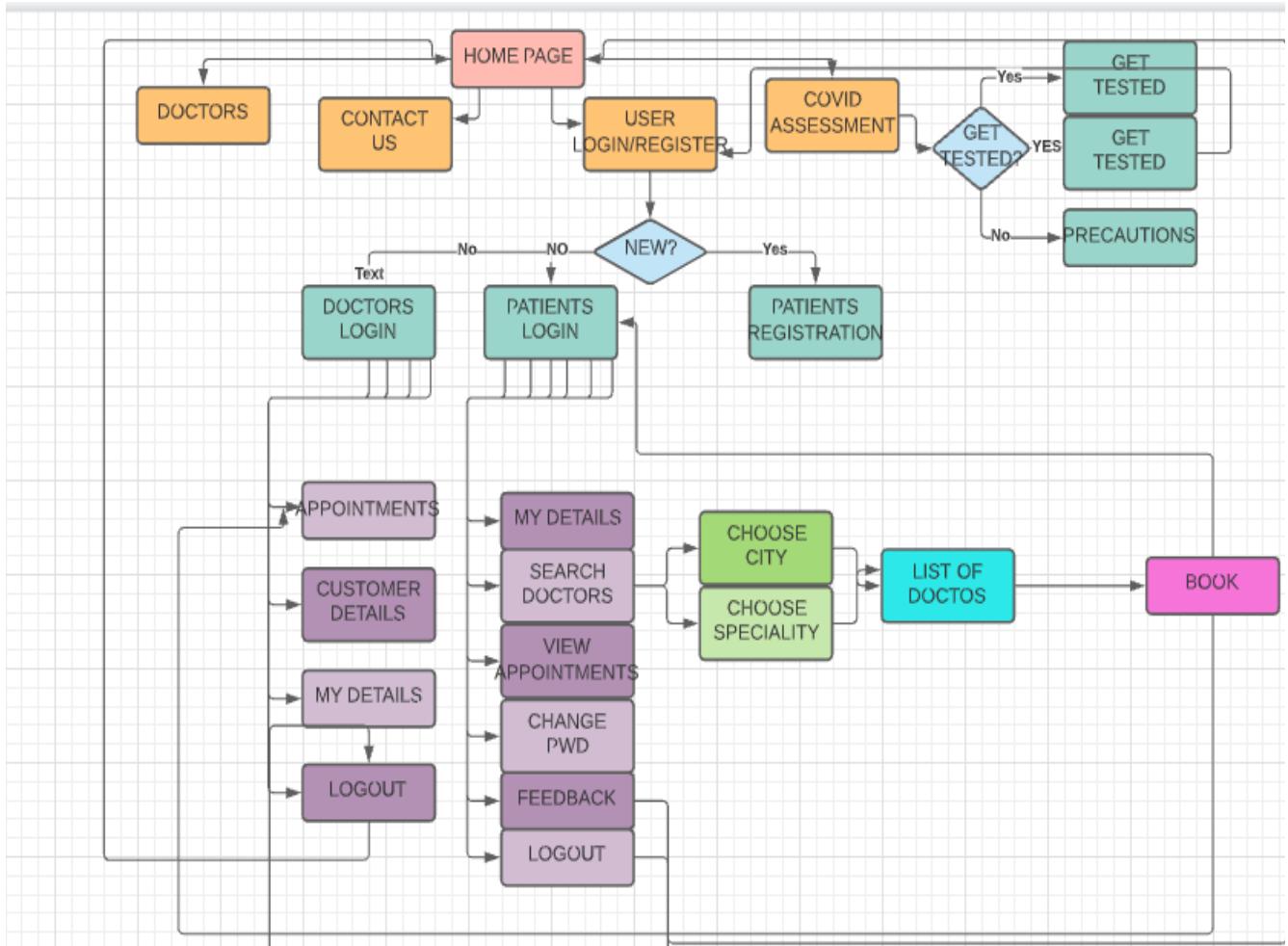
The following features will be provided by the proposed system for Doctor Recommendation:

- > List of medical professionals and informations about them, along with their contact details to provide suggestions for people to choose from
- > A way to book an appointment with the chosen doctors, call them for assistance or send them a message if required
- > A Patient's portal, which needs to be entered using a patient's login- In the portal, patient can search for a suitable doctor based on their location and the health issue for which they are seeking consultation
- > To book appointment the patient needs to enter various information about themselves, and after successfully entering, they will get a confirmation of their booking
- > The patient can also view their existing appointments and cancel any of them if the same is not convenient for them
- > A Doctor's portal will be presented which can be accessed by the doctor's login- it contains all the details of the doctor which will be on display to the patients
- > The doctor can edit their details and view their appointments to make themselves well equipped to help out people who need them
- > A covid assessment section, that will help people make a self-assessment by answering a few questions related to their recent lifestyle(covid contact, covid symptoms, etc.) to make a conclusion if they need a consultation or not. This is just to provide some guidance to people who don't know whether they need a consultation or not.

