Data Analytics and Resource Planning Using Deep Learning for Overcoming Challenges of Covid-19

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ABSTRACT: Statistical disease modeling, data analysis and planning of resources are important aspects for overcoming the challenges of COVID-19. The proposed pandemic modelling involves pre-screening of virus affected peoples and resource allocation using deep learning frameworks. Since most of the virus infected peoples are asymptomatic in nature, hence it is very difficult to recognize and isolate them from the society. In this paper a new pre-screening methodology is introduced to classify peoples who are more likely to be virus infected based on image analytics. The pre- screening techniques consists of classifying x ray images and coughing sounds by using Convolutional Neural Networks(CNN). The pre-screening results of deep learning frame works are used to prepare a risk score, i.e., higher risk score higher probability of infected and vice-versa. The proposed method has good classification accuracy for predicting various lung diseases and also can be used in pre-screening covid infected individuals. However, results alone cannot be used to confirm the COVID-19 virus, whereas it helps to distinguish people more prone to get virus infected based on a risk score. The real time results with an accuracy of 90% indicate the competency of proposed technique.

KEY WORDS: Convolutional Neural Network, PCR, Stride, SoftMax

1. INTRODUCTION

The year 2019 ends with flourishing news of the pandemic covid 19. Like a wind, it spread all over the world without any barriers and boarders. The pandemic Covid 19 affected everyone but more dangerous in children, senior citizens, and poor immune peoples. Mostly the virus enters in our body through nose. The virus first attack and unlock the protein (ACE2) and enter into human cell and it uses another protein (TMPRSS2). Further stage of reproduction and spread of the cell occurs with the use of TMPRSS2.Scientific studies reveals that same kind of proteins are seen in lungs, eyes, nasal cavity, kidney, ear, liver etc. Virus can be transfer from one person to another by with contact and also without any physical contact. However, the virus is sever and mortality rate is high to peoples with lifestyle diseases like diabetics, kidney disorders, lung disorders, heart issues and other diseases. The study of mortality rate (% out 100 individuals) of corona virus by World Health Organization was extremely astonishing i.e., Diabetics (22%), Lungs disorder (18%), Kidney problems(15%),Heart problems (18%).The noble services of police officials, health workers including doctors ,nurses and social workers are

highly appreciable and valuable for fight against this pandemic. Lung diseases affect the proper function of lungs like breathing, respiration etc. Lung disease is caused by abnormal growth of cells, environmental factors and also through bacterial, fungal, virus infection. COVID-19 19 diseases is caused by viral infection. The various common lung disorders are Asthma, Chronic obstructive pulmonary disease(COPD), Emphysema, Bronchitis, Pneumonia, Tuberculosis, Lung cancer, Acute respiratory distress syndrome[8-10]

Most common methods to analyzing and detect covid 19 are antibody test, antigen test, truenat test, etc. In antibody test, blood samples are need for this test. usually, time taken for attaining test result is nearly 20-30minutes.The antibody test is not 100% accurate for identifying the virus[11-13][21-23]. If the test result is positive, then again, we need to conduct RT-PCR test for conformation. Antigen test, Nasal sample is used to carry out the test,15-30minutes required for the test[14-16][19-20]. Recently, ICMR gave permission for conducting antigen test. The antigen test is also not 100% reliable. Truenat test, requires nasal and oral samples for conducting test. In RT-PCR test