FACO-FIGHT AGAINST CORONA

INSPIRATION

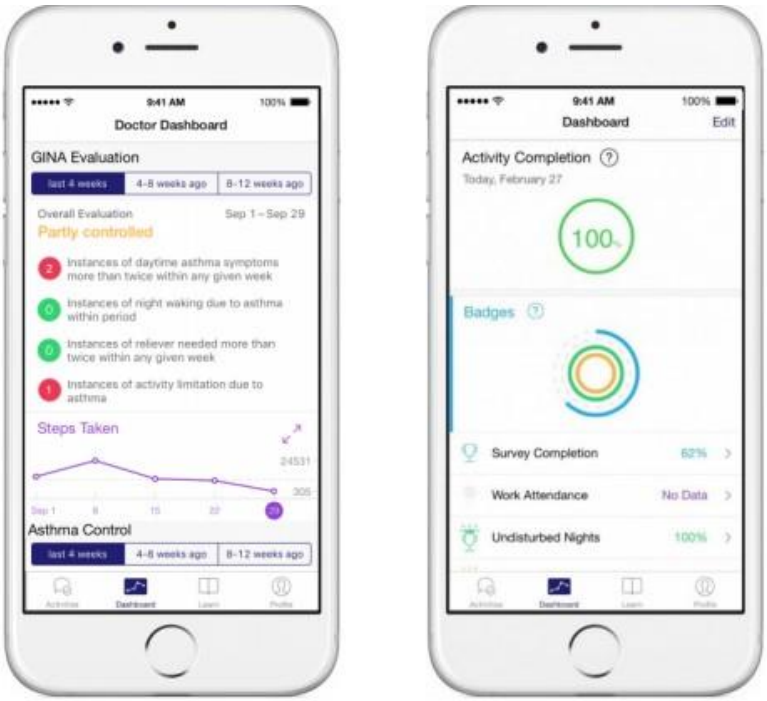
A diagnosis of respiratory disease is one of the most common outcomes of visiting a doctor. Respiratory diseases can be caused by inflammation, bacterial infection or viral infection of the respiratory tract. Diseases caused by inflammation include chronic conditions such as asthma, cystic fibrosis, COVID-19 and chronic obstructive pulmonary disease (COPD). Acute conditions, caused by either bacterial or viral infection, can affect either the upper or lower respiratory tract. Upper respiratory tract infections include common colds while lower respiratory tract infections include diseases such as pneumonia. Other infections include influenza, acute bronchitis, and bronchiolitis. Typically, doctors use stethoscopes to listen to the lungs as the first indication of a respiratory problem. The information available from these sounds is compromised as the sound has to first pass through the chest musculature which muffles high-pitched components of respiratory sounds. In contrast, the lungs are directly connected to the atmosphere during respiratory events such as coughs.

These audible sounds, used by our app, contain significantly more information than the sounds picked up by a stethoscope. Our approach is automated and removes the need for human interpretation of respiratory sounds. Plus, we can see lots of spreadable diseases nowadays such as HIV, Coronavirus, etc., so we have to track those patients to stop them from spreading

PROBLEM STATEMENT

1. In this difficult time, a lot of people panic if they have signs of any of the symptoms, and they want to visit the doctor.
2. It isn’t necessary for the patients to always visit the doctor, as they might have a normal fever, cold or other condition that does not require immediate medical care.
3. The patient who might not have COVID-19 might contract the disease during his visit to the Corona testing booth, or expose others if they are infected.
4. Most of the diseases related to the respiratory systems can be assessed by the use of a stethoscope, which requires the patient to be physically present with the doctor.
5. Healthcare access is limited—doctors can only see so many people, and people living in rural areas may have to travel to seek care, potentially exposing others and themselves.

