

# Application for Diagnosis of Detection of Pneumonia Disease for Rural Context

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## ABSTRACT

Pneumonia is a respiratory infection resulting in inflammation of the lungs. The causes of this infectious disease could be attributed to viruses, bacteria or fungi. One of the many ways of detecting the disease is by a chest X-ray of the patient. The rural population in developing nations have limited access to doctors, medical diagnostic facilities, and hospitals. Hence, diagnosis is delayed resulting in adverse consequences. This paper is an attempt to design and develop a iOS Platform - based application (app) for the preliminary detection of pneumonia using X-ray images. The app is based on machine learning which identifies pneumonia, using a chest X-ray image of a patient and uses ML Model integration.

**KEYWORDS:** APPLICATION, SWIFT, IOS, PNEUMONIA DETECTION, MACHINE LEARNING MODEL, Chest X-RAY, Breathing issues

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## 1. INTRODUCTION

### 1.1. PNEUMONIA DISEASE

Pneumonia and other lower respiratory tract infections are the leading cause of death worldwide. Exposure and inhalation of the contaminated air in these environments ultimately leads to inflammation, and fluid filling in the lungs, in turn, reducing oxygen flow to the bloodstream. Aspiration pneumonia, pneumonia acquired by patients in hospitals (via contact with ventilators, instruments) are other categories of pneumonia. Viruses are the primary cause of pneumonia in children under five years. Children, infants, elderly, people with weakened immune systems, and people with severe alcohol misuse have an increased risk.

Additionally, MRI scans and imaging facilities are expensive and obtaining an accurate diagnosis is cumbersome. Patients in fast-growing metropolitan cities have better access to diagnostic imaging facilities, whereas those in third world countries or rural areas and low growth economic regions do not have easy access to diagnostic imaging facilities.

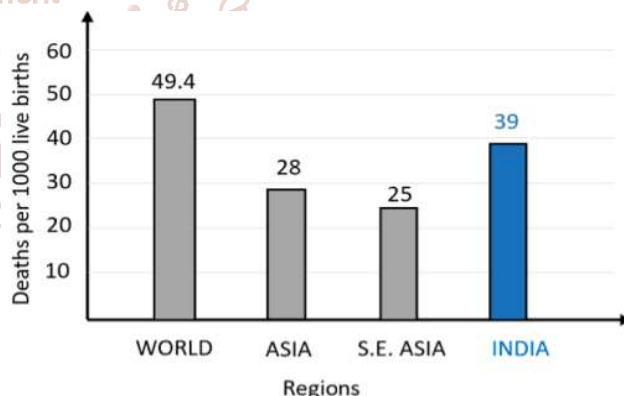
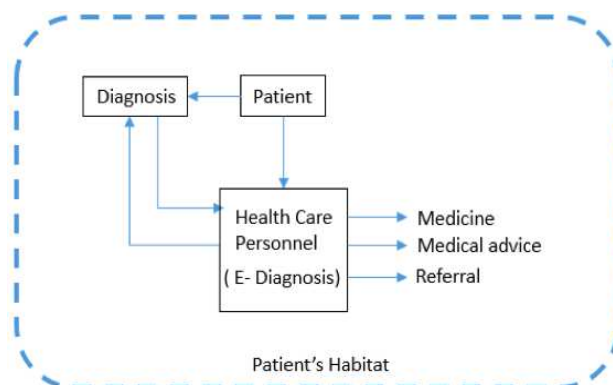


Fig 1 The Infant Mortality of world, asia, south East Asia (S.E. Asia) and India respectively [5], [6], [7], [8]



## 2. METHODOLOGY

### 2.1. DESIGN METHODOLOGY

Pneumonia Disease Detection has been implemented by using a dataset of 157 X-ray images, of which 73 are X-ray images of pneumonia patients while 84 are X-ray images of healthy individuals, through google search engine database, i.e. from Kaggle.com Datasets.

