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COVID-19 DETECTION USING CNN ALGORITHM

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Abstract - *In this paper we approach a new method of Deep learning Algorithm Convolutional Neural Network for the prediction of Covid - 19 in patients. Safety and human cost is most valuable thing. Risking of human lives is not acceptable. So, it is a need to find a outcome for reducing the mortality of lives due to human mistakes. The Feature Extraction gives us a broad view about the image which is captured and help us to process the image for preprocessing. The given system has overcomes the errors and has higher efficiency than the current image processing Methods.By the usage of multiple hidden layers such as conv2D, maxpoolD , Flatten and Dense the infection is detected and it can be viewed by the user in the shell of python.By the help of Classified image, the infectedperson is identified before gets contact with other people.*

Key Words: **CNN, Conv2D, , *maxpoolD* , *Flatten* ,Dense**

1. INTRODUCTION

Coronavirus (COVID-19) is getting international attention due it considered as a life-threatened epidemic disease that hard to control the spread of infection around the world. Deep learning (DL) is one of intelligent technique that able to automatically predict the event with reasonable accuracy based on the experience and learning process. In the meantime, a rapid number of DL models have been proposed for predicate the cases of COVID-19. This proposed system an intelligent methodology is to help the health organisations in the selection COVID-19 diagnosis system. There are multiple criteria requires to evaluate and some of the criteria are conflicting with each other.

Deep Learning (DL) methods have a high capability to detect the COVID-19 with a reasonable accuracy prediction using the chest radiography images of the infected patients with COVID-19. Unfortunately, to the best of the authors' knowledge, these DL approaches can be non-open sourced and not publicity available which prevent the research to access and investigate them for further research. Selection of an efficient automated tool to produces reliable solutions lays on how is it widely used [3]. AI methods able to produces rapid reliable solutions of COVID-19 with high diagnostic accuracy. Nowadays, many hospitals and medical research centres use a computer-aided system based on AI to automate the COVID-19 diagnosis instead of analysing the data manually. With a big number of the existing automated AI methods, selecting an appropriate method that produces an efficient, fast solution with errorfree is a critical task [4]. As there is no ML classifiers for COVID-19 diagnose is superior [5, 60]. This is put the medical managers in a big challenge to find and evaluate different ML classifiers for COVID-19 diagnose in order to select the best method. It becomes more difficult when various DL classifiers and evaluation methods with different criteria are involved. Moreover, there are various DL classifiers to detect COVID-19.

2. SYSTEM DESIGN

2.1. EXISTING SYSTEM

They have used to kmeans segmentation and KNN classifier to detect the lung images. The virus (COVID-19) has spread widely throughout the world and has led to the examination of large numbers of suspected cases using standard COVID-19 tests and has become pandemic. Everyday life, public health and the global economy have been destroyed. The pathogenic laboratory tests such as Polymerase chain reaction (PCR) take a long time with false negative results and are considered the gold standard for diagnosis. Therefore, there was an urgent need for rapid and accurate diagnostic methods to detect COVID-19 cases as soon as possible to prevent the spread of this epidemic and combat it. Applying advanced artificial intelligence techniques along with radiography may be helpful in detecting this disease. A dataset containing chest x-ray images of normal people, people with pneumonia such as SARS, streptococcus and pneumococcus and other patients with COVID-19 were collected. Histogram of oriented gradients (HOG) is used for image features extraction. The images are then classified using Support Vector Machines (SVM), random forests and K- nearest neighbors (KNN). Kmeans segmentation and KNN classifier based models need lager data sets to train the data and this method also does not sometimes classify the data, so there is a higher risk of matching with the unrelated data which in turn will affect the accuracy of the lung image detection method. They are not automated, and feature prediction is not possible.

