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COVID-19 DETECTION WITH CHEST X-RAY IMAGES USING TRANSFER LEARNING

SHAHNA S[1], VIJI PRASAD[2], REVATHY PRASANNAN[3]

[1,2]UG Scholars , Assistant Professor, Dept. of Computer Science and Engineering, Vidya Academy of Science and Technology Technical Campus, Kerala, India
[3]Assistant Professor, Dept. of Computer Science and Engineering, Vidya Academy of Science and Technology Technical Campus, Kerala, India

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Abstract- *Coronaviruses are menacing wide-reaching family of viruses that cause illness ranging from common fever to harsh disease. The virus was first diagnosed in December 2019 Wuhan, China. The pandemic has resulted in significant global and economic disruption. It's critical to identify the virus affected cases as early as possible. RT-PCR and Antigen Tests are currently used diagnostic tools for virus detection, but it takes more time. Recent findings obtained using the radiology imaging techniques suggests that such images contain salient information about the coronavirus. In this study a new model for the automatic detection of COVID-19 using raw chest x-ray images. Our approach employs a data set which has chest x-ray images to train the system. We use Transfer Learning and KNN methods, transfer learning to extract the features from the X-ray and KNN to classify the feature that is to stores all the available data and classify a new data point based on the similarity, this means when a new image appears then it can be easily classified into COVID-19 affected or not by using KNN algorithm.*

Key words: Covid-19, Transfer learning, KNN, Vgg16, X-Ray

1.INTRODUCTION

Covid-19 is a contagious disease brings about a lately discovered corona virus. Corona virus is one of the deadliest viruses which source normal fever to acute health problems. Most of the virus affected persons will undergo clement to moderate respiratory illness. This virus was first diagnosed on December 2019 Wuhan, China. Coronavirus is a RNA virus which roots diseases in mammals and birds. This leads some mild illness including cold, breathing difficulties etc., which may also occur due to other viruses, while some varieties can cause SARS, MERS and COVID-19.

Corona viruses are large harshly spherical particles with distinctive surface projections.A novel corona virus is a new type that has not been previously identified in human. The earliest reports of corona virus inflection in animals occurred in late 1920s.It was fought in domesticated chicken emerged in North America. Arthur Schalk and M.C Hawn in 1931 describes the newly found respiratory infection in chicken. The virus was known as infectious bronchitis virus (IBV) back then. Charles D. Hudson and Fred Robert Baudette cultured the virus for. The virus was known as infectious bronchitis virus (IBV) back then. Charles D. Hudson and Fred Robert Baudette cultured the virus for the first time in 1937. In the late 1940s, JHM that roots brain disease (murine encephalitis) and mouse hepatitis virus (MHV) that reason of hepatitis in mice were discovered. Human coronaviruses were come upon in the 1960s using different methods in the United Kingdom and the United States.

Corona viruses are spread to the environment and to other persons from the carrier. One study inspect confirmed COVID-19 patients has shown that the average incubation period is approximated to be 3 days, with an incubation period range of 0 to 24 days. There is also confirmation affirm that the incubation period can be hold out to 27 days. Coronaviruses vary crucially in risk factor. Some can do away with more than 30% of those infected, such as MERS-CoV, and some are comparably harmless, such as the common cold. Coronaviruses can cause colds with major symptoms, fever, breathing problems, loss of taste smell etc. It effect persons differently .For some may cause pneumonia, viral sepsis, kidney failure etc.

This paper proposes new method for automated detection of covid-19 using chest x-rays.

2. RELATED WORKS

Transfer learning, used in machine learning, is the reprocess of a pre-trained model on a new problem. In

transfer learning, a machine utilize the knowledge attain from a forgoing task to improve generalization about another. Neural network is a string of algorithms that venture to acknowledge fundamental relationship in a set of data through a process like human brain.

2.1Automated detection of COVID-19 cases using deep neural networks with X-ray images

The DarkNet model was used in here as a classifier for you only look once (YOLO) real time object detection system. But this requires more input images and takes more time.

2.2 Object Detection and Tracking based on Recurrent Neural Networks

Authors in this paper developed an object Detection and Tracking based on Recurrent Neural Networks. They use the temporal correlation of RNN to foresee the direction of the object at next frame. Secondly, determine region of interest (ROI) using the direction predicted by RNN. RNN is used for object detection. Less feature compatibility. Accuracy will decrease dramatically. RNN includes less feature compatibility when compared to CNN. The figuring of this neural network is slow. Training can be difficult. If use the activation functions, then it becomes very monotonous to process long sequences. It faces issues like Exploding or Gradient Vanishing.

