EFFICIENT PNEUMONIA DETECTION IN DIGITAL CHEST XRAY IMAGES USING DEEP TRANSFER LEARNING

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Main Project Final Review, 2022

Outline

INTRODUCTION

- Pneumonia is one of the largest infectious diseases that cause death in children and elderly people across the globe.
- Pneumonia is ranked eight in the list of the top 10 causes of death in the United States.
- Due to pneumonia, every year, 3.7 lakh children die in India, which constitutes a total of fifty percent of the pneumonia deaths that occur in India.

PROBLEM STATEMENT

Several tests that can be done for diagnosing pneumonia are as follows :

- chest X-rays
- CT of the lungs
- Ultrasound of the chest
- Needle biopsy of the lung
- MRI of the chest

- Among these , Chest X-rays are primarily used for the diagnosis of this disease.
- However , even for a trained radiologist, it is a challenging task to examine chest X-rays.
- There is a need to improve the diagnosis accuracy.

LITERATURE REVIEW

Sl.No	Name of Paper	Name of Author	Summary
1	Efficient Pneumonia Detection in Chest Xray Images Using Deep Transfer Learning **(2020)**	Hashmi , Mohammad Farukh et al.	• The paper presents an efficient model for the detection of pneumonia trained on digital chest X-ray images is proposed, which could aid the radiologists in their decision making process. • A novel approach based on a weighted classifier is introduced, which combines the weighted predictions from the state-of-the-art deep learning models such as ResNet18, Xception, InceptionV3, DenseNet121, and MobileNetV3 in an optimal way.
2	Deep-Learning based Automated Detection of Pneumonia in Chest Radiographs **(2021)**	S. Arunmozhi , V. Rajinikanth and M. P. Rajakumar	• The paper suggests implementing a the deep-learning (DL) scheme to detect the pneumonia. • The disease detection performance of the DL scheme is confirmed using a binary classification achieved with SoftMax classifier unit.
3	Pneumonia Detection using Deep Learning **(2021)**	K. More , P. Jawale, S. Bhattad and J. Upadhyay	• The paper suggests different deep convolutional neural network(CNN) architectures to extract features from images of chest X-ray and classify the images to detect presence pneumonia in a person with a higher accuracy

OBJECTIVE

- To develop an efficient application to detect Pneumonia by uploading digital Chest X-ray images and there by reducing human interventions to detect the disease.
- Minimise human interventions and time in detecting pneumonia.