2.2 PROPOSED SYSTEM

In this paper, convolutional neural networks (CNNs) with novel architecture is proposed to recognize and detect the covid-19. The proposed architecture consists of two sub-networks connected by a feature aggregate operator. The first sub-network is designed to extract high-level features from images of the fundus. These features from different images in an examination are fused by the aggregate

operator, then used as the input for the second sub network to predict its class.The application gain popularity not only by the way it looks but also the way it feels and our project makes the most use of it, since it is based on Convolutional Deep Learning Neural Networks.The different algorithms are available for detection and matching of image, out of them CNN algorithm is used for this proposed system. It gives the high accuracy and more efficient than the existing system.

2.3. CNN MODEL

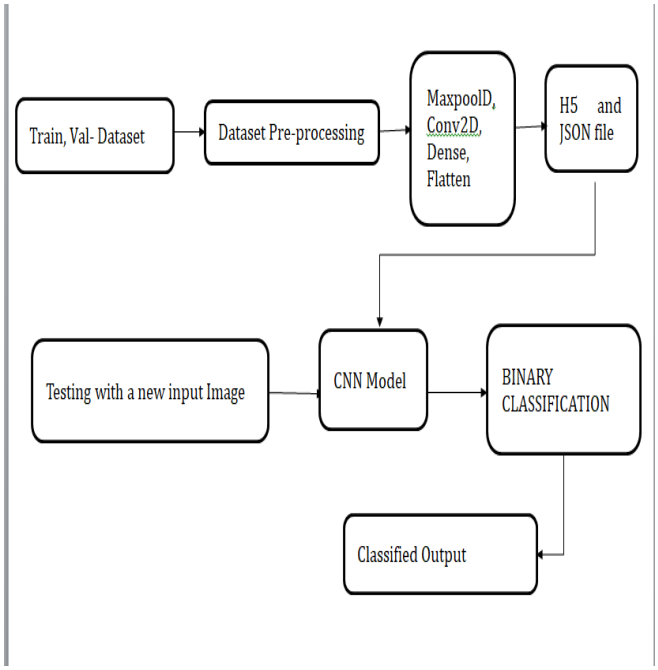

Fig -1: CNN MODEL

3. METHODS

3.1. CNN ALGORITHM

A Convolutional Neural Network is a class of deep learning, feed-forward artificial neural networks, and most commonly useful for several analyses. They visualize metaphors and Numerical data. It can use a difference of multilayer perceptron designed to need minimal pre-processing. It is very similar to normal Neural Networks. They are made up of neurons that have learned weights and biases. Each neuron receives several inputs, performs a dot product and optionally follows it with a non-linearity. The complete network at rest articulates to achieve the function from the raw input data on one end to achieve the class at the other end. It can make a clear hypothesis that the inputs allow us to encode certain possessions into the CNN process and then, make the forward function more efficient to implement. They very much reduce the number of parameters in the network. Neural Networks consider an input and transform it through a series of hidden layers. Each hidden layer is made up of a set of neurons, where each neuron is fully connected to all neurons in the previous layer. Neurons in a single layer function in a completely separate manner and do not share any relations. The very last fully-connected layer is called the output layer and it represents the class achieved.

4. Layers in CNN

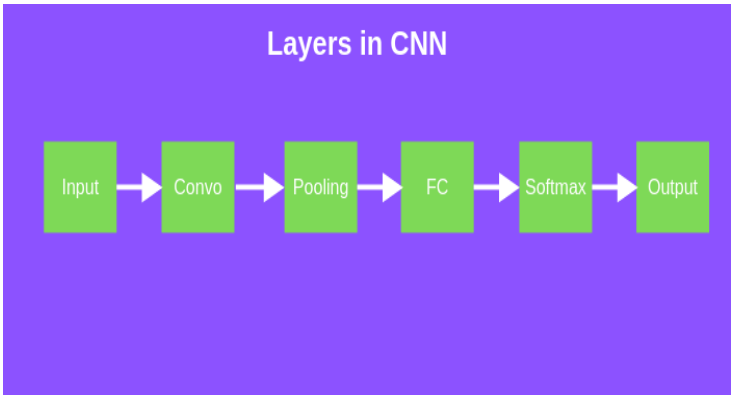

Fig -2: CNN LAYERS

Input Layer

Input layer in CNN should contain image data. Image data is represented by three dimensional matrix as we saw earlier. You need to reshape it into a single column. Suppose you have image of dimension 28 x 28 =784, you need to convert it into 784 x 1 before feeding into input. If you have "m" training examples then dimension of input will be (784, m).

