V.1.0

Installation Guide and User Manual for Android App

This guide let you learn how to install and use the android app CXR2COVID.

1. Overview

CXR2COVID is an artificial intelligence enabled scientific and technology utility app for Android users, that helps to screen COVID-19 patients based on "Digital Frontal Chest X-rays" images either obtained from X-ray machine or portable X-ray setup.

2. Full Description

This is a deep learning-enabled android app to predict the vulnerable COVID-19 patients based on digital frontal chest X-ray images. This app is designed to individuate COVID-19 cases from no-findings and non-COVID Pneumonia. Using this application, you can get the automated classification of frontal chest X-rays revealing fine-grained variability in appearance that are not distinguishable by Pulmonologist. Here, deep convolutional neural networks (CNN) were used to accomplish highly variable tasks in many types of fine-grained objects in the images. For the development of the CNN model, the classification of chest X-rays was carried out using a single CNN with transfer learning, formed end-to-end from direct images, using only pixels and disease tags as entries. The used CNN model was trained on a dataset accessed from public repository consisting of a total of 1697 frontal X-ray images (549 samples of COVID-19, 576 samples of no findings, and 572 samples of non-COVID pneumonia) with high classification accuracy.

3. Usability

This tool can be substituted as viable alternatives in test installations or at home since chest x-rays are even possible at test facilities/homes using portable x-ray units. In fact, this mobile device can potentially extend the scope of pulmonologists outside the clinic. It is expected that more than 4 billion smartphone subscriptions worldwide will exist by the end of 2021, which could potentially provide low-cost universal access to life-saving diagnostic care.

4. Requirements

- Android OS.
- Digital frontal chest X-ray images.
- Camera captured images of X-rays are not adequate.
- Works on android smartphones and tablets.

5. Developers

- **Neelanjan Akuli**, Dual Degree student, Indian Institute of Technology Kharagpur, India.
- **Arka Bhowmik,** Post-doctoral fellow, Indian Institute of Technology Kharagpur, India.
- **Suman Chakraborty**, Professor of Mechanical Engineering, Indian Institute of Technology Kharagpur, India.

6. Installation steps

The following steps will show you how to setup the app and enjoy it.

Google Play Installation	USB Installation from Local Computer
Search and install **cxr2covid** on Google Play store in your android phone or tablet*. Note: We have uploaded our app to google play but due to regulatory issue with covid apps. The app is dropped by google. Please use the second method 	Step 1: Download the app (.apk file) in local computer using the url (https://rb.gy/ep1ine) or the google drive link (https://drive.google.com/file/d/18TXCboergQ6OU7cJ1D4SBx224tPNVRfw/view). Step 2: Connect your android phone or tablet with local computer using USB. Step 3: Copy the app (.apk file) from local computer to file folder in the android device. Step 4: Disconnect the USB and go to File manager in android device and locate the apk file. Step 5: Tap on the .apk file to install on your android device. *Note: Any google play warning shown by the device can be ignored while direct installation. The program will seamlessly work even if the warnings appear.*

7. App Operations

Step 1:

To test the operation of the app download the sample frontal digital chest X-rays images from the url (https://rb.gy/rktwci) or google drive link (https://drive.google.com/drive/folders/1qf1UetZ_RC-x0W0mhdjeqwdYW0AgK5YB) in your local computer and transfer to the (file manager → gallery folder) in your android device using USB link.

Step 2:

