INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 2)
Available online at: www.ijariit.com

Prediction of Pneumonia using deep learning

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ABSTRACT

The project is to classify pneumonia by processing the image of chest X-ray using diverse deep learning algorithms. For classification purpose, we have to develop an algorithm which can most accurately predict on a validation set of chest X-rays. Deep learning is very helpful in automatically discovering chest diseases at the expert's level, providing the two Liberian radiologists with some respite and used for saving countless lives potentially worldwide. The problem is solved using Convolution neural networks [9]. Convoluted neural networks are used to classify where each neuron is tightly connected to other neurons. Inception network was used in the development of CNN classifiers. Inception network was heavily engineered. It used a lot of tricks to improve performance in terms of speed and accuracy. With much more robust and large dataset our project can intervene in all domains.

Keywords— *Pneumonia, Deep learning, Classification, InceptionV3, Convolution neural networks, Prediction, Django*

1. INTRODUCTION

Pneumonia a disease which is an infection in one or both lungs. The disease can be caused by bacteria, viruses, or fungi. Bacterial pneumonia is common type mostly in adults. The disease Pneumonia causes inflammation in the air sacs in your lungs, which are called alveoli. The alveoli filled with fluid will lead to difficulty breathing. The Symptoms of pneumonia will be like a cough with phlegm or pus, chills, fever, and difficult breathing. Detecting pneumonia is a tedious task, it is possible only for expert radiologists.

So, we are building this for automatically detect pneumonia at a level exceeding practising radiologists. It makes easy for every radiologist so that the prediction is made easy and therefore could reduce the mortality rate due to pneumonia. To predict pneumonia from chest X-ray first the input is taken from the directory where the

image is stored and then the deep learning steps are followed and then data is fitted into the model and from the predictions the output is generated. Convolution Neural Networks is used to get more accuracy and get results fast.

2. EASE OF USE

The improvements in the quality of network resulted in new application domains for convolutional networks. The computational cost of Inception is also much lower than VGGNet or its higher performing successors [1]. This has made it feasible to utilize Inception networks in big-data scenarios [7], [5], where a huge amount of data needed to be processed at reasonable cost or scenarios where the memory or computational capacity is inherently limited. Example in mobile vision settings. It is certainly possible to mitigate parts of these issues by applying specialized solutions to the target memory use [2], [6] or by optimizing the execution of certain operations via computational tricks [4].

3. PRIOR WORK

[10]Owing to the restrictions of power and speed many models have been proposed to perform under similar circumstances. Why not have filters with multiple sizes operate on the same level? The network essentially would get a bit "wider" rather than "deeper". The inception module is to reflect the same. The key idea for devising this architecture is to deploy multiple convolutions with multiple filters and pooling layers simultaneously in parallel within the same layer (inception layer). For example, the architecture can employ convolution with 1x1 filters as well as 3x3 and 5x5 filters and a max pooling layer. Demonstrates the use of 1x1 convolution filters can achieve dimensionality reduction (since no. of channels is reduced).