Convo Layer

Convo layer is sometimes called feature extractor layer because features of the image are get extracted within this layer. First of all, a part of image is connected to Convo layer to perform convolution operation as we saw earlier and calculating the dot product between receptive field (it is a local region of the input image that has the same size as that of filter) and the filter. Result of the operation is single integer of the output volume. Then we slide the filter over the next receptive field of the same input image by a Stride and do the same operation again. We will repeat the same process again and again until we go through the whole image. The output will be the input for the next layer. Convo layer also contains ReLU activation to make all negative value to zero.

Pooling Layer

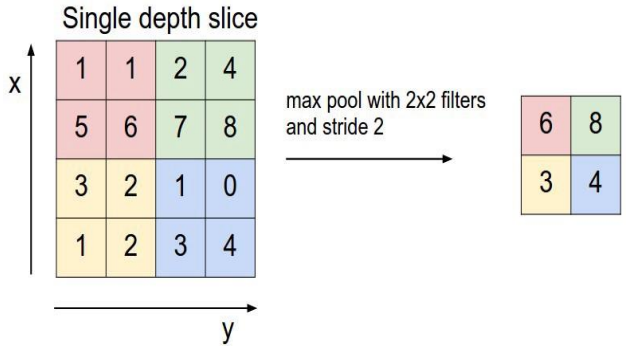

Fig -3: POOLING LAYERS

Pooling layer is used to reduce the spatial volume of input image after convolution. It is used between two convolution layer. If we apply FC after Convo layer without applying pooling or max pooling, then it will be computationally expensive and we don't want it. So, the max pooling is only way to reduce the spatial volume of input image. In the above example, we have applied max pooling in single depth slice with Stride of 2. You can observe the 4 x 4 dimension input is reduce to 2 x 2 dimension.

There is no parameter in pooling layer but it has two hyperparameters — Filter(F) and Stride(S).

In general, if we have input dimension W1 x H1 x D1, then

W2 = (W1−F)/S+1

H2 = (H1−F)/S+1

D2 = D1

Where W2, H2 and D2 are the width, height and depth of output.

Fully Connected Layer (FC)

Fully connected layer involves weights, biases, and neurons. It connects neurons in one layer to neurons in another layer. It is used to classify images between different categories by training.

Output Layer

Output layer contains the label which is in the form of one-hot encoded.

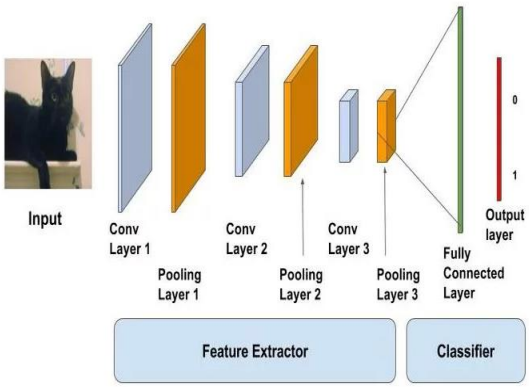

Fig -4: OUTPUT LAYER

5. IMPLEMENTATION:

5.1. DATASET COLLECTION

A total of 4000 above chest X-Ray images were collected from Kaggle website. Here dataset images nearly 2000 covid -19 Affected images and 2000 Normal images .the dataset format is image type of x –Ray(lung image) .

