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Pneumonia Detection Using The Deep Learning

Student Name: Rajan Dulal || Student ID: 1928440
Supervised By: Rupak Koirala
Herald College Kathmandu

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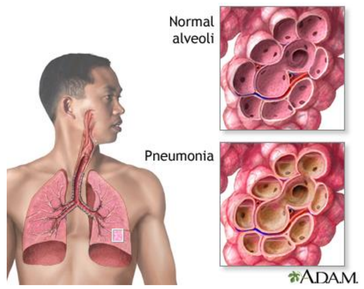
Overview

What is Pneumonia?

- Pneumonia is the state of the lungs where the air sacs and alveoli of the lungs is filled with the fluid or liquid.
- Around 2.56 million people die in the world which consists of around 25000 children along from Nepal
- It isn't the fatal disease but timely diagnosis is need for effective treatment



Academic Questions

To find out the effectiveness of the deep learning for clinical diagnosis of Pneumonia

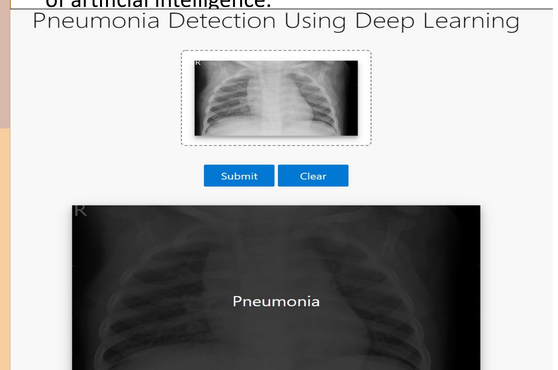
To find out which architecture of the model is effective for medical image segmentation

Aim of the project

- Solve the existing problem of the ambitious medical image analysis i.e. accuracy and well interpretation of the images for the disease diagnosing even more faster and more precisely

Objectives of the project

- To provides the full functioning system.
- To enhance the knowledge in the field of project development.
- Helps to solve the tedious process of examining the medical images.
- To provide the system for Pneumonia detection.
- To increase the information and learning in the field of artificial intelligence.

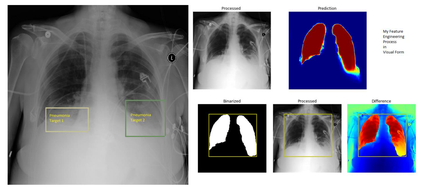


Literature review

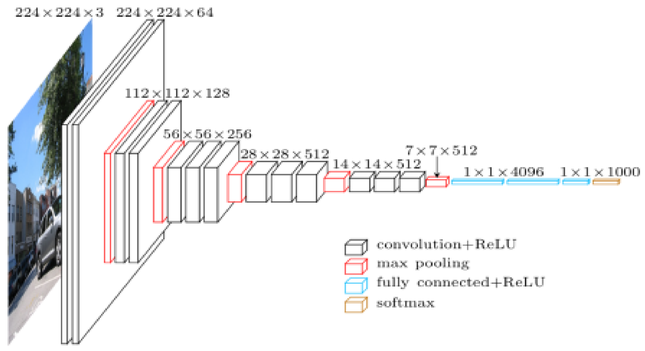
Projects	Dataset Used	Data Preprocessing	Deep learning structure	Accuracy
CheXNet: Radiologist-Level Pneumonia Detection on the chest x-rays with deep learning	112,120 frontal view of X-ray of 30,805 different patients	Resized into 224*224, randomly flipped into horizontal	Trained on pretrained ImageNet model with final layer replacement for binary classification	76%
An efficient Deep learning Approach to pneumonia classification in healthcare	5856 x-ray images of the pediatric patients	Resized into 225*225, rotation 40 degree along with the horizontal flip	Developed from scratch. extractor layers consist of the conv3×3, 32; conv3×3, 64; conv3×3, 128; conv3×3, 128 layers	93%
Detecting Pneumonia in Chest X-rays with Supervised Learning	112,120 x-rays by NIH	Resized into 32*32 and 224*224 and trained separately	Uses the CheXNet model for training the dataset	0.609 AOC
Deep Learning Approach for prediction of pneumonia	5863 images of the patients	Resized into 128*128, 256*256 and 512*512 and trained separately	Uses the pretrained ResNet34 along with the modification of the last layer	92.9%
Detecting Pneumonia with Convolutional Neural Networks	29000 images of x-rays	Resized into 128*128 no other transformation was done	Two normal Convolutional layers were used	78%

Dataset and Data feature abstraction

All the X-rays were acquired from the Kaggle Chest X-ray repository.
2570 training data and 624 testing images including Normal and Pneumonia
All the images were resized into 150 and all the pre processing like random flip, zoom, horizontal flip height shift, width shift were done to avoid the over fitting.



