Artificial Intelligence And Covid-19: Deep Learning Approaches For Diagnosis And Treatment

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Abstract-TheCOVID-19 eruption has made the world to stop and has claimed the lives of many people. Because of COVID-19's unfold in 212 countries with rising number of infected peoples and death toll reaching105.4 million cases, the covid-19 still remains a threat to the peoples worldwide. This paper provides a solution to fight against the virus by using AI. Deep Learning (DL) strategies are used to succeed in this goal, which includes CNN(Convolutional Neural Network) and Long /Short Term Memory (LSTM). The recent medical reports connected to that topic were investigated to select the inputs of the network that would help in reaching a dependable ANN-based tool for problems related to COVID-19.

Keywords- Deep Learning, Artificial Intelligence, CNN, LSTM, COVID-19, Diagnosis, Treatment.

I. INTRODUCTION

To the ending of 2019 a disease namedas COVID-19 appeared. It is an illness that has the severity range of mild to severe.It can also lead to pneumonia, organ failure and even death. With the increment inthe count of the positive cases and patients who experience severe respiratory failure and cardiovascular complications[8]. Another problem that scientists have to face is big data. It is a challenge for them in the battle against the disease. AI can save time in a situation when even one hour of time can save the lives ofpeople.

AI also improves the accuracy in prediction and observation of the disease. The study of output enables healthcare policy maker stop repair their nation against the outburst of the illness and make smart decisions. One sector that can take advantage of AI's practical input is image- based medical diagnosis through which speedy and precise diagnosis of the disease can take place and save lives. Artificial intelligence (AI) may be the perfect solution for this challenge. According to recent research AI algorithm can be more efficient than the human expert in diagnosis usingmedical image[1].

II. AIMS AND OBJECTIVE

a) Aim

The aim of this project is to focus on deep learning approach fordiagnosis and treatment of Covid-19 disease. It is an AI based platform. Accurate detection of this disease can be done using advancedartificial intelligence (AI) techniques. With the help ofmedical information of patient, system can predict whether the person is suffering from disease.

b) Objective

The main motive of this work is to build aimplementation derived from Deep Learning that allows, to determine in a precise way the appearance of signs or anomalies capable of representing a case of covid-19. Providing a complete diagnostic tool for case of covid-19[5][7].

III. LITERATURE SURVEY

Paper 1:An Efficient Deep Learning Approach to Pneumonia Classification in Healthcare":

This is a report that detects and classifies pneumonia from lung X-ray images. The algorithm starts by transforming lung X-ray images into sizes smaller than the original. The next step involves the identification and classification of images by the convolutional neural network framework, which extracts features from the images and classifies them. Due to the effectiveness of the trained CNN model for identifying pneumonia from chest X-ray images, the validation accuracy of this model is significantly higher when compared with other approaches[2].

Paper 2:Automatic COVID-19 Detection from X-Ray images using Ensemble Learning with Convolutional Neural Network:

This system uses a Deep Convolutional Neural Network based solution which can detect the Covid-19 positive

patients using chest X-Ray images. GUI application is developed for public use. This application can be used on any computer by any medical personnel to detect COVID positive patients using Chest X-Ray images within a very few seconds. This new proposed ensembling method is expected to make the prediction more robust. This system comprises of three pre-trained CNN models– Dense Net, Resnet and Inception. The biggest advantage of Dense Convolution Network or Dense Net is that it requires comparatively fewer parameters than similar types of traditional CNN[3].

Paper 3:A DEEP LEARNING APPROACH FOR CANCER DETECTION AND RELEVANT GENE IDENTIFICATION:

This study applies a deep learning approach that extracts the important gene expression relationships using SDAE. After training the SDAE, a layer is selected that has both low- dimension and low validation error. An SDAE with four layers of dimensions of 15,000, 10,000, 2,000, and 500 was selected. Consequently the selected layers were used as input features to the classification algorithms. The approach was evaluated for feature selection by feeding the SDAE- encoded features to a shallow artificial neural network (ANN) and an SVM model. Furthermore, a similar approach with PCA and KPCA was applied as a comparison. Lastly, the SDAE weight from each layer to extract genes with strongly propagated influence on the reduced-dimension SDAE-encoding was used.