SOLUTION



We provide a point of care diagnostic solutions for telehealth that are easily integrated into existing platforms. We are working on an app to provide instant clinical quality diagnostic tests and management tools directly to consumers and healthcare providers. Our app is based on the premise that cough and breathing sounds carry vital information on the state of the respiratory tract. It is created to diagnose and measure the severity of a wide range of chronic and acute diseases such as corona, pneumonia, asthma, bronchiolitis and chronic obstructive pulmonary disease (COPD) using this insight. These audible sounds, used by our app, contain significantly more information than the sounds picked up by a stethoscope. app approach is automated and removes the need for human interpretation of respiratory sounds., plus user disease can also be detected by measuring heart beat from camera of smartphone **The Application Work in following manner-:**

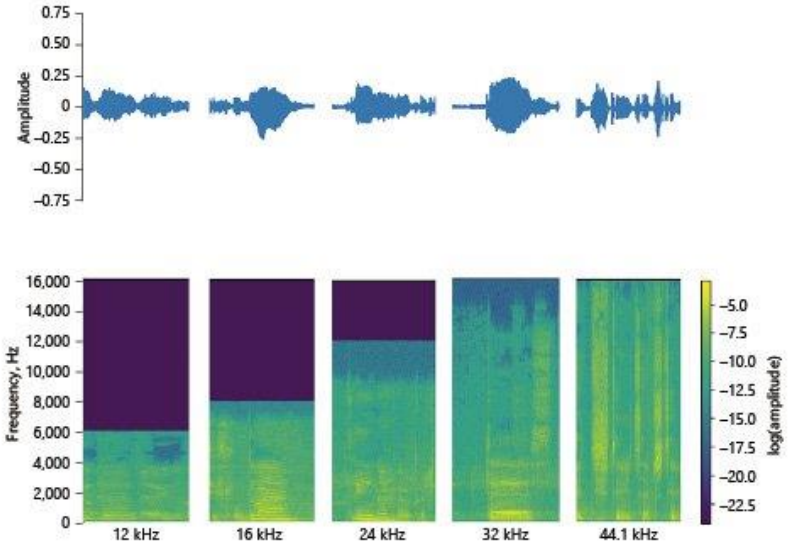
- User downloads the application from the app store and registers himself/herself.
- After creating his/her account, they have to go through a questionnaire describing their symptoms like headache, fever, cough, cold etc.
- After the questionnaire, the app records the users' coughing, speaking ,breathing and heartbeat sounds through the microphone of the smartphone.
- After recording, the integrated AI system will analyze the sound recording, comparing it with a large database of respiratory sounds. If it detects any specific pattern inherent to a particular disease in the recording, it will enable the patient to contact a nearby specialist doctor.
- The doctor then receives a notification on a counterpart of this app, for doctors. The doctor can view the form, listen to the audio recording, and also read the report given by the AI of the application.

- The doctor, depending upon the report of the AI will develop a diagnosis, suggest medicines, or recommend a hospital visit,plus if person have symptoms of corona .
- In cases where the AI detects a very seriously ill patient, it will also enable the physician to call an ambulance to the users' location and continuously track the user.

HOW WE GOING TO BUILD IT

We will take a machine learning approach to develop highly-accurate algorithms that diagnose disease from cough and respiratory sounds. Machine learning is an artificial intelligence technique that constructs algorithms with the ability to learn from data. In our approach, signatures that characterize the respiratory tract are extracted from cough and breathing sounds. We start by matching signatures in a large database of sound recordings with known clinical diagnoses. Our machine learning tools then find the optimum combination of these signatures to create an accurate diagnostic test or severity measure (this is called classification). Importantly, we believe these signatures are consistent across the population and not specific to an individual so there is no need for a personalized database Following are the steps app will take-:

1. Receive an audio signal from a microphone



2. Convert at least a portion of an audio signal into a frequency-based matrix representation by removing background sound
3. Transform the frequency-based matrix representation into a lesser dimensional matrix using projections from a set of basis vectors in a cough model
4. Classify audio signal based on a lesser dimensional matrix(predictions through Artificial intelligence and Machine Learning
5. Store features of the audio signal when the classification indicates a cough