All the above functionalities will be present in the recommender system.

Flow Diagram

a) Doctor Recommender



- All the processes here are nothing but the web pages that we have created in our website
- The lines that are drawn show the connection between two given web pages.
- This flowchart helps us to visualize the entire flow of data in a more elaborative and clearer way.

Output Screenshots

1. Homepage

The screenshot shows the homepage of the COVID Doctor Recommendation System. At the top, there is a navigation bar with links to 'localhost/iwp-pro/index.php', 'Apps', 'Lists - Learn Python...', 'VIT Chennai: Log in...', 'Vellore Institute of...', 'DBMS Transaction...', 'Print Colors in Pyth...', 'Conference in Rese...', 'Smart-Tourist-Guid...', and a 'Reading list' section. Below the navigation bar is a banner titled 'COVID Doctor Recommendation System' featuring a group of diverse medical professionals. A black navigation menu below the banner includes 'Home', 'Medical Doctors', 'Contact Us', 'User Login', and 'COVID Assessment'. The main content area is titled 'COVID-19' and contains a paragraph about coronaviruses, followed by several cartoon illustrations related to medicine and COVID-19.

2. Medical Doctors

The screenshot shows the 'Doctors' page of the system. The top navigation bar is identical to the homepage. The main content area is titled 'Doctors' and displays four doctor profiles in a grid:

- Dr. Priyanshu**: Qualifications: MBBS, BCS (Health); Chamber: [link]; Call for Appointment: [link]; Get Appointment: [link].
- Dr. SHyam**: Qualifications: MBBS, MCPS; Chamber: [link]; Call For Appointment: [link]; Get Appoinment: [link].
- Dr. SMRI**: Qualifications: MBBS, MS; Chamber: [link]; Call for Appointment: [link]; Get Appointment: [link].
- Dr. Smrithi**: Qualifications: MBBS, MD (Medicine) Medicine Specialist; Chamber: [link]; Call For Appointment: [link]; Get Appoiment: [link].

Each profile features a cartoon illustration of the respective doctor.

3. User login(similar for both doctors and patients)

The screenshot shows a web browser window with the URL `localhost/iwp-pro/patient_login.php`. The title of the page is "COVID Doctor Recommendation System". Below the title is a banner featuring ten medical professionals (doctors and nurses) in white coats. A navigation bar below the banner includes links for "Home", "Medical Doctors", "Contact Us", "User Login", and "COVID Assessment". The main content area is titled "Patient Login" and contains fields for email ("sm@gmail.com") and password, along with "Login" and "Sign Up" buttons. At the bottom of the page are links for "Category", "Contact us", and "Link With".

4. Doctor Search

The screenshot shows a web browser window with the URL `localhost/iwp-pro/patient/search_doctor.php`. The title of the page is "Doctor Appointment System". The page features a background image of a doctor examining a patient through a magnifying glass over a virus model. A navigation bar at the top includes links for "My Details", "Search Doctors", "View Appointment", "Change Password", "Feedback", and "Log Out". The main content area is titled "Search Here" and contains dropdown menus for "Search By" (set to "Delhi") and "Category" (set to "COVID Talk"), along with a "Search" button.

5. Search Results

localhost/iwp-pro/patient/search_result.php

Apps Lists - Learn Python... VIT Chennai: Log in... Vellore Institute of... DBMS Transaction... Print Colors in Python... Conference in Rese... Smart-Tourist-Guid... Reading list

Doctor Appointment System

My Details | Search Doctors | View Appointment | Change Password | Feedback | Log Out

Search result

SL	Name	Address	Mobile	Email	Expertise In	Fee	Book
4	Dr. samuel	Delhi	01949589985	sam@gmail.com	COVID Talk	700	Book
6	Dr. pri	Delhi	01754761999	pri@gmail.com	COVID Talk	800	Book
20	shivam	Delhi	436457556	dfg@gmail.com	COVID Talk	500	Book
21	shourya	Delhi	454657565	s@gmail.com	COVID Talk	600	Book

[Search Again](#)

6. Book appointment

localhost/iwp-pro/patient/booking.php?doc_id=6

Apps Lists - Learn Python... VIT Chennai: Log in... Vellore Institute of... DBMS Transaction... Print Colors in Python... Conference in Rese... Smart-Tourist-Guid... Reading list