V. COMPARTIVE STUDY

Sr. No	Paper Name	Author/Publication	Technology	Advantages	Disadvantages
1.	An efficient Deep Learning approach to Pneumonia classification inhealthcare.	Okeke Stephen, Mangal Sain, Uchenna Joseph, Maduh and Do-Un Jeong.	CNN.	Does not rely heavily on transfer learning approach.	Does not distinguish X-Ray images that contain lung cancer and pneumonia.
2.	Automatic COVID-19 detection from X-Ray images using ensemble learning with convolutional neural network.	Amit Kumar Das, SayanTaniGhosh, Samiruddin Thunder, Rohit Duta, SachinAgarwal and AmlanChakrabarti.	Pre-trained CNN models- Dense Net, ResNet and inception.	It is very fast and has the accuracy of 95%.	It only considers the chest X-Ray (CXR) and does not consider otherinputs.
3.	A Deep Learning approach for cancer detection and relevant gene identification.	Padideh Danaee, Reza Ghaeini,David A. Hendrix.	ANN, SVM.	It will always give an opinion without the need of human intervention.	Large data sets are required, which may not be available for cancer tissues.

Table 1: Comparative Analysis

VI. PROBLEM STATEMENT

- System can handle only structured data and cannot handle unstructured data.
- Human intervention is required.
- Large data sets are required, which may not beavailable.
- Comparative less effective in feature detection.

VII. PROPOSED SYSTEM

This system concentrates on the introducing some applicable AI-based techniques that can support current standard methods of coping with COVID-19 in health care systems globally[1]. Hence in the present work deep learning strategy is used. It aims at finding the best solutions for COVID-19 related problems that are faced by health care systems. In order to increase the effectiveness of the existing techniques and strategies, the formation of this system is

based on most recent updates on COVID-19 as well as AI-related published medical updates. Therefore, this section is aboutideas that can accelerate and enhance ANN- based techniques to get better diagnosis. In this system the User can register first. Once the user registers then admin can activate the user. Once admin activated the user then user can login into the system. First user can get the current covid status[4]. How may recovered on the day. The user will invoke the algorithms by making sub process call. The user will train the model by infected x- ray images and normal images. Once the model is trained then it is ready for testing. The admin can set the training and testing data for the project dynamically to the code. We used ANN model to predict the given CT scan images weather covid

patient or not. Clinical process is an effort to compile a repository of the clinical characteristics of patients who have taken a COVID-19 test. To protect the patient's privacy, their reported age differs from their actual age by a reasonable amount[10]. The data includes clinical reports (vitals, comorbidities, epidemiologic factors, patient-reported symptoms, clinician-assessed symptoms), as well as laboratory and radiological findings as well as includes both positive and negative test results for symptomatic as well as asymptomatic patients. CNN (Convolutional Neural Network) model is used for detection of the disease. The dataset of 764 CT Scan images of which 349 contents images if pneumonia infected patients and the rest are of normal patientsis used by the model.

VIII. ALGORITHM

Step.1: Start

Step.2: User registration

Step.3: Once the user register then admin can activate the user.

Step.4: Activated user can login into the system.

Step.5: Input data.

print("**[INFO] loading images...**") imagePaths□list(paths.list_images(args["**d ataset**"]))

data□[] labels□[]

Step.6: Partition the data into training and testing splits using 80% of

the data is used for training and the remaining 20% is used for testing. (trainX, testX, trainY, testY) = train_test_split(data, labels, test_size=0.20, stratify=labels, random_state=42)

Step.7: Construct head model that is placed on top of base model.

headModel□ Dense(64, activation="**relu**")(headModel) headModel□Dense(2, activation="**softmax**")(headModel)

Step.8: Place the head FC model on top of the base model.

model□ Model(inputs=baseModel.input, outputs=headModel)

Step.9: Train the head of the network print("**[INFO] training head...**")