4. INCEPTIONV3 ARCHITECTURE

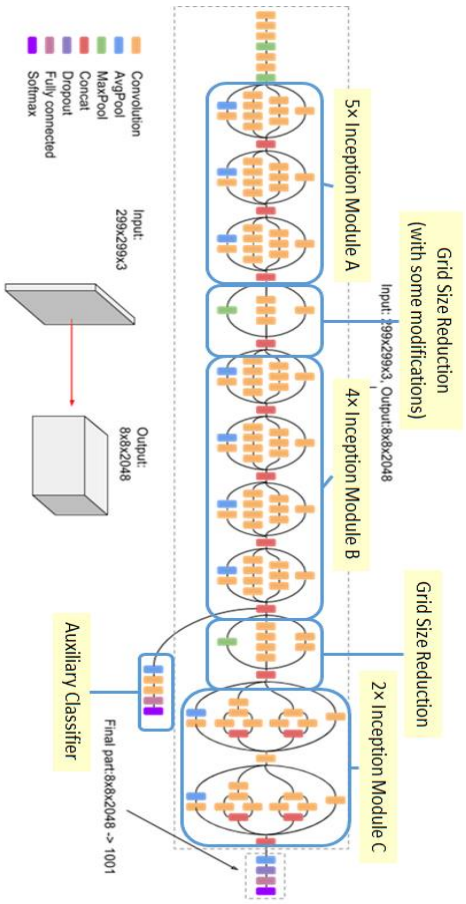

Fig. 1: Inception V3 architecture

Deep neural networks are computationally expensive. To make it cheaper this algorithm limits the number of input channels by adding an extra 1x1 convolution before the 3x3 and 5x5 convolutions. Though adding an extra operation may seem counterintuitive, 1x1 convolutions are far cheaper than 5x5 convolutions, and the reduced number of input channels also help. Therefore, any reduction in computational cost results in a reduced number of parameters. This means that with suitable factorization, we can end up with more disentangled parameters and therefore with faster training. Also, we can use the computational and memory savings to increase the filter-bank sizes of our network while maintaining our ability to train each model replica on a single computer. We have run several control experiments and using linear activation was always inferior to using rectified linear units in all stages of the factorization. We attribute this gain to the enhanced space of variations that the network can learn especially if we batch-normalize [3] the output activations. One can see similar effects when using linear activations for the dimension reduction components. Factorizing convolution with large filter size, Factorizing into smaller convolutions, Spatial Factorizing into asymmetric convolutions are key points

5. ABOUT THE DATASET

The dataset was taken from kaggle website. The challenge was to predict pneumonia by processing the image of the X-ray of their palm. The dataset is vast and consists of 5840 images. There are 624 images of X-rays for testing and 5216 images for training. The dataset contains a .csv file that contains the target value (the age) and two folders, train and test. The dataset has a considerable amount of variance, well-distributed image resolutions which makes the task easier to handle. The size of the dataset is 1GB.

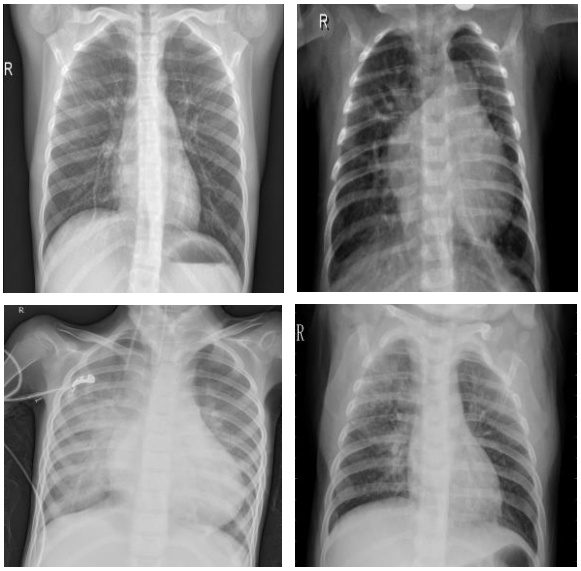

Fig. 2: Images that are included in the RSNA bone age challenge dataset

6. PROPOSED SYSTEM ARCHITECTURE

The system architecture implies the workflow of our system. This explains how the input image undergoes several phases of processing and eventually yields output. Initially, the user has to upload the image of the X-ray on the site which is then stored in the cloud for future purposes. Then, the image is fed into the pre-trained model which is constructed from the weights of the model. Once the model is built, it is then fed by the image to predict. Hence at the end of the flow, the model outputs yes or no. If there is pneumonia then it predicts yes, else it predicts no which in turn is displayed to the end user.

The architecture of the model includes Pre-trained model containing a convolutional layer and a variable no. of hidden layers.