Classification Model



47 layers 19 learnable weight 16 convolutional layers with 3 fully connected layers

Modified flattened 128 neurons with 0.5 drop out with relu
Last dense layer 2 neurons for classification

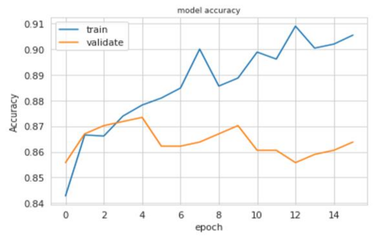
Model: "model_2"

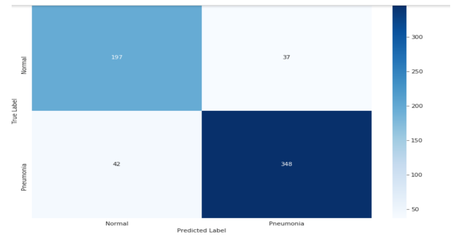
Layer (type)	Output Shape	Param #
input_4 (InputLayer)	(None, 150, 150, 3)	0
block1_conv1 (Conv2D)	(None, 150, 150, 64)	1792
block1_conv2 (Conv2D)	(None, 150, 150, 64)	36928
block1_pool (MaxPooling2D)	(None, 75, 75, 64)	0
block2_conv1 (Conv2D)	(None, 75, 75, 128)	73856
block2_conv2 (Conv2D)	(None, 75, 75, 128)	147584
block2_pool (MaxPooling2D)	(None, 37, 37, 128)	0
block3_conv1 (Conv2D)	(None, 37, 37, 256)	295168
block3_conv2 (Conv2D)	(None, 37, 37, 256)	590080
block3_conv3 (Conv2D)	(None, 37, 37, 256)	590080
block3_conv4 (Conv2D)	(None, 37, 37, 256)	590080
block3_pool (MaxPooling2D)	(None, 18, 18, 256)	0
block4_conv1 (Conv2D)	(None, 18, 18, 512)	1180160
block4_conv2 (Conv2D)	(None, 18, 18, 512)	2359808
block4_conv3 (Conv2D)	(None, 18, 18, 512)	2359808
block4_conv4 (Conv2D)	(None, 18, 18, 512)	2359808
block4_pool (MaxPooling2D)	(None, 9, 9, 512)	0
block5_conv1 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv2 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv3 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv4 (Conv2D)	(None, 9, 9, 512)	2359808
block5_pool (MaxPooling2D)	(None, 4, 4, 512)	0
dropout_2 (Dropout)	(None, 4, 4, 512)	0
global_average_pooling2d_2 (	(None, 512)	0
dense_3 (Dense)	(None, 128)	65664
batch_normalization_2 (Batch	(None, 128)	512
dense_4 (Dense)	(None, 2)	258

Total params: 20,090,818
Trainable params: 66,178
Non-trainable params: 20,024,640

Evaluation Matrix

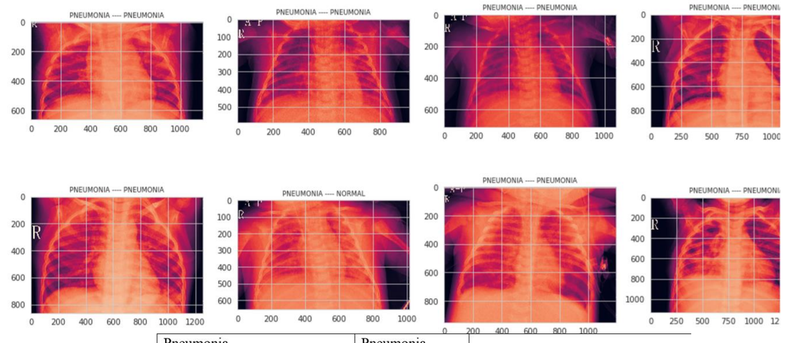
Evaluation matrices for this project are model accuracy, confusion matrix, and Precision

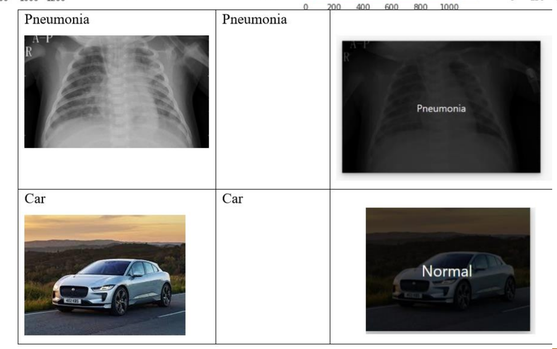




	precision	recall	f1-score	support
Normal	0.82	0.84	0.83	234
Pneumonia	0.90	0.89	0.90	390
accuracy			0.87	624
macro avg	0.86	0.87	0.87	624
weighted avg	0.87	0.87	0.87	624

AUC: 0.8670940170940171





Conclusions and Discussion

- Based on research and development the pneumonia detection is performed
- Model performs quite well in the prediction of the Pneumonia or Normal image
- Making the algorithms from scratch could be even more precise but requires more computational power
- Making the custom data preprocessing argument feature in application can be even more better
- If the model is improved according to the feature abstraction understanding the model can be clinically used as the reference
- Proper diagnosis could be done easily using the project integrated into the hospital management system