Examine the application of anomaly detection from x-ray images to determine if a subject has COVID-19

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***Abstract*—**
***Index Terms*—**

I. Related Work

With COVID-19 spreading rapidly many research studies were performed to detect the virus and to help the overwhelmed healthcare system. Some of the research studies used several deep learning techniques on covid xray images for detection.[1,2,3]. Few researchers approached the study as a classification problem, where they considered a set of x ray images with different chest infections including pneumonia and covid-19 as input.[1,2,3] They used DNN models to classify covid from other diseases. From their experiments, ResNet50 produced an accuracy of 88.92% [1]and VGG-19 model produced an overall accuracy of 93.3% [3] in detecting Covid-19 while DenseNet showed a prediction accuracy of 93.26 % in detecting pneumonia[2].

In[4], the authors examined the influence of augmentation with respect to detection accuracy, dataset diversity, augmentation methodology, and network size.They have compared the performance of 17 deep learning algorithms with and without different geometric augmentations on three sets of data. Performance comparison based on accuracy and MCC[Matthews correlation coefficient] were done on 17 pretrained neural networks including AlexNet, SqueezeNet, GoogleNet, ResNet-50 and so forth. However, the authors concluded that the accuracy and MCC for models which use augmentation was lower than that of the model which did not use augmentation.

Takahiro Nakao et al., in[5] proves that an unsupervised anomaly detection method based on a DNN model using only normal chest images for training can successfully detect and localise lesions in chest radiographs. The authors have used the auto-encoding generative adversarial network (-GAN) framework [combination of a GAN and a variational autoencoder] model. The authors stated that their anomaly detection system could correctly identify diseases or anomalies such as lung mass, cardiomegaly, pleural effusion, bilateral hilar lymphadenopathy, and dextrocardia. Thier model showed 67.2% of the abnormal chest radiographs with a false-positive rate of 28.5%. Authors stated that their system detected the abnormal images with an area under the receiver operating characteristic curve (AUROC) of 0.752. The AUROCs for the abnormal labels Opacity and No Opacity/Not Normal were 0.838 and 0.704.

To fine tune the existing deep learning networks for medical imaging process from over fitting and low transfer efficiency Shuaijing Xu et.al. in [6], designed a hierarchical convolutional neural network (CNN) structure for ChestXray14 and proposed a new network called CXNet-m1. By using a sin-loss function in CXNet-m1, the author claims to achieve better accuracy rate, recall rate, F1-score, and AUC value as compared to the best performing deep network model, ResNet-50-DCNN.

In [7], the authors formulates the viral peumonia screening into an anomaly detection problem and introduces a CAAD model which is less dependent on labeled data than classification models to detect viral pneumonia. The authors prove that anomaly detection using EfficientNet-B0 model achieves higher accuracy (80.65%) as compared to the binary classfication model using ResNet(78.52%). As part of generelisation of their model, the authors applied their model on an unseen covid dataset with no further fine tuning and acheievd an AUC of 83.61% and sensitivity of 71.70%.

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