Pre-trained models are employed throughout the system in order to sustain the pressure of computation on the system to predict the output quickly. This is beneficial because it is better to train the model once and give the output instantaneously rather than training it every time the service is requested.

7. OUR APPROACH

First off we have decided to go with the simple approach of using Imagenet as a basis and attempting to do regression directly on the age variable using low-resolution images. Thereby we have identified the factors which would help segregate the data better so that differentiating the image based on the target would be easier. The dataset contained distributed images on Pneumonia and Normal. From this point, we headed to analyse the dataset to observe any sort of patterns.

Upon doing this we then started to cut the dataset into training and testing for the real process to start. For data processing, we imported the Keras library and used ImageDataGenerator method.

7.1 UI representation

For the sake of representing the model to the end user and to make the project accessible. We decided to create a UI for the project. Since the language we used was python, there were two choices, [8] Django and Flask. We opted for Django for its robust and flexible framework design.

Django is an open source web application. It can act as a framework. The language used to write it in Python. If you

want to develop websites faster and easier than web frameworks like Django will be useful

8. RESULTS

The submission which was made by a team using Inception V3 got an accuracy around 95. An image will be given in x*y pixels. The model will be in JSON format as deep learning models are chosen only in JSON format. It is converted into python and then weights file will be given.The image will be then converted into an RGB value.cv class is used for this and imread is the method used for it. Then the image is resized and we expand the axis and then the model is predicted. If there is Pneumonia our prediction result will be 1 else 0.In website we display it is pneumonia X-ray or it is a normal X-ray according to the X-ray uploaded

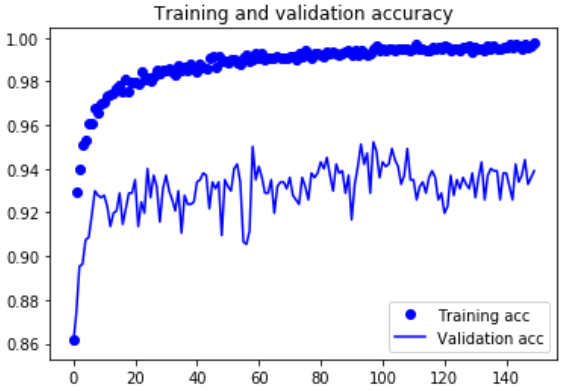

Fig. 3:.Training and validation accuracy

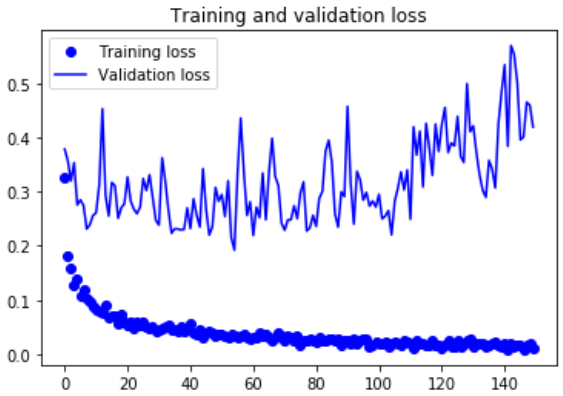

Fig. 4: Training and validation loss

9. CONCLUSION

Here we discussed several state-of-the-art models and novel approaches for detecting, classifying, and analyzing various abnormalities involving the chest. It is possible that deep learning will bring phenomenal improvement to the efficiency of radiologists' workflow and quality of radiological diagnosis worldwide.

We tried to fine-tune some of the hyperparameters, increasing the efficiency of the model by enhancing the resolution of the image. We believe what we have achieved is a step towards the path of realising the application of Machine Learning, Deep Learning in the medical field, particularly in the radiology department. However, this also provokes the thought as to how these factors can be utilized for the improvement of the medical fields.

This can be improved massively with high-resolution images, Better Data sampling, No leakage between training and testing, Better target variable, Normalisation.

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