H □model.fit_generator(trainAug.flow(trainX, trainY, batch_size=BS), steps_per_epoch□len(trainX) // BS, validation_data□(testX, testY), validation_steps□len(testX) // BS, epochs□EPOCHS)

Step.10: Make predictions on the testing set. print("**[INFO] evaluating network...**") predIdxs□model.predict(testX, batch_size=BS)

Step.11: For each image in the testing set we need to find the index of the

label with corresponding largest predicted probability. predIdxs□np.argmax(predIdxs, axis=1) **Step.12:** Compute the confusion matrix and use it to derive the raw accuracy, sensitivity andspecificity.

cm

confusion_matrix(testY.argmax(axis=1), predIdxs)

total□sum(sum(cm))

acc□ (cm[0, 0] + cm[1, 1]) / total sensitivity □ cm[0, 0] / (cm[0, 0] + cm[0, 1])

specificity□ cm[1, 1] / (cm[1, 0] + cm[1, 1])

Step 13: Severity check score

If score<0: **return 'Asymptomatic' if** score <1: **return 'Extremely Mild' if** score <2: **return'Mild'**

ifscore <3: **return 'Moderate' else**: **return 'Severe'**

Algorithm build covid model Step.1: model□Sequential() Set the

training and testing data for the project. Checking the performance of multiple model architectures by optimizing and changing values of parameters.model.save('**covid19_pneumonia_detectio n_cnn.model**')

Step.2: Normalize the dataset scaler□MinMaxScaler(feature_range=(0, 1))dataset □scaler.fit_transform(dataset) **Step.3:**Split into train and test sets train_size□int(len(dataset) * 0.67) test_size□len(dataset) - train_size train, test

□ dataset[0:train_size, :], dataset[train_size:len(dataset), :]

Step.4: Create and fit the LSTM network model □Sequential() model.add(LSTM(4, input_shape=(1, look_back)))model.add(Dense(1))

model.compile(loss='**mean_squared_error** ', optimizer='**adam**')

Step.5: Calculate root mean squared error trainScore□math.sqrt(mean_squared_error(trainY[0], trainPredict[:, 0]))

print('**Train Score: %.2f RMSE**' % (trainScore)) testScore□math.sqrt(mean_squared_error(t estY[0], testPredict[:, 0]))

print('**Test Score: %.2f RMSE**' % (testScore))

IX. MATHEMATICAL MODEL

1. Compute the confusion matrix andand use it to derive theraw

accuracy, sensitivity, and specificity.

cm□confusion_matrix(testY.argmax(axis=1

), predIdxs)

total□sum(sum(cm))

acc□ (cm[0, 0] + cm[1, 1]) / total sensitivity □ cm[0, 0] / (cm[0, 0] + cm[0, 1])

specificity□ cm[1, 1] / (cm[1, 0] + cm[1, 1])

2. Calculate root mean squared error trainScore□math.sqrt(mean_squared_error(trainY[0], trainPredict[:, 0])) print('**Train Score: %.2f RMSE**' % (trainScore)) testScore□math.sqrt(mean_squared_error(testY[0], testPredict[:, 0])) print('**TestScore:**

%.2f RMSE' % (testScore))

3. Computes the test-positive ratio. if(p != -1.0) **and** (t != -1.0) **and** (t != 0): **return** round(p / t, 3)

else:**return**-1

if(p != -1.0) **and** (t != -1.0) **and** (t != 0):

returnround(p / t, 3)

