<u>Deep Learning Project</u>

Project Title: Pneumonia Prediction

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Batch: DL1

Model: VGG-16

1. Introduction

This project is about detecting pneumonia in patients using x-ray images of their chest. Pneumonia is an infection that causes inflammation in the air sacs in one or both lungs. It may cause cough with phlegm, fever, chills and difficulty in breathing. This project aims to detect whether a person has pneumonia or not. It uses pre-trained VGG-16 model.

2. Model Architecture

The model used in this project was built by applying transfer learning on pre-trained VGG-16 model. VGG-16 is a CNN model proposed by K. Simonyan and A. Zisserman in the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition". This model achieved 92.7% test accuracy in ImageNet. ImageNet is a dataset of over 14 million images which belong to 1000 classes. It makes an improvement on AlexNet by replaceing the large kernel-sized filters with 3x3 kernal-sized filters. It was trained for weeks using NVIDIA Titan Black GPUs.
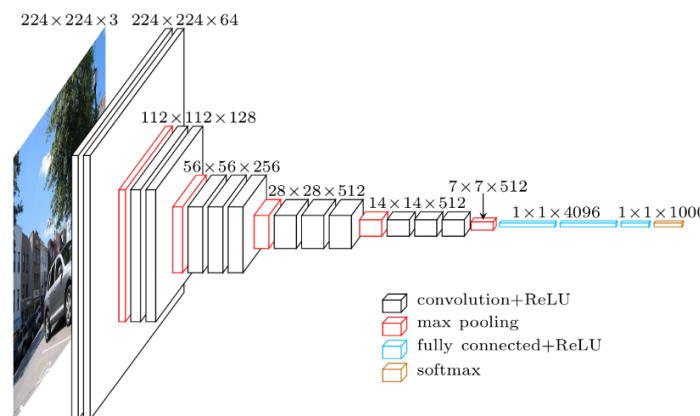
VGG16 Architecture

```
Model: "sequential"
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 Layer (type)                Output Shape              Param #
=================================================================
 vgg16 (Functional)          (None, 7, 7, 512)         14714688

 dropout (Dropout)           (None, 7, 7, 512)         0

 flatten (Flatten)           (None, 25088)             0

 batch_normalization (BatchN  (None, 25088)            100352
 ormalization)

 dense (Dense)               (None, 1024)              25691136

 batch_normalization_1 (Batc  (None, 1024)             4096
 hNormalization)

 activation (Activation)     (None, 1024)              0

 dropout_1 (Dropout)         (None, 1024)              0

 dense_1 (Dense)             (None, 1024)              1049600

 batch_normalization_2 (Batc  (None, 1024)             4096
 hNormalization)

 activation_1 (Activation)   (None, 1024)              0

 dense_2 (Dense)             (None, 1)                 1025

=================================================================
Total params: 41,564,993
Trainable params: 26,796,033
Non-trainable params: 14,768,960
_____
```

Model Summary

The model used in this project adds two more Dense layers to VGG-16 with relu activation. The output layer gives the final prediction uses sigmoid activation. The optimizer used is adam and loss is binary crossentropy. This model was trained over 10 epochs and achieved a training accuracy of 99.83% and validation accuracy of 97.56%.

3. Dataset

The name of the dataset used is 'Chest X-Ray Images (Pneumonia)'. There are 5,863 X-Ray images (JPEG) and 2 categories (Pneumonia/Normal) in the dataset. The images were selected from retrospective cohorts of pediatric patients of one to five years old from Guangzhou Women and Children's Medical Center, Guangzhou. The chest radiographs were screened for quality control by removing all low quality or unreadable scans.

This dataset is available on Kaggle at the following address:

https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia

4. Libraries

The following technologies and libraries were used for developing this project:

Python: Python is an interpreted high-level general-purpose programming language. It is dynamically-typed and garbage-collected. Python is widely used in multiple domains such as data science, machine learning and deep learning.

Tensorflow: Tensorflow is an open-source library for machine learning and deep learning. It is mainly used for training and inference of deep neural networks. It was developed by Google Brain Team for internal Google research and production.

NumPy: NumPy is a Python library used for working with arrays. It was developed by Travis Oliphant in 2005. NumPy provides array object which is 50x faster than traditional Python lists.

Matplotlib: Matplotlib is a comprehensive library for creating static, animated and interactive visualizations with Python.

Seaborn: Seaborn is a visualization library for statistical graphics plotting in Python. It is based on Matplotlib. It provides a high-level interface for drawing attractive and informative statistical graphics
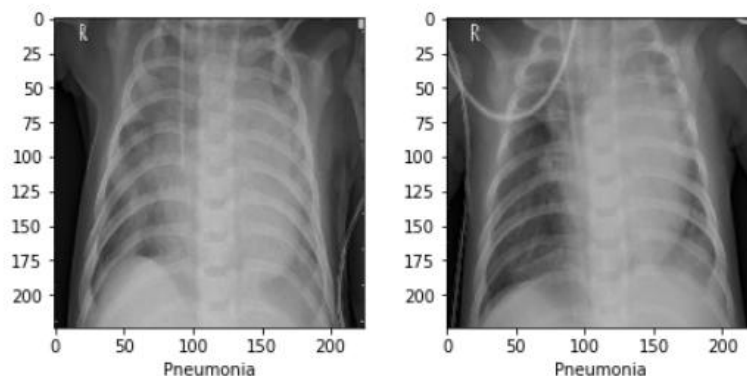
5. Results

The model achieved test accuracy of 82.12 % over 624 test images.
Precision: 0.85
Recall: 0.82
F-Score: 0.80

6. Conclusion

Prediction of diseases is a vital process. It should be treated very carefully. A false diagnosis can result in death of patients. This task can be done efficiently by using deep learning. This project gave satisfactory results for prediction of pneumonia but there is still room for improvement.

The code for this project is available on GitHub:

https://github.com/purvesh261/pneumonia-detection