Covid Tester

Rakesh.M[1], Sai Krishna.M[2], Rithvik. S[3], Gunasekaran.K[4]
[1, 2, 3] Dept of computer science and engineering
[4]Assistant Professor, Dept of computer science and engineering
[1, 2, 3, 4] Panimalar Engineering College, Tamil Nadu,India

Abstract- *This paper describes medical diagnosis using deep learning is producing more useful information for identification, where the problem lies is the volume of data needed. Major aim of our study is to look at low volume data sets and use them to identify the maximum accuracy. As in the current situation this is the most needed method as the outbreak of Covid-19 lead us to look into problems with sparse data, so here we use our current method to identify the presence of Covid-19. To make this possible we used transfer learning with the current proposed state of art CNN s. Datasets used are of X-ray images. We used two datasets with one containing 1427 X-ray images (224 Covid,700 Bacterial Pneumonia,504 Normal) and other containing 1437 X- ray images (224 Covid,714 Bacterial and Viral Pneumonia,504 Normal). Images are collected from various public online medical repositories. Results provided to be quite fruitful with accuracy tending to 99% with specificity of 99% and sensitivity of 98%. Results are quite satisfying but while coming to the bigger picture the accuracy may tend to reduce by a percent or two but it can be improved by improving the custom model built.*

Keywords- Transfer learning, Covid-19, X-rays

I. INTRODUCTION

COVID-19 is an acutely resolving condition, although it can be lethal, with a case fatality rate of 2%. Due to significant alveolar destruction and progressive respiratory failure, severe illness onset may result in mortality . The ability to diagnose Covid-19 early and automatically may be advantageous to countries in terms of prompt referral of patients to quarantine and fast intubation of dangerous cases in specialized facilities, and keeping an eye on the disease's spread.

Despite the fact that diagnosis has become a relatively quick process, financial concerns about diagnostic test costs affect both states and patients, particularly in countries with private health systems or limited access to systems due to prohibitive fees.

In early stage of 2020, there was a surge in the number of publicly available X-rays from both healthy and Covid-19 sufferers. This allows us to examine medical photos and look for trends that could lead to an automatic disease diagnosis.

II. METHODOLOGY

Major aim of the paper is to focus on the performance of the current state of art CNNs in medical diagnosis. State of art CNNs are the most powerful and current best CNNs available, CNNs used are VGG19, MobileNet v2, Inception, Xception, Inception ResNet v2. Datasets are extracted from different sources like GitHub , Kaggle , Kermany . Diagnosing costs are increasing day by day so this trail would lead us to cost- effective method to diagnose. Medical diagnosing using images can be best used by exploiting the best CNNs present to extract the features and patterns so that it can identify the odd one in the dataset i.e., identify the presence of virus in the person. These CNNs can be selected from different competitions held on classification of images using minimal datasets of which Google's ImageNet Large Scale Visual Recognition Challenge (ILSVRC). This study contributes in identification of the deadly virus which is now being transmitted extremely fast.

Major research has been done in the field of technology used in the identification of Pneumonia, as the virus is considered effecting the lungs in the same manner a bacterial or viral pneumonia would do , then started looking after technologies which can produce results using small datasets, they came across transfer learning and started digging deep into the concept, found that the ImageNet is good for transfer learning , further to this deep Convolution Neural Networks(CNNs) produce very high quality feature extraction and produce a great classification of images. For further detailing and selecting the CNNs to be used for feature extraction, there should be a CNN trained on heavy image databases so that the feature extraction is better and at it's best so they turned towards the competition and found the top performing CNNs and handpicked some of them by looking individually into them [9][10]. Finally, for construction of the final CNN looked at different possible models which can be used so that the obtained features are used to best of its abilities and finally fixated on a CNN with a Rectified Linear Unit (ReLu) and a totally connected layer.

Convolution Neural Networks (CNNs): CNNs are deep learning models that are generally used in visual image recognition and classification. CNNs belongs to class artificial neural networks which actually resembles the working of human brains. Generally, CNNs contains some hidden layers followed by an activation and a fully connected layer. As the purpose of the CNN changes, we the function of the hidden layers and the activation function changes, a drop out layer can be added to decrease the possibility of over fitting. Here state of art CNNs are used and a 2 layered CNN is constructed as final model.