Book Appoinment

Dr. Name: Dr. pri
 Contact: 01754761999
 Category: COVID Talk
 Fee(Tk): 800
 Your Name:
 Contact:
 E-mail:
 Address:
 Date: mm/dd/yyyy

Date: mm/dd/yyyy

Time: -select-

Payment: -select-

[Confirm](#) [Cancel](#)

7. Doctor's "My Appointments"

The screenshot shows a web browser window for the COVID Doctor Recommendation System. The title bar says "localhost/iwp-pro/doctors/myAppointment.php". The main header is "COVID Doctor Recommendation System" with a background image of ten medical professionals. Below the header is a navigation bar with links: "My Appointment", "Customer Details", "My Details", and "Logout". A section titled "Today's Appointment" displays a table of patient information:

Patient Name	Contact	E-mail	address	Date	Time
priya	4365465	pr@gmail.com	sgeritr	2021-05-27	11.00am
smrithu	340546	df@gmail.com	dfsgtr	2021-06-25	11.00am
pri	4365465			2021-06-29	11.00am
pri	1	sm@gmail.com	ss	2021-06-20	11.00am

At the bottom, there are sections for "Category", "Contact us", and "Link With" with social media icons.

8. COVID Assessment

The screenshot shows a web browser window for the COVID Assessment system. The title bar says "localhost/iwp-pro/index2.php?start=". The main content area has a red banner at the top with the text "Answer the questions carefully and accurately." Below it is a "Home" link. The main question is "Did you come in contact with anyone who claimed to be COVID affected?" with three radio button options: "Yes", "No", and "Maybe". A "Next" button is located below the radio buttons. The background features a large image of a COVID-19 virus particle.

9. Sample COVID test output of a user



Conclusion

The website provides them with doctors that they can easily get access to, on the basis of patient's locality and need. This also allows the doctors to register themselves to the website and provide guidance and help to patients who need them the most. Overall, this system helps in integrating the seekers to the helpers. The existing recommenders are all mostly generalized. There are not many doctor recommendation systems specifically for Covid-19. Hence, we decided to make this system, which could be of the most help to people in the current scenario. The entire world is facing its toughest period. In such challenging times, people need to support one another and lift each other up. We as students wish to contribute somehow by creating such a platform that could provide medical, and emotional help and support to many people. We wish that our system can popularize and be of some help to people who are in dire need of it. We also truly hope that the world rises from this crisis and starts to function as before.

References

1. Waqar, M., Majeed, N., Dawood, H., Daud, A., & Aljohani, N. R. (2019). An adaptive doctor-recommender system. *Behaviour & Information Technology*, 38(9), 959-973.
2. Narducci, F., Musto, C., Polignano, M., de Gemmis, M., Lops, P., & Semeraro, G. (2015, May). A recommender system for connecting patients to the right doctors in the healthnet social network. In *Proceedings of the 24th international conference on World Wide Web* (pp. 81-82).
3. Bao, Y., & Jiang, X. (2016, June). An intelligent medicine recommender system framework. In *2016 IEEE 11Th conference on industrial electronics and applications (ICIEA)* (pp. 1383-1388). IEEE.
4. Han, Q., Ji, M., de Troya, I. M. D. R., Gaur, M., & Zejnilovic, L. (2018, October). A hybrid recommender system for patient-doctor matchmaking in primary care. In *2018 IEEE 5th International Conference on Data Science and Advanced Analytics (DSAA)* (pp. 481-490). IEEE.
5. Majeed, T., Rashid, R., Ali, D., & Asaad, A. (2020). Covid-19 detection using cnn transfer learning from x-ray images. *medRxiv*.
6. Apostolopoulos, I. D., & Mpesiana, T. A. (2020). Covid-19: automatic detection from x-ray images utilizing transfer learning with convolutional neural networks. *Physical and Engineering Sciences in Medicine*, 43(2), 635-640.
7. Abbas, A., Abdelsamea, M. M., & Gaber, M. M. (2021). Classification of COVID-19 in chest X-ray images using DeTraC deep convolutional neural network. *Applied Intelligence*, 51(2), 854-864.
8. Nayak, S. R., Nayak, D. R., Sinha, U., Arora, V., & Pachori, R. B. (2021). Application of deep learning techniques for detection of COVID-19 cases using chest X-ray images: A comprehensive study. *Biomedical Signal Processing and Control*, 64, 102365.
9. Asif, S., Wenhui, Y., Jin, H., Tao, Y., & Jinhai, S. (2020). Classification of covid-19 from chest x-ray images using deep convolutional neural networks. *MedRxiv*.