Press the app logo that appears on your device after installation 

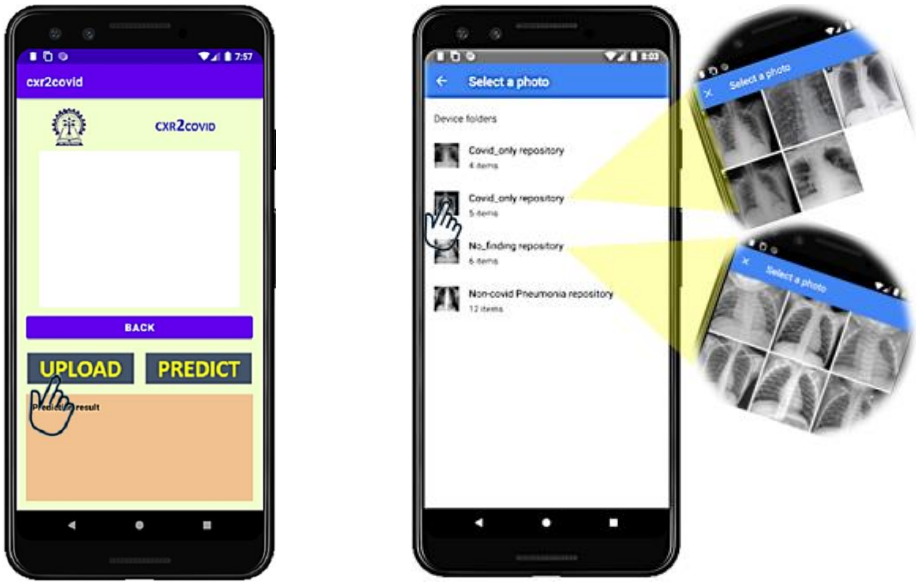
Step 3:

The app homepage will be displayed with small description of the function that this app performs. Press the **start** button to go to next page for analysis.

Step 4:

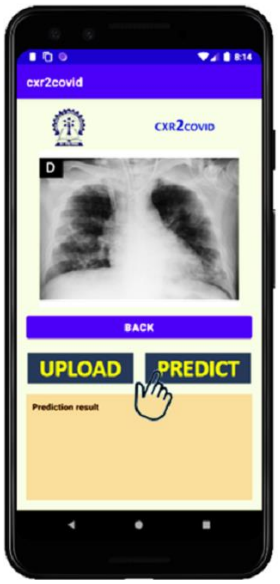
In the second page three buttons exists. **(A) Back button** to go back to homepage, **(B) Upload button** to upload digital chest X-ray images from device gallery, and **(C) Predict button** to predict the chest X-ray class (i.e., whether it is COVID, non-COVID pneumonia, and Normal).

After pressing the **Upload button**, the app will first time ask for your permission to access the device gallery. After providing the permission, press the **Upload button** once again to access the device gallery. Note, the app will only ask permission to access the gallery for the first time.



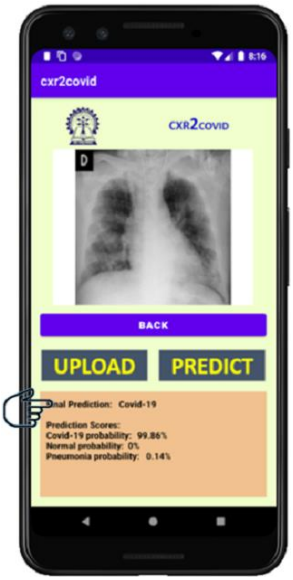
Step 5:

After uploading the image to the image view panel, press the **Predict button**. The predict button triggers the deep learning model to classify the images either of the three disease classes (a) COVID-19 probability, (b) non-COVID pneumonia probability, and (c) No finding probability. This information will be displayed in the text box below.



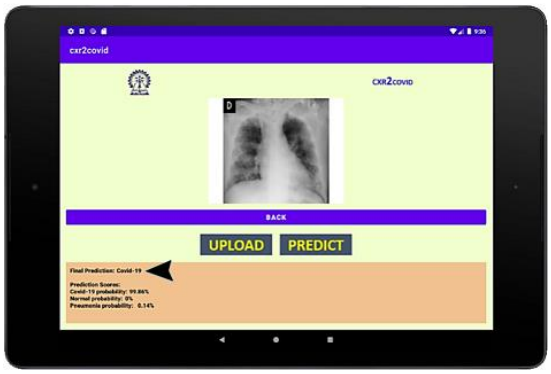
Step 6:

After pressing the **Predict button** the app will resize the image and display the deep learning model prediction in the text box. The out of the deep learning model is the probability of the disease classes. In fact, the disease class with high probability is the true disease displayed by the app.



Step 7:

Some additional screenshots reflecting app operation in android tablet. Note, the operation steps are same in both smartphones and tablets.



8. Contact Us

Any app related issue can be reported to email id (arkabhowmik@yahoo.co.uk).

9. App Rights

Use of app with or without modification are permitted.