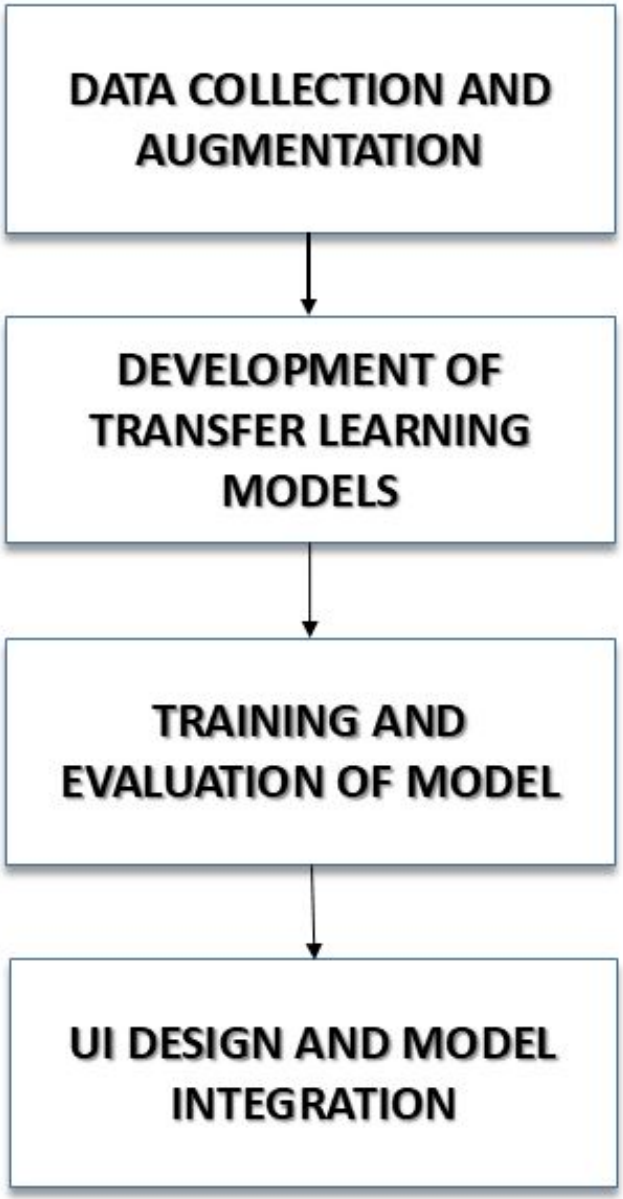
PROPOSED SYSTEM

- Develop an application to detect Pneumonia by uploading digital Chest X-ray images
- Develop a model for the detection of pneumonia
- Trained on digital chest X-ray images
- Transfer learning is used to fine-tune the deep learning models
- Supervised learning approach.

PROPOSED SYSTEM

- Several deep learning models are customised and trained in order to get the best detection model.
- Various models used are as follows :
  - DenseNet121
  - MobileNetV3
  - InceptionV3
  - ResNet152V2
  - Sequential
  - VGG16

ARCHITECTURE DIAGRAM



WORK FLOW

- Implementation is supposed to have the following steps :
  - Data Collection
  - Data Augmentation
  - Development of transfer learning models (customization)
  - Train models
  - Evaluation
  - Choose the best model
  - UI Design and model Integration
  - Generate predicted results

REQUIREMENT SPECIFICATIONS

- Software Requirements :
  - Operating System : Windows 8 or above
  - Front End : Android , Java
  - Back End : python
  - IDE : Google Colab , Android studio
  - Libraries : Tensorflow , Numpy , Keras

- Hardware Requirements:
  - Processor : core i3 or above
  - Hard Disk Space : 320 GB
  - Memory : 4 GB or above

MODULES

- DATA COLLECTION AND AUGMENTATION
- DEVELOPMENT OF TRANSFER LEARNING MODELS
- TRAINING AND EVALUATION OF MODELS
- UI DESIGN AND MODEL INTEGRATION

MODULES

DATA COLLECTION AND AUGMENTATION

- The Data set is taken from kaggle repository for training.
- Some Data are collected from hospital for testing purpose.
- Split images as 80% for training and 20% for validation.
- Images are grouped into 2 classes - normal and pneumonia.
- The training set contains 5889 labeled images
- The test set contains 1749 images
- All the images are resized to [224,224]
- Data augmentation is done to significantly increase the diversity of data available for training models
- ImageDataGenerator class is used for Data Augmentation

DEVELOPMENT OF TRANSFER LEARNING MODELS

- Model for training is built using keras.
- Add preprocessing layer to the front of the model.
- Here we will be using imagenet weights which is large visual database designed for use in visual object recognition
- The layers in the model are set "trainable = false" , thus not to train the existing weights.
- The last layer in the model is flattened and then dense using ReLU Activation function
- Rectified Linear Unit activation function is a linear function that will output the input directly if it is positive, otherwise, it will output zero

TRAINING AND EVALUATION OF MODELS

- Model thus created is compiled.
- Adam is used as the optimizer with binary-crossentropy as loss and accuracy as the metrics
- optimizer is a function or an algorithm that modifies each epoch's weights and minimize the loss function.
- Binary cross entropy compares each of the predicted probabilities to actual class output which can be either 0 or 1
- Finally the model is trained with the required number of epochs and is saved.

UI DESIGN AND MODEL INTEGRATION

- The model thus created is converted to tflite_model for integrating to android UI.
- TFLiteConverter in Tensorflow Library is used for conversion
- Upload a chest X-ray image to test the model.
- When the user clicks the predict button, it will return the corresponding class to which the image belongs to.