Transfer learning: Transfer learning is a method in which learning is transferred from one model trained on similar type but different data to the other model through which results are obtained. Visually…

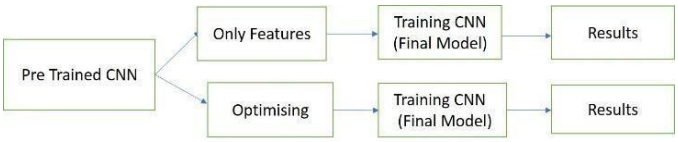

Image [1]: Flowchart of transfer learning

As the Image [1] represents, it has a pretrained model through which the features are extracted i.e., the state of art CNNs come into picture at this stage and as these are used in the competition they are already trained with millions of images i.e., the model is used in identification of patterns for some millions of images, so the images passed through comes with useful patterns and features. Now the extracted features can be used directly to pass to the final model or can be optimized to pass it to the final model, in this case the features are passed as it is without optimizing to the model.

The final CNN contains of one Relu activation layer, one Fully connected layer and Adam optimize.

III. RESULTS AND DICUSSIONS

Table 1: Metrics

CNN	Accuracy	Specificity	Sensitivity
VGG19	98.54	99.50	98.54
InceptionNet v2	98.06	99.09	98.05
Xception	96.39	97.78	96.39
Inception ResNet v2	98.34	99.09	98.33
Mobile Net v2	99.03	99.67	99.02

Table 2: Confusion Matrix for two best CNNs.

VGG19		Covid-19	Normal	Pneumonia
	Covid-19(Pre)	224	0	6
	Normal	0	504	15
	Pneumonia	0	0	693
Mobile Net v2		Covid-19	Normal	Pneumonia
	Covid-19	224	0	4
	Normal	0	504	10
	Pneumonia	0	0	700

As the metrics speaks itself but the doubt arises as the accuracies are this high and the model had been checked with different sets of data but resulting in same accuracies around 99%. As the specificity values of results are too high i.e., the tending false positives are less. Now seeing the results for obtaining the best CNN to be used in this case can be conclude as Mobile Net v2(by comparing both accuracy and specificities as in medical false positives are considered dangerous).The research can be extended to different parameters of the medical history of patient and can build a more complex model around the parameters and increase the efficiency of the model.

IV. CONCLUSION

The current research advances the possibility of a low-cost, quick, and automatic Coronavirus illness detection. It will be explored whether the retrieved characteristics extracted by the CNNs are reliable biomarkers for Covid-19 detection. Despite the fact that the right treatment is not decided merely by an X- ray image, a preliminary examination of the case is recommended. would be beneficial, not in terms of treatment type, but in terms of the prompt implementation of quarantine measures in positive samples until a more thorough evaluation and a specific treatment or follow-up procedure are carried out.

Furthermore, the advantage of automatically detecting Covid-19 from any medical imaging is that it reduces nursing and medical staff exposure to the outbreak

REFERENCES

[1] Cohen JP (2020) COVID-19 image data collection https://githu b.com/ieee8023/covid-chestxray-dataset.
[2] Kaggle. https://www.kaggle.com/andrewmvd/convid19-X-rays

[3] Kermany DS, Goldbaum M, Cai W et al (2018) Identifying medical diagnoses and treatable diseases by image-based deep learning. Cell 172:1122–1131.e9. https://doi.org/10.1016/j. cell.2018.02.010
[4] Xu Z,Shi L, Wang Y et al (2020) Pathological findings of COVID19 associated with acute respiratory distress syndrome. Lancet Respir Med. https://doi.org/10.1016/S2213- 2600(20)30076-X 2.
[5] Greenspan H, Van Ginneken B, Summers RM (2016) Guest editorial deep learning in medical imaging: overview and future promise of an exciting new technique. IEEE Trans Med Imaging 35:1153–1159
[6] Weiss K, Khoshgoftaar TM, Wang D (2016) A survey of transfer learning. J Big data 3:9
[7] Huh M Agrawal P Efros AA (2016) What makes ImageNet good for transfer learning?. arXiv preprint arXiv:160808614