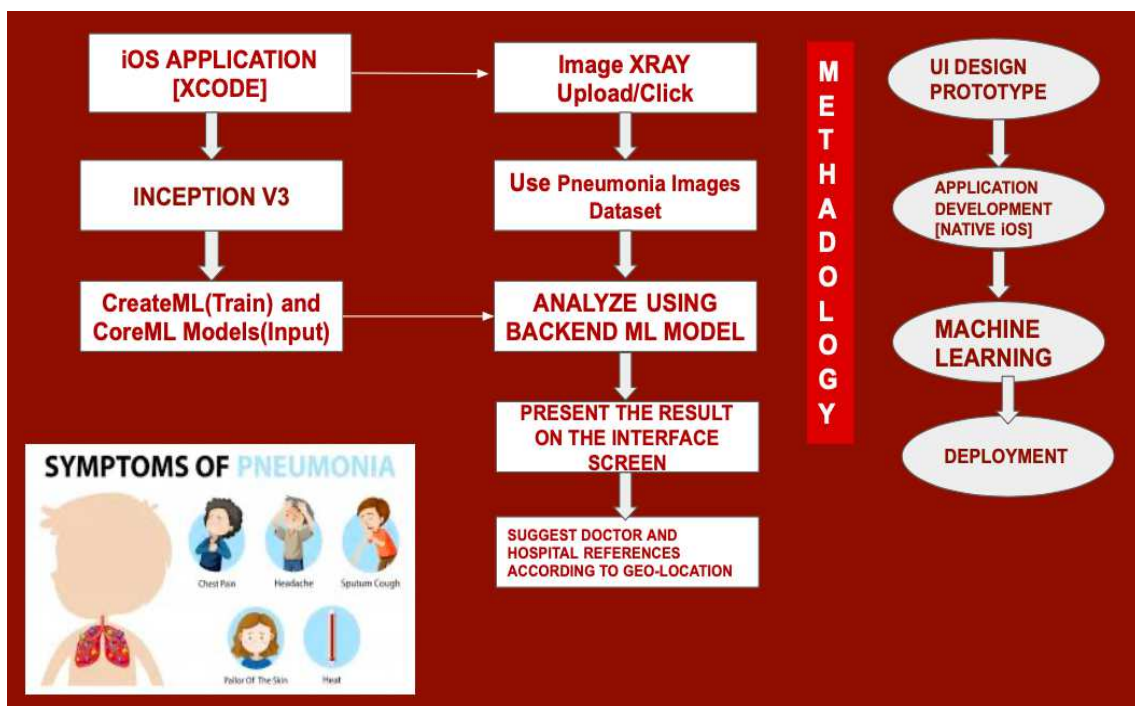
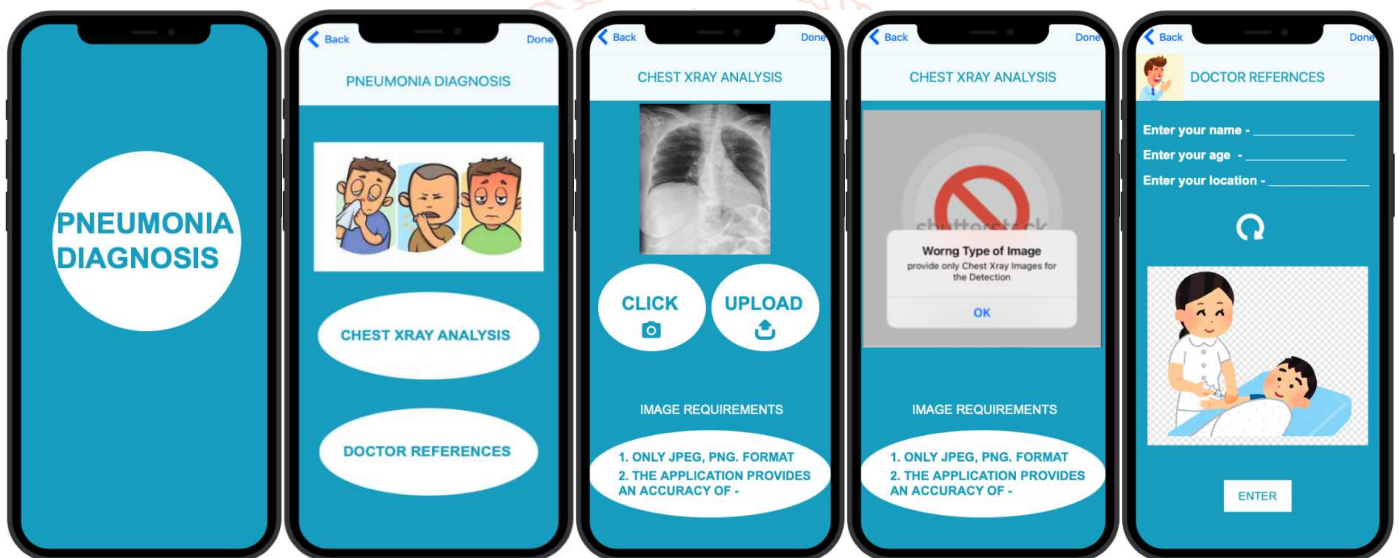
### 2.2. DEVELOPMENT OF APPLICATION (iOS)

- The iOS application is developed keeping in mind the solution irrespective of the platform. The application uses the Apple Developer provided API's and training the CreateML with CoreML model.
- The Application has an option for the user to click or upload Chest X-RAY images while accessing the mobile gallery as well. The format of the image input is specified and the app is integrated with InceptionV3 to accept only specific format.
- The application then analyzes the input image and gives a result pop up notification. If the person is diagnosed positive, they are redirected to the screen with doctor and hospital references which are responded using the person's geo-location.
- If they are not diagnosed with Pneumonia, they are

redirected to screen with Symptoms, Precautions and Preventions.

### 2.3. DEVELOPMENT OF PROTOTYPE (iOS)

- The X-ray image data is analysed with the help of the trained model in the CoreML Model to predict the probability of pneumonia in the test data presented by the user.
- Also, preliminary advice on dealing with the disease is provided to the user.
- In the scenario where there is an active internet connection, the user can get connected to a group of expert medical practitioners (situated at distant metropolitan regions or anywhere in the world) available online, who can provide a real-time opinion for accurate prediction of the disease and affirm or disagree with the results provided by the application.
- The system is developed in such a manner that there is always a pool of doctors online, to serve the users of this application.
- The design methodology used in the development of this application for the preliminary detection of pneumonia is based on the CreateML and CoreML Apple API's.