else:**return**-1

X. SYSTEM ARCHITECTURE

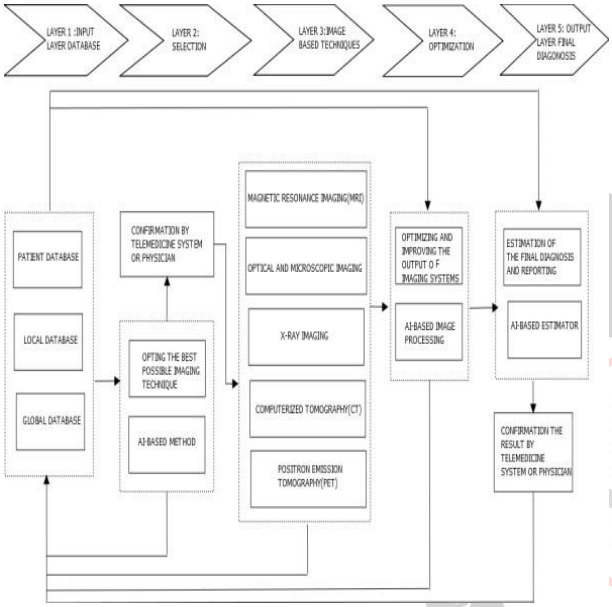

Fig.1: System Architecture

Description: The input layer as the initial layer which is related to the database and is designed for database access. A high-speed channel is used to couple this layer with the main (front-end) computer. While the database server is loosely coupled through the network, the database machine is tightly coupled to the main CPU. Taking advantage of a good number of microprocessors with database, software database machines can send huge packets of data to the main frame. The next layer, selection layer, is designed by an intelligent ANN-based selector and has the task of adopting the best possible imaging techniques in the light of past experiences of the system. If physicians confirm the decisions made by this layer, the recommended techniques in the third layer take the required images.

XI. ADVANTAGES

1. Saves time and efforts.
2. Convenience to operate the information of the patient.
3. System handles both structured data and unstructured data with the help of pre-processing.
4. This system does effective prediction of diseases.
5. Fast and accurate diagnosis.
6. No human intervention required.
7. Fills the gap between AI-based methods and medical approaches and treatments.

XII. DESIGN DETAILS

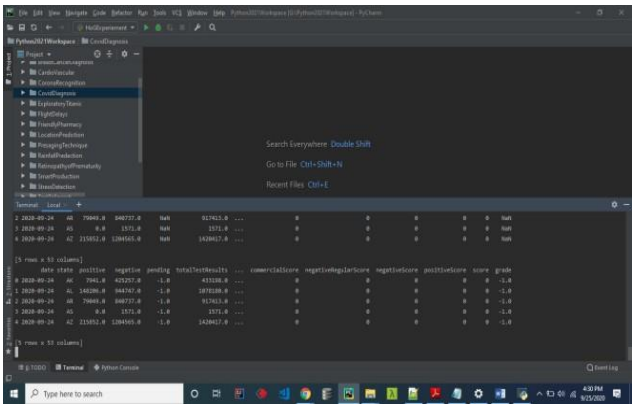

Fig 2: Current Data

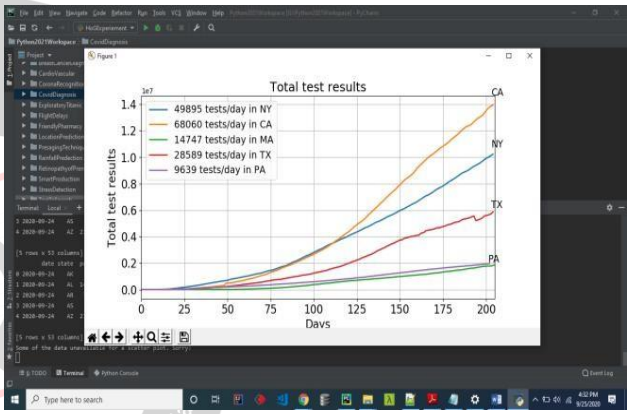

Fig 3: Total Test Results.

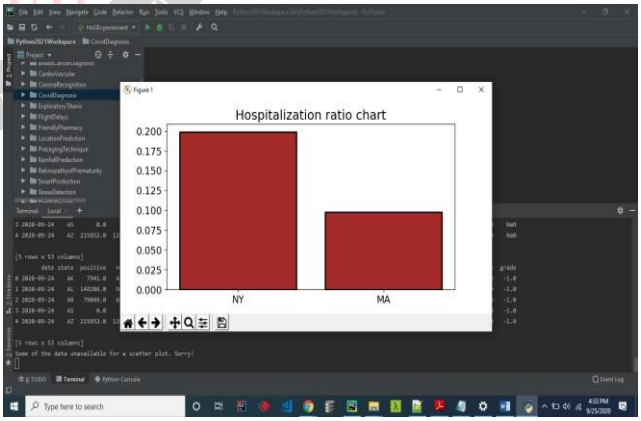

Fig 4: Hospitalization Ratio.

