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Detecting Covid 19 from X-Rays

DSTI

A19

ANN Project

Objective:

With the ongoing Covid-19 crisis, I wanted to implement a model to understand if we could use computer vision to help to fight the crisis.

Data Compilation:

I combined two data sets:

1. https://github.com/ieee8023/covid-chestxray-dataset : Data set consisting of X-rays and CT Scans of patients suffering from Covid-19, SARS, MERS,ARDS

2. https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia : Data set consisting of X-rays patients with pneumonia and patients who are healthy .

Why Did I choose two different Datasets?

A Quick check through the data showed high number of Covid patients but a very low number of patients suffering from other diseases. I checked through the different datasets and found the X rays of normal Patients and decided to go ahead with creating a model for Covid-19 Vs Normal Patients.

How did I build the model?

Image Segregation: Meta data of the image was available in the CSV which provided information of findings, Filename, Modality, View etc .I selected Filenames with Modality as X-Ray and View PA and separated the Covid19 Xray Images from rest of the images in the dataset and stored them in **Covid** Folder and saved the healthy patients in **Normal** Folder.

Pre-Processing the Image: A quick check with the images showed that some images had two channels, while others had three. To have uniformity throughout the images, I converted all the two channels images to three. I resized the images to (224,224) and created two categories of data

0 - Normal 1 – Covid

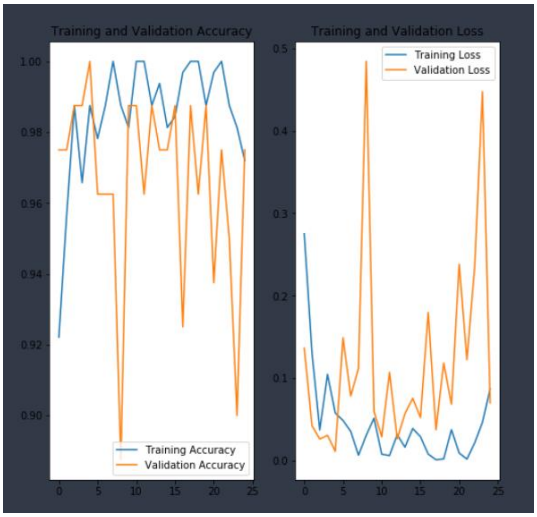
Images are always in the range of 0 to 255. I thought it will be best for the model to learn if the images pixels are in the range of 0-1. So, I rescaled the images by dividing them with 255.0 and build two arrays. First array comprising of the processed image pixels and the second array consisting of the corresponding labels.

Dividing the data: I divided the data in 20% Validation data, 10 % Test Data and remaining 70% as Train data.

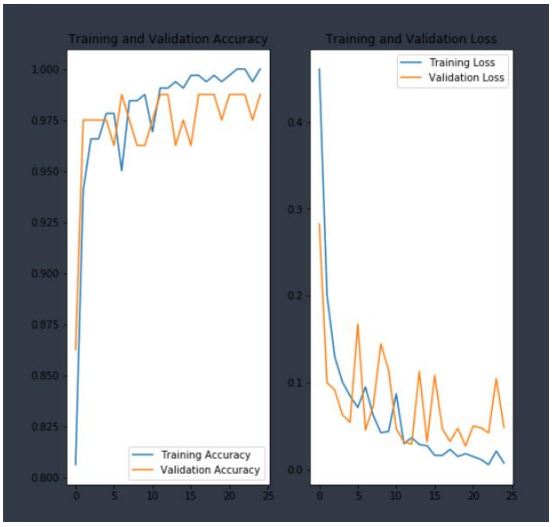
Data Augmentation: Since I had 227 images of each class, I chose to augment the images to increase the diversity of the data.

Creating the Model: I choose VGG16 Model as it is considered one of the best Computer vision model even at present time. I initiated with the pre trained weights of Imagenet. I created a top layer with Maxpooling2D, Dense layer 64 and 2 in the end with relu activation (as it overcomes the vanishing gradient problem and helps model learn faster) and softmax (as it not only maps our output to a [0,1] range but also maps each output in such a way that the total sum is 1 which is the best for classification models).

Issues faced and solution provided:

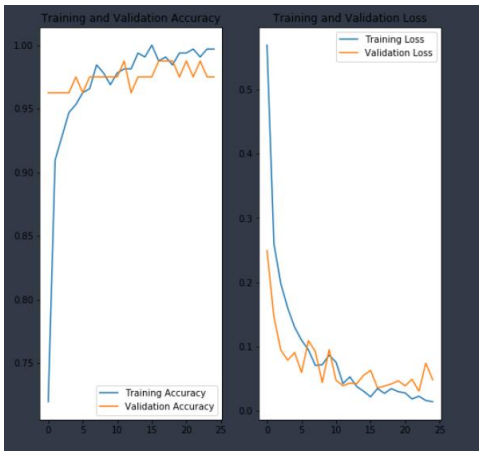


Higher Learning rate : Initial learning rate was 0.01 for which lead to unstable training graph. So I reduced the LR to 1e-3.



Overfitting : I dropped 20% random layers by adding dropout. This reduced the validation loss (below).

Final Model Training graph:



Model Accuracy: Model with 99.7% accuracy on training data and 97.5% accuracy on validation data was obtained.

Confusion Matrix: Matrix indicated 22 True Positive and 21 True Negative against the Test Data.

Model Predictions: Model could predict the Covid and Normal Cases accurately.