5.2. TRAINING THE DATA

The collected dataset is pre-processed and then it was given as an input the CNN Algorithm

TRAINING CODE:

```
from keras.models import Sequential

from keras.layers import Conv2D

from keras.layers import MaxPooling2D

from keras.layers import Flatten

from keras.layers import Dense

from keras.preprocessing.image import ImageDataGenerator

from keras.layers import Dropout

model = Sequential()

model.add(Conv2D(32, (3, 3), input_shape = (512,512, 3), activation = 'relu'))

model.add(MaxPooling2D(pool_size = (2, 2)))

model.add(Conv2D(64, (3, 3), activation = 'relu'))

model.add(MaxPooling2D(pool_size = (2, 2)))
```

```
model.add(Conv2D(128, (3, 3), activation = 'relu'))
model.add(MaxPooling2D(pool_size = (2, 2)))
model.add(Conv2D(256, (3, 3), activation = 'relu'))
model.add(MaxPooling2D(pool_size = (2, 2)))
model.add(Conv2D(512, (3, 3), activation = 'relu'))
model.add(MaxPooling2D(pool_size = (2, 2)))
model.add(Flatten())
model.add(Dense(units = 512, activation = 'relu'))
model.add(Dense(units = 1, activation = 'sigmoid'))
model.compile(optimizer = 'adam', loss = 'binary_crossentropy', metrics = ['accuracy'])
train_datagen = ImageDataGenerator(rescale = 1./255, shear_range = 0.2,zoom_range = 0.2,horizontal_flip = True)
val_datagen = ImageDataGenerator(rescale = 1./255)
training_set = train_datagen.flow_from_directory('data/train',
target_size = (512,512), batch_size = 12,class_mode = 'binary')
val_set = val_datagen.flow_from_directory('data/valid
target_size = (512,512),batch_size = 12, class_mode = 'binary')
model.fit_generator(training_set,
steps_per_epoch = 150,
epochs = 120,
validation_data = val_set,
validation_steps = 4)
model_json = model.to_json()
with open("model.json", "w") as json_file:
json_file.write(model_json)
model.save_weights("model.h5")
print("Saved model to disk")
```

5.3. TESTING THE DATA:

Once the Collected data is build as a model, the model's accuracy can be determined with the help of trained model. In which all the data are taken as an input.

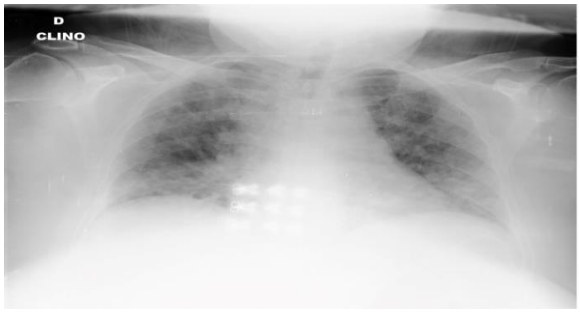

Fig5: Affected lung image

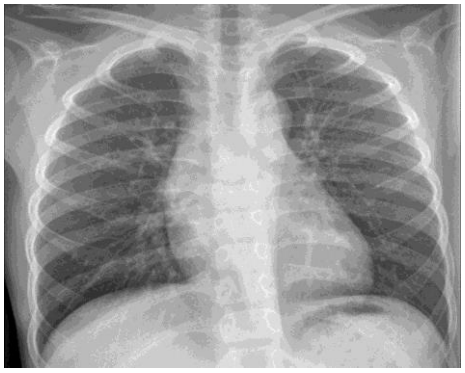

Fig 6: Normal lung image

5.4: TEST CODE :

```
from keras.models import model_from_json
import numpy as np
from keras.preprocessing import image
json_file = open('model.json', 'r')
loaded_model_json = json_file.read()
json_file.close()
model = model_from_json(loaded_model_json)
model.load_weights("model.h5")
print("Loaded model from disk")
def classify(img_file):
 img_name = img_file
 test_image = image.load_img(img_name, target_size = (512,512))
 test_image = image.img_to_array(test_image)
 test_image = np.expand_dims(test_image, axis=0)
 result = model.predict(test_image)
```

```
if result[0][0] == 0:

prediction = 'AFFECTED'

else:

prediction = 'NORMAL'

print(prediction,img_name)

import os

path = 'data/test'

files = []

# r=root, d=directories, f = files

for r, d, f in os.walk(path):

for file in f:

if '.jpg' in file:

files.append(os.path.join(r, file))

for f in files:

classify(f)

print('\n')
```

6. ADVANTAGES AND APPLICATION

1. To serve the patient with best possible quality and maximum facilities with less price.
2. Honor suggestions from doctors.
3. Process complete backup services.
4. Ensures safety of user data.
5. Ensures user satisfaction.