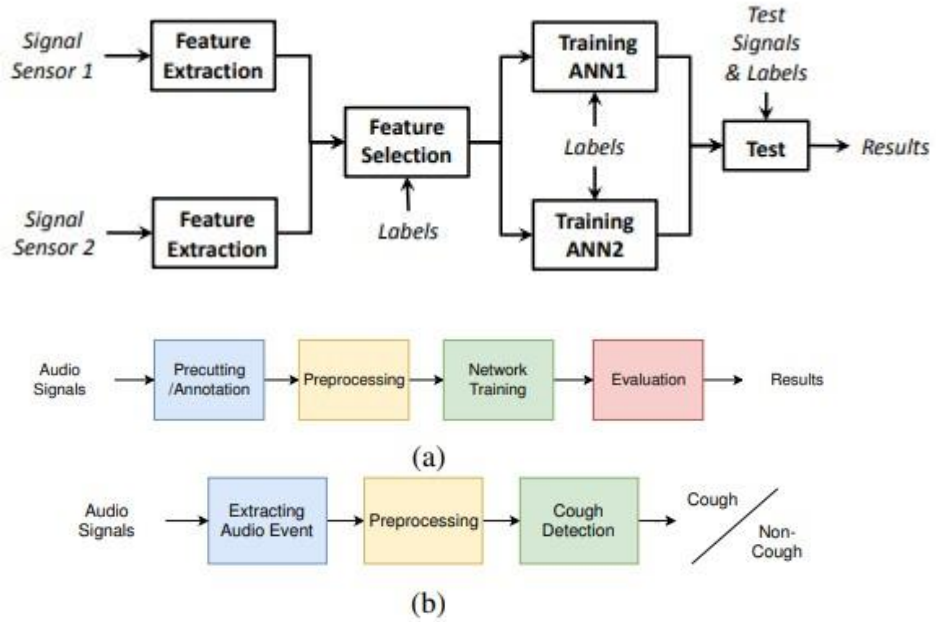


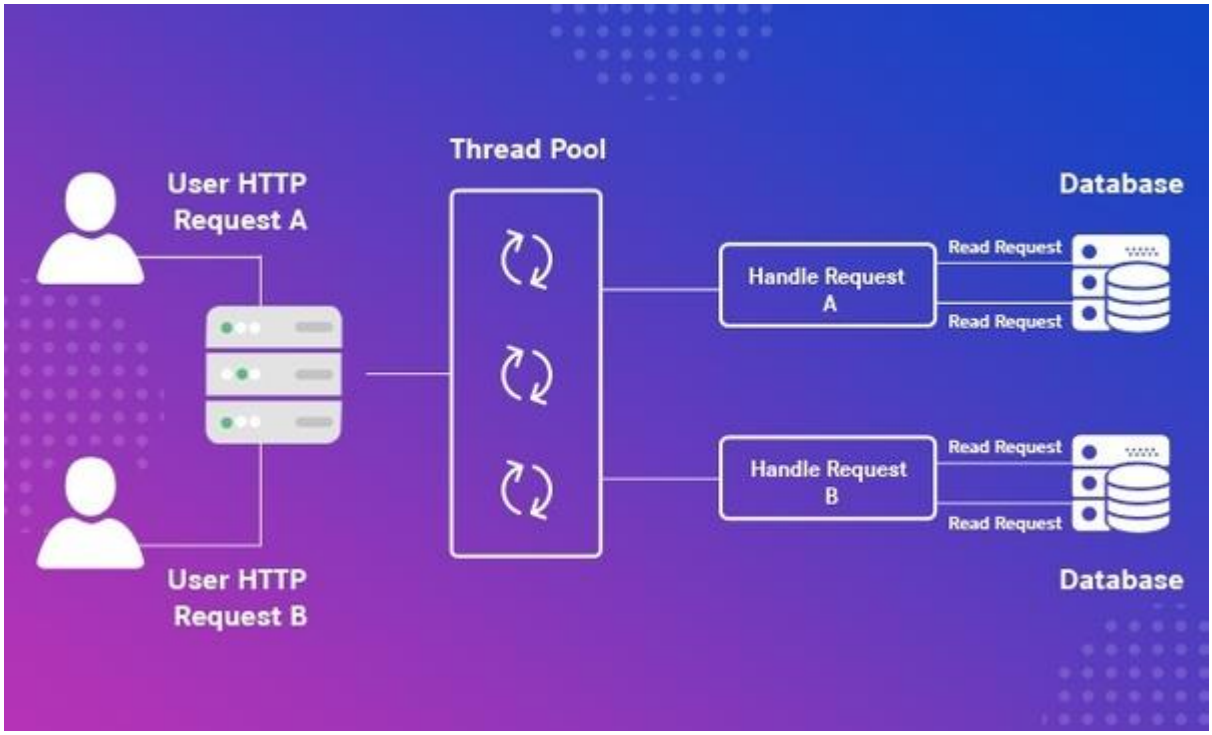
Fig. 3: (a) Machine learning pipeline: Describes the learning of a model from audio signals. (b) Cough detection pipeline: Describes the inference of cough from audio recordings.