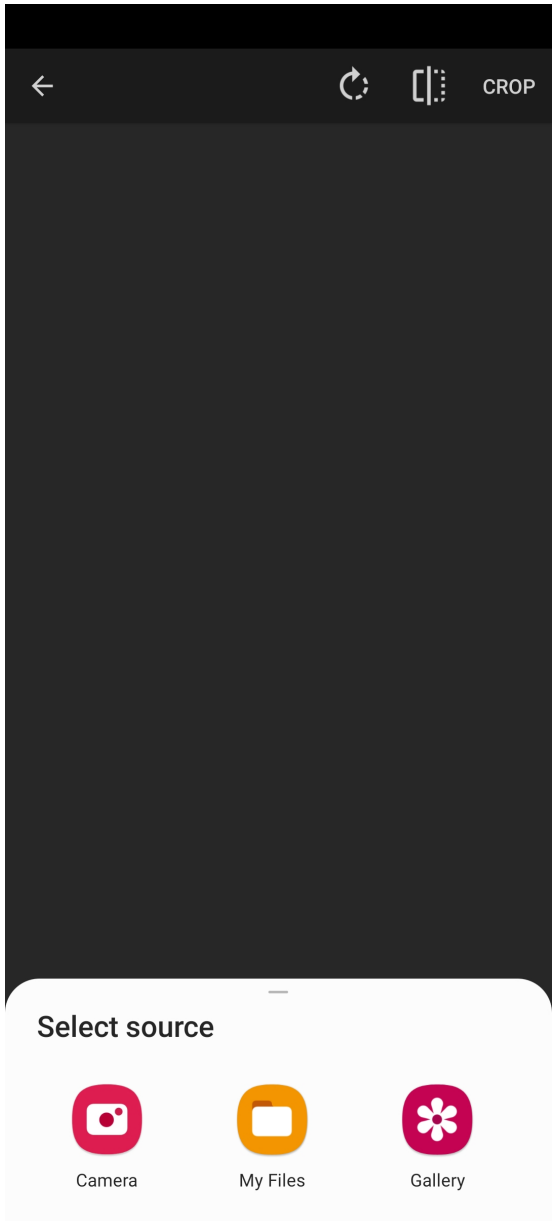
RESULT

Pneumonia Detection

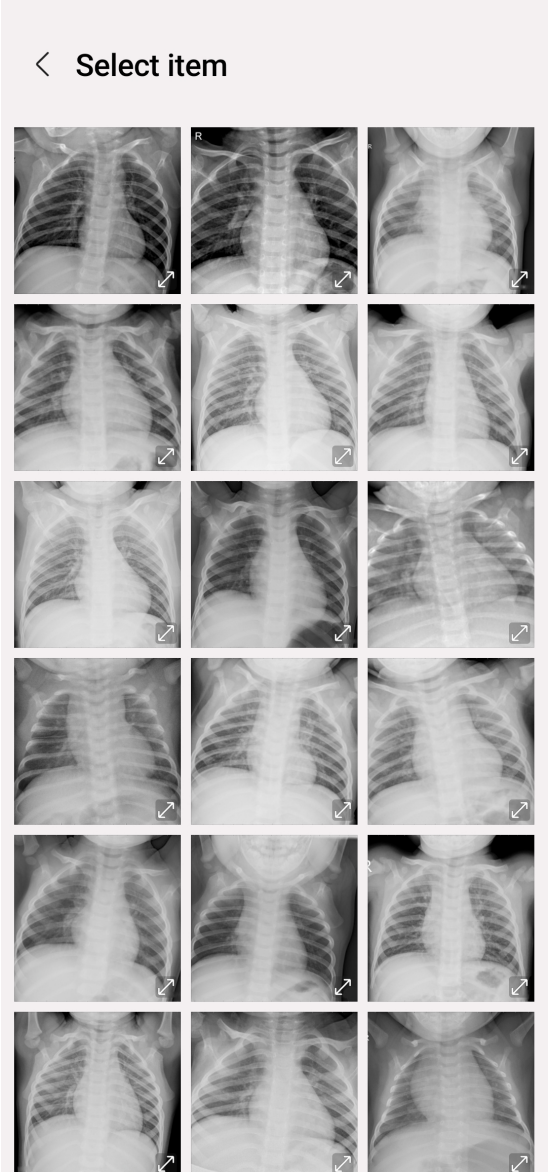
UPLOAD

PREDICT

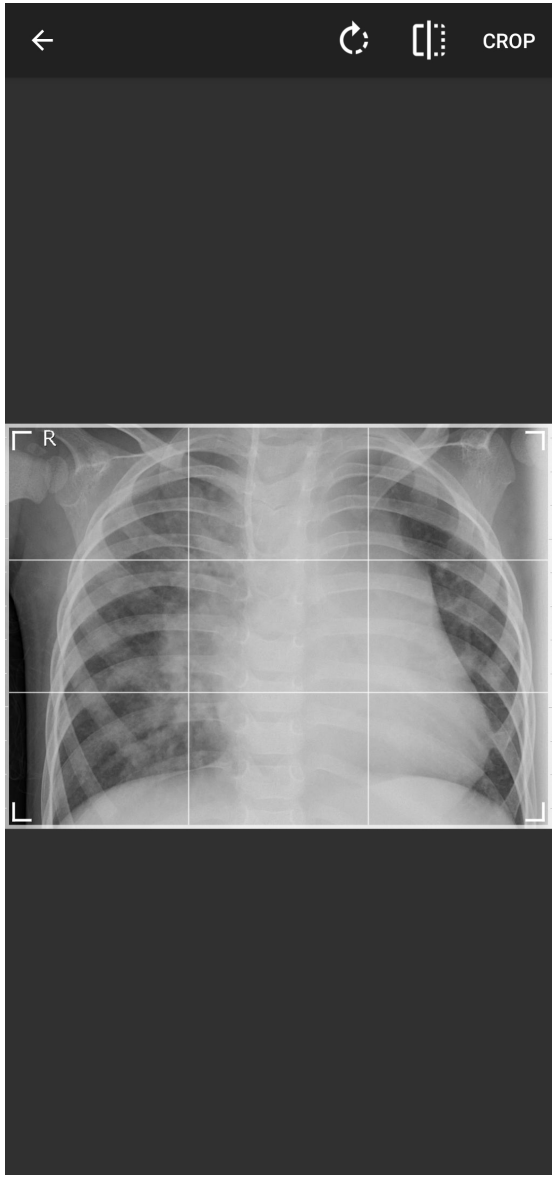
RESULT



RESULT

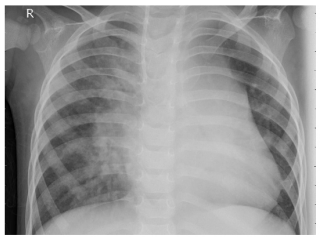


RESULT



RESULT

Pneumonia Detection



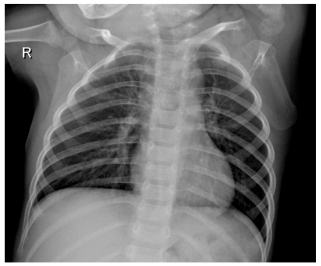
UPLOAD

PREDICT

Pneumonia

RESULT

Pneumonia Detection



UPLOAD

PREDICT

Normal

EVALUATION MEASURES

- ACCURACY :
  - Computes the count of correct predictions.

- ACCURACY OF VARIOUS TRAINED MODEL ARE AS FOLLOWS :

  - DenseNet121 - 50%
  - MobileNetV3 - 49%
  - InceptionV3 - 50%
  - ResNet152V2 - 85%
  - Sequential - 88%
  - VGG16 - 90%

FUTURE ENHANCEMENT

- In the future, this work could be extended to detect and classify X-ray images consisting of lung cancer and pneumonia.
- In the future, this work could be extended to explore more accurate classification architectures to diagnose two types of pneumonia, viruses, and bacteria.
- The future works can involve developing an algorithm which can localize the parts of the lung affected by pneumonia.

CONCLUSION

- An android application using a deep transfer learning model is built that can detect pneumonia from digital chest X-ray images with an accuracy above 90
- With this model ,it is possible for early diagnosis of Pneumonia, that helps to save the patients from being severe.
- Minimise human intervention in detecting pneumonia.
- The result shows that the proposed method has good performance that helps the trained radiologist for early detection of pneumonia.

REFERENCE

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Thanks

THANK YOU