APPILCATION:

1. Fast processing and immediate results with high security.
2. Minimizing human effort and cost efficient databases.
3. Navigation through the site is easy.

7. Results and Discussion

- When the prototype was put into working, it worked as expected. The image is classified as based on Binary Classification.
- Based on the input Dataset the developed model works and classifies input.
- Here the infected person is identified by applying multiple Hidden Layers.
- By the help of Classified image the infected person is identified and separated from the other people.
- The manual methods are replaced by Neural network and Cost is reduced

7.1. Output of the project

A.Training the dataset

The given bellow picture(fig 7) is cnn model implementation. This CNN model using dataset is can training. CNN model using **Conv2D, *maxpoolD* , *Flatten* ,Dense** layers we are implanting.

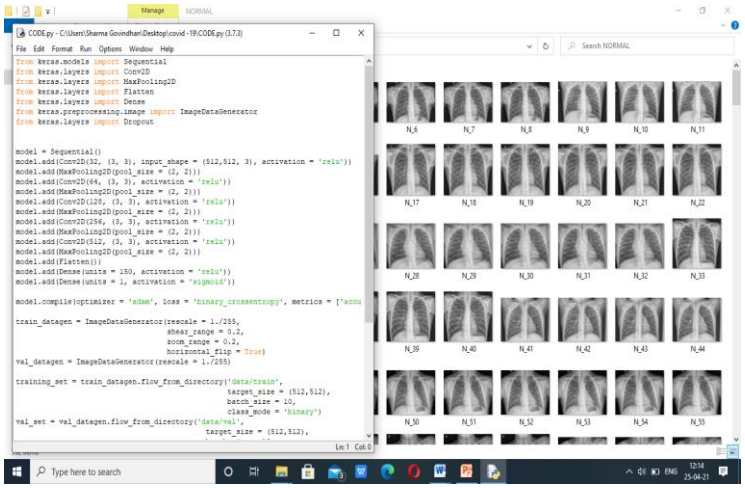

Fig 7: cnn model implementation

B.TESTING THE DATA

Once the Collected data is build as a model, the model's accuracy can be determined with the help of trained model. In which all the data are taken as an input.

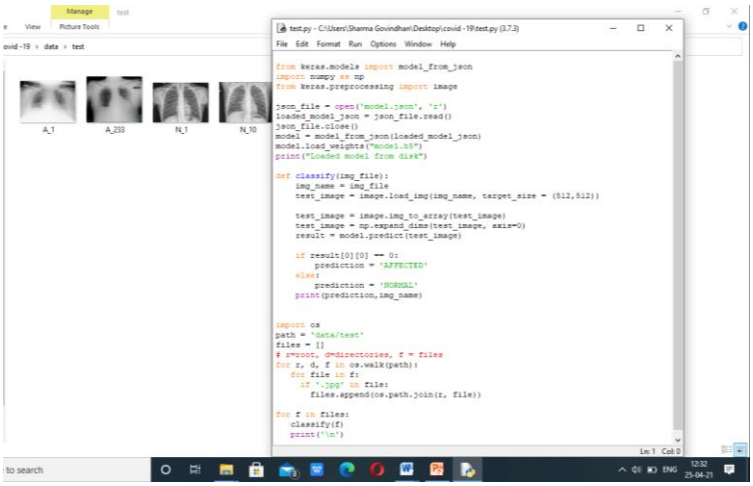

Fig 8. TESTING THE DATA

C.Output:

- Hence, the project presented will identifies the Infected person.
- It also allows reduced contact with the humans.
- This COVID – 19 detection system can be further developed into an hardware device. So that the identification and classification is done automatically.
- AI – Bot can also be developed to do this work automatically