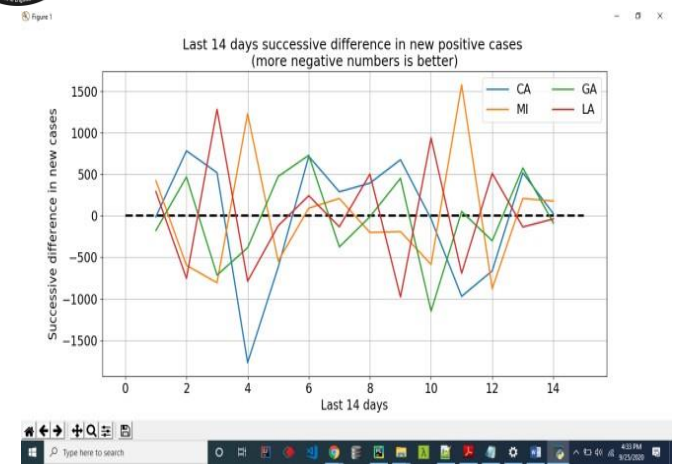

Fig 5: Last 14 Days Report

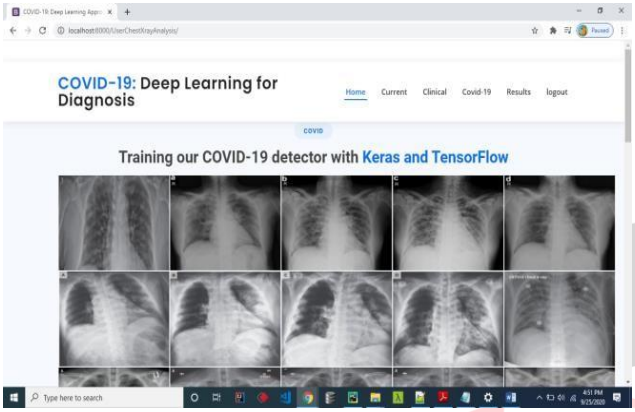

Fig 6: Chest X-ray image

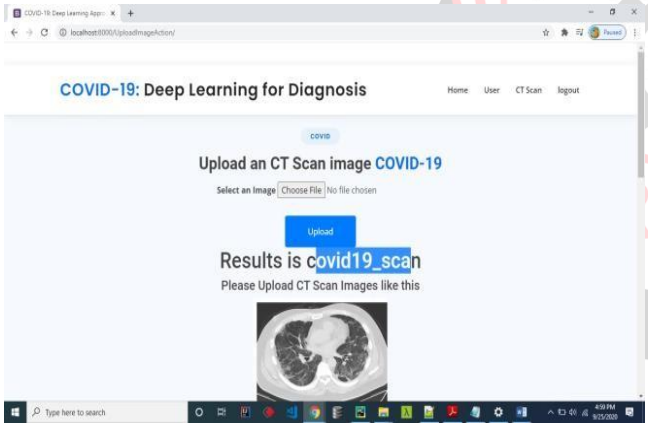

Fig 7: Results

XIII. CONCLUSION

Thus we have tried to implement the paper"M. Jamshidi*et al.*: AI and COVID-19: Deep Learning Approaches for Diagnosis and Treatment" and the conclusion isthe system detects whether the individual is covid positive dependent on the medical dataset. CNN model is used for detection of the disease. The model comprises of a uniform dataset of 764 Images. Among them 349 images are of CT Scan of Covid-19 Pneumonia affected patients and the rest shows normal patient scans. The system also calculated the accuracy, sensitivity, specificity, positive ratio, recovery ratio, etc.

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