2.3Recurrent neural network training with dark knowledge transfer.

An Image Classification Model Based on Fashion-MNIST Dataset. Author developed the model with Long-Short Term Memory (LSTM) technique to lower the probability of gradient vanishing that traditional RNN faces. Use fine tuning and cross validation to optimize the model, and also test Heuristic Pattern Reduction method and Network Pruning method. LSTM can't remember much longer sequences and again be fierce. It is not that much suit for a broad range of tasks.

2.4 The prediction of character based on recurrent neural network language model

This paper is prediction of character based on recurrent neural network language model. The paper endorses a special language model based on Recurrent Neural Network. With the help of LSTM and RNN, program can forecast the next character after a definite character. LSTM do not have long memory from a statistical perspective. In case of image classification cannot be modelled easily with the standard LSTM.

3. PROPOSED SYSTEM

Our system is one of the better options for detecting coronaviruses, fully automated with an end-to-end structure without the use of manual feature extraction. We can determine if the person is COVID-19 affected or not with the characteristics of lungs X-Ray. Some of the features are air space consolidation, traction bronchiectasis, bronchi vascular thickening etc. COVID-19 X-Ray image database is persistently updated with images shared by researchers from different regions.

First step is data set preparation. Then VGG 16 algorithm applied to extract features, it is a convolutional neural network with 16 layers. Each layer filters the original image. Classification task to determine the labels of the input chest X-ray images as COVID-19 affected or not. Extracted features will be classified with KNN classifiers. Confusion matrices make use of visualization of performance of algorithms; it yields the value of accuracy, precision, recall etc. Finally the prediction process will execute. That is to confer the path of input data. The accurate result will be forecast with respect to the trained process.

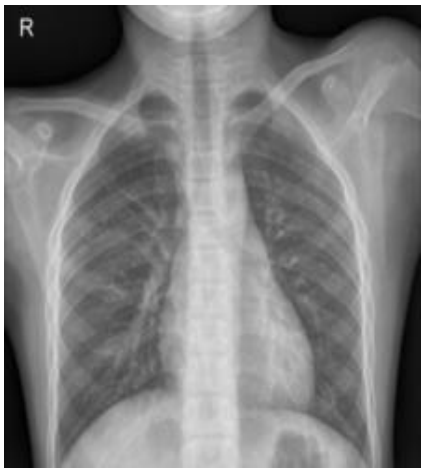

Figure 1: Normal

Figure 2: Covid-19

4. DATA FLOW DIAGRAM

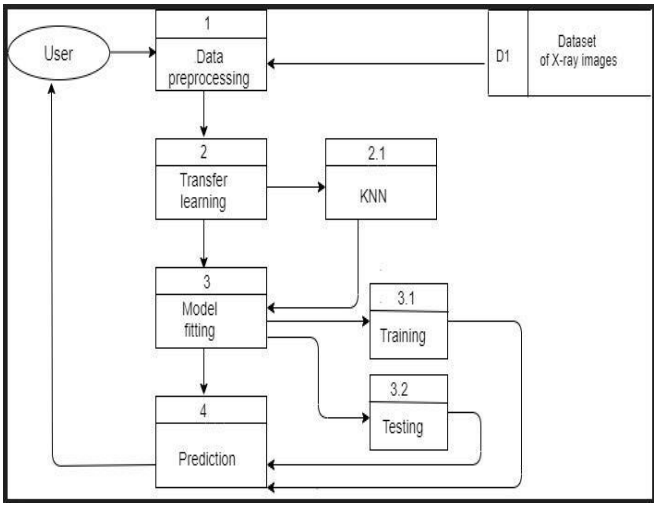

Figure 3: Data Flow Diagram

4.1 DATA PREPROCESSING

This segment mentioned the technique of preparing the raw data to make these suitable for building and training machine learning models. We used 3 repositories for data set preparation. 2 sets from GitHub and another from kaggle. 2 directories make for COVID19 and normal data set. Data set image will be classified to normal and COVID-19.