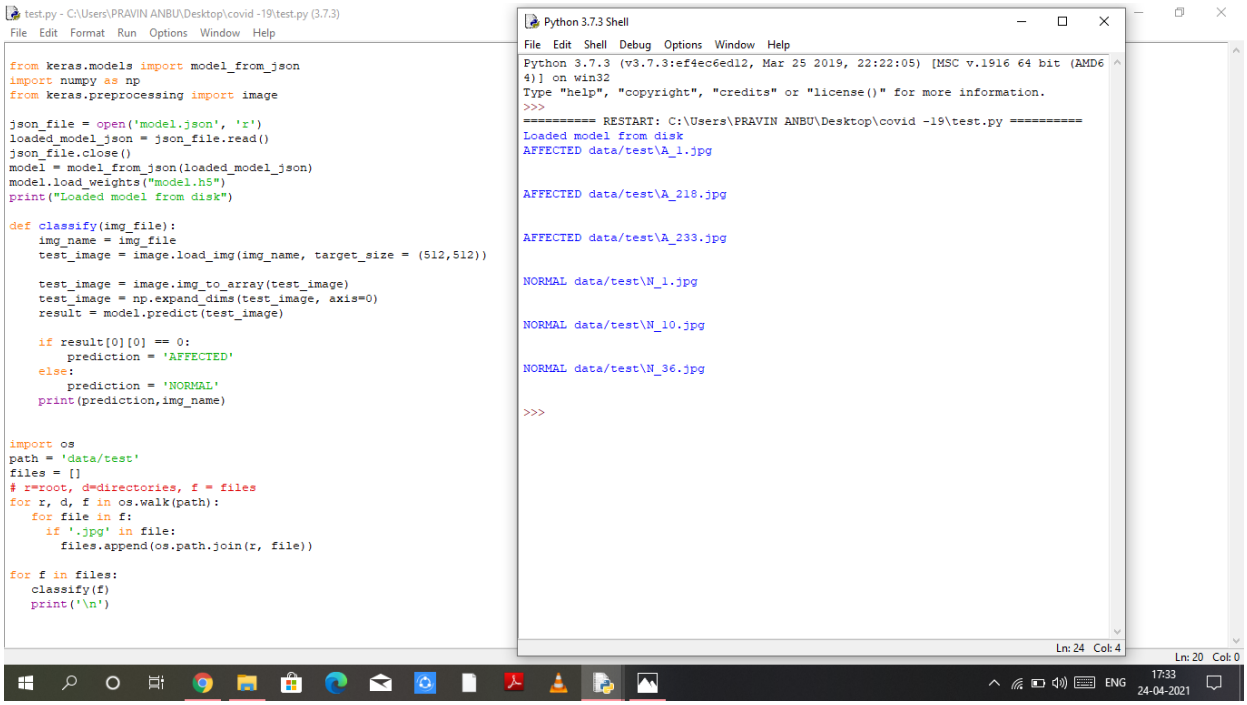

Fig 9 : OUTPUT OF COVID AFFECTED AND NORMAL PERSON

8. CONCLUSION

It is proven that the accuracy of the model has reached good level, if it is deployed in the real-time scenario then it will help many people in diagnosing the affected lung without wasting the money on check-up. If the cancer on bone is confirmed by the model based on the dataset the developed model works and classifies input. It can be the best way of prediction of covid-19 for people to save money. As we know that the data Plays a crucial role in every deep learning model, if the data is more specific and accurate about the symptoms of the covid-19 then that can help in reaching greater accuracy with better results in real-time applications.

The proposed system overcomes the existing contact methods and replaces it by applying Multiple Neural or hidden Layers. The Feature Extraction gives us a broad view about the X – Ray image which is given and help us to process the image for preprocessing.

Here the covid-19 is identified based on lung images by applying multiple hidden layers. By the help of classified the lung image is identified and monitoring continuously. The manual methods are replaced by neural network and cost is reduced. In this work, a classification technique named Convolution Neural Networks has Experimental results have shown that CNN is more efficient. In the future it could be planned to make analysis on dataset by considering more features and more clusters and to use deep learning techniques.

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