## 2.4. APPLE DEVELOPERS GUIDE

- Core ML delivers blazingly fast performance with easy integration of machine learning models, allowing us to build apps with the intelligent new features using just a few lines of code.
- Easily pre-built machine learning features into our apps using API's powered by CoreML or use CreateML for more flexibility and train custom CoreML Models straight in our Mac.
- Create ML lets you quickly build and train Core ML models right on your Mac with no code. The easy-to-use app interface and models available for training make the process easier than ever, so all you need to get started is your training data.
- We can even take control of the training process with features like snapshots and previewing to help you visualize model training and accuracy.

## 3. RESULTS AND DISCUSSION

- The user needs to take a picture of the chest X-ray Image using his smartphone camera. Once this data is uploaded to the app, within a short period, the app can provide the results of the confidence percentage in the detection of the disease.
- The detection framework is implemented with the help of three layers primary, secondary and tertiary.
- The primary layer is a filter that detects whether the patient has pneumonia or not. If pneumonia is detected, the secondary layer predicts the cause viral or bacterial. The tertiary layer predicts the confidence level of pneumonia based on a fixed range. This percent range 1–5, 20–30, and 80–100 denotes mild, intermediate, and severe pneumonia, respectively.
- The percentage of specificity shows the pneumonia type and confidence level of the prevalence of pneumonia.

## 4. CONCLUSION

- Pneumonia is a critical respiratory infection which could become life-threatening if medical aid is not administered in optimum time.
- Diagnostic facilities are expensive and not affordable to the rural communities in the developing world. Moreover, there is an acute shortage of hospitals and doctors in rural regions, which makes the early detection and diagnosis, a difficult task for most people in rural areas.
- After an X-ray image of the chest is obtained by a patient, there is a possibility of long waiting periods, before meeting concerned doctors. This delay may aggravate the health conditions of pneumonia patients.
- This mobile application can be of significant help to any individual, including infants and children. This app requires a chest X- ray image and a smartphone for early detection of pneumonia.
- It is also convenient and affordable to users, as it helps save their time and money.
- The X-ray image analysis helps in improving the prediction accuracy and provides confidence to the patients, to approach concerned medical facilities for necessary treatment at the earliest.

- The patients have an additional option to use the e-diagnosis facility for cross-examining the authenticity of the app's prediction and also avail guidance and support from professional healthcare experts available online.

## 5. REFERENCES

- [1] American Lung Association Scientific and Medical Editorial Review Panel, "Lung Health & Diseases," American Lung Association, 2019. [Online]. Available: <https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/pneumonia/learn-about-pneumonia.html>. [Accessed: 18-Apr-2019].
- [2] NHS, "What causes pneumonia?," NHS, 2016. [Online]. Available: <https://www.nhs.uk/conditions/pneumonia/>. [Accessed: 14-May- 2019].
- [3] Kaggle.com- Datasets
- [4] IGME, "UN Inter-agency Group for Child Mortality Estimation," IGME, 2018. [Online]. Available: <https://childmortality.org/data>. [Accessed: 15-Apr-2019].
- [5] Statista, "Infant mortality rates in South East Asian countries between 2010 and 2015 (infant deaths per 1,000 live births)," Statista, 2019. [Online]. Available: <https://www.statista.com/statistics/590013/infant-mortality-rates-in-south-east-asia/>. [Accessed: 16-Apr-2019].
- [6] United Nations Population Division | Department of Economic and Social Affairs, "World Mortality 2017: Data Booklet (ST/ESA/SER.A/412)," 2017.
- [7] WHO, "World Pneumonia Day 2018," WHO, 2019. [Online]. Available: [https://www.who.int/maternal\\_child\\_adolescent/child/world-pneumonia-day-2018/en/](https://www.who.int/maternal_child_adolescent/child/world-pneumonia-day-2018/en/). [Accessed: 16-Apr-2019].
- [8] Ministry of Health and Family Welfare, "National Health Profile 2018 - Birth Rate," p. 23, 2018.
- [9] R. Nagarajan, "6 states have more doctors than WHO's 1:1,000 guideline," TNN, 2018. [Online]. Available: <https://timesofindia.indiatimes.com/india/6-states-have-more-doctors-than-whos-11000-guideline/articleshow/65640694.cms>. [Accessed: 14-Apr-2019].
- [10] K. D. Rao, R. Shahrawat, and A. Bhatnagar, "Composition and distribution of the health workforce in India: estimates based on data from the National Sample Survey," WHO South-East Asia J. public Heal., vol. 5, no. 2, p. 133, 2016.
- [11] Global Health Observatory, "Density of physicians (total number per 1000 population, latest available year)," WHO, 2019. [Online]. Available: [https://www.who.int/gho/health\\_workforce/physicians\\_density/en/](https://www.who.int/gho/health_workforce/physicians_density/en/). [Accessed: 14-May-2019].