4.2 TRANSFER LEARNING

Our system proposed to detect COVID-19 affect or not with the use of X-Ray imagesof lungs. Normally transfer learning techniques are used to solve the problems. Afterthat the knowledge gained from solving the problem will be stored and used to solve theproblem related to this. In our system we used VGG 16 technique, extracting the featuresin each layer. Convolutional neural networks are used for visual imagery. Pooling layerswill reduce the size of the input image and also speed up the computation. In our system,the input X-Ray image of the lungs will pass through the 16 layers of VGG 16 and performabove functions. KNN is an algorithm used here. This technique is to use data and classify new data points based on similarity, COVID-19 and normal

4.3 MODEL FITTING

Testing and training of data will be performed in this segment. 80% of data will be move through training and the remaining of them will move through the testing segment. Here used confusion matrix for re-evaluating performance of classification model. The matrix contrasts the actual target values with those predicted by the machine learning model. This shows us how well our classification model is performing and what kinds of errors it is making.

4.4 PREDICTION

Here, predict that the person is COVID-19 affected or not by comparing the features of the input data with the pre-trained data set. The predicted answer will be put as output.

```
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications.vgg16 import preprocess_input
import numpy as np

img_path='/content/drive/MyDrive/data/covid test.jpg'
img=image.load_img(img_path,target_size=(224,224))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
x=preprocess_input(x)
features=loaded_model_vgg.predict(x)
features=features.reshape([1,4096])
pred=loaded_model_knn.predict(features)
print('The predition is',pred[0])
```

```
The predition is covid
```

Figure 4: Output 1

```
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications.vgg16 import preprocess_input
import numpy as np

img_path='/content/drive/MyDrive/data/normal lungs.jpg'
img=image.load_img(img_path,target_size=(224,224))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
x=preprocess_input(x)
features=loaded_model_vgg.predict(x)
features=features.reshape([1,4096])
pred=loaded_model_knn.predict(features)
print('The predition is',pred[0])

The predition is normal
```

Figure 5: Output 2

Here, proposes new method for automated detection of covid-19using chest x-rays. In the existing DarkCovidNet approach, have 19 convolutional layers and requires more number of input images. This gives an accuracy of 75% and need more training time. A COVID-19 X-ray image database is persistently updated with imagesshared by researchers from distinctregions. A classic CNN structure has a convolution layer that take out features from the input. Categorization task to determine the labels of the input chest X-ray images asCOVID-19 affected or not. We use transfer learning VGG16. We have four folders and first one is for Data set preparation. 2directories made for covid and normal. Data set is picking out from kaggle and GitHub platforms. Two set from github and one from kaggle. Data Set imported from GitHub contains normal, pneumonia and covid data. Covid image data set will be saved from github platform. Then save covid 19 and normal images from dataset of kaggle. At last content copied to drive.

In second folder we plot VGG16 model. List class and features. Finally print class and corresponding features. VGG16 is a convolutional neural network model. The input to cov1 layer is a 224 x 224 fixed size. The image is passed through a stack of convolutional (conv.) layers, where the filters were used with a very small amenable field: 3×3. In one of the arrangements, it also makes use of 1×1 convolution filters, which can be seen as a linear transformation of the input channels (followed by non-linearity). The convolution stride is confirmed to 1 pixel; the spatial padding of conv. layer input is such that the spatial resolution is preserved after convolution, i.e. the padding is 1-pixel for 3×3 conv. layers. Spatial pooling is carried out by five maxpooling layers, which follow some of the conv. layers (not all the conv. layers are followed bymax-pooling). Max-pooling is performed over a 2×2 pixel window, with stride 2.In third folder load features and class from the second folder. Then we perform test and train operation. Then import KNN. Extracted features will be classified with KNN. KNN is non-parametric and lazy learner algorithm. In k-NN classification, output is a class membership. An object is classified by a multitude vote of its neighbours, with the object being allot to the class almost all regular among its k nearest neighbours Distance function is used. Then import classification report and confusion matrix. Finally we predict given input x-ray image is covid affected or not.

5. CONCLUSION

The world is hopefully looking forward to an efficient method to prevent Coronavirus. This virus spread all over the world in a very quick time. If the virus identifies rapidly, then we can prevent more people from infection. Our paper proposes a method for detecting COVID-19 viruses through transfer learning. It aims to train the system using a constantly updated data set. CNN extracts the features from input data and it is classified by using KNN. Auxiliary diagnosing of corona can be done in less time by using this method. Transfer learning helps to reduce complexity, because it requires less input images and takes comparatively smaller training time.

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BIOGRAPHIES

Shahna S
Student at Vast-tc, kilimanoor
B. Tech Computer Science and Engineering

Viji Prasad
Student at Vast-tc, kilimanoor
B. Tech Computer Science and Engineering

Revathy Prasannan
Assistant Professor at Vast-tc, Kilimanoor, Computer Science and Engineering