(a) VGG-19 architecture [38]

(b) Proposed CNN architecture

Fig. 4: CNN architectures: The annotations "dep sep conv $1 \times 7, 16$" represent a depthwise separable convolutional layer with a 1×7 convolutional filter and 16 channels and "fc 2" a fully connected layer with two outputs, respectively. Max pooling is abbreviated as "max pool".

For tracking patients, these technologies will be used-:: Client (Frontend): React (JavaScript + Material-UI) Server (Backend): Blockstack managed backed (user data), Golang (notifications, education) Database: Gaia managed storage (user data), MongoDB (notifications, education) Deployment: Client site deployed on AWS S3 Golang servers deployed on AWS EC2 behind an API Gateway Blockstack/Gaia is managed by Blockstack, not us then through tools, API, and languages such as Java, XML,webrtc (shown in the last pic), google maps, etc, we going to make rest of the functionality of the app



BUSINESS PLAN

1. Business Model

Canvas Business model

- **Value proposition**: easy and fast professional diagnostic right from your home
- **Customer segment**: mass market, individuals from the areas of infections growth rate
- **Primary channel**: mobile application
- **Customer relationships:** automated diagnostic and service platform
- **Key resources:** AI, medical professionals
- **Key partners:** health care providers (health insurance companies), government
- **Key activities:** medical consultation and diagnostic, the whole pipeline from first symptoms to ambulance if it is needed
- **Cost structure**: development of AI, app, holding a database of doctors, Marketing and PR

2. Revenue Model:

Key Elements-:

WHO pays?

- Healthcare provider. Starting from such counties as the USA, India and Germany, where the institution of telemedicine is already established, we are going to be present as a third-party service between patient and doctor. The negotiation contracts between our company and main insurance companies of a country will

allow patients to use their own health insurance system, and not worry about additional payments. That's how our app should be free for users.

- Pharmacy partners. We will also partner with pharmacies/chemists, allowing patients to purchase medication from nearby locations. We will take a small commission from each sale, or to promote a particular pharmacy.

WHAT is paid?

- Services. Paying by performing services for the partner, providing them patients quickly and safely. Playing a role of third-party service, we reduce time and costs of both our partners and users.

HOW is paid?

- Contract. We will establish partnership relations with our partners as a third-party service and build a pricing policy for our services.

HOW much is paid?

- Dynamic pricing. Paying a price calculated by time, place, demand and availability.

3. The main directions of a long-term vision of a project:

1. **Geographic growth**. For us, it is important that our technologically revolutionary app could be available in all countries, where it is needed. We will start in the USA, Germany and other European countries, and move towards the needy regions.
2. **Technological growth**. We are planning to develop our key resource—neural networks which can predict respiratory diseases, for recognizing more diseases from all fields of medicine.
3. **Product growth**. After the end of the critical pandemic situation, the application will not lose its significance. With the growth of computing power, the application will be able to identify various types of diseases by symptoms and connect the patient with the right doctor. Thus, the application will be able to completely replace the therapist with its accuracy and convenience.

IMPACT

FACO will help patients to get themselves tested at home, supporting in areas where tests and access to tests are limited. This will help democratize care in hard-to-reach or resource-strapped areas, and provide peace of mind so that patients will not overwhelm already stressed healthcare systems. Doctors will be able to prioritize patients with an urgent need related to their speciality, providing care from the palm of their hand, limiting their exposure and travel time.

Challenges we ran into

- No financial support.
- Working under quarantine measures.
- Working in different time-zones.
- One Feature Related Problem- Legal shortcomings we might face when adding the tracking patient feature

Accomplishments that I'm proud of

We successfully built the fully functional prototype of app now focusing on developing app

You can explore the full prototype here or watch the demo (and check out our promo gif)!

What's next for FACO-Fight Against Corona

Our goals are global - we aim to produce and distribute our project around the world as quickly as possible! From the technological level, we now need to make the algorithm more accurate, also work intensively on the application development process, finish it and finally launch. Besides that, it is necessary to connect with public health providers of targeted areas and establish partnerships, build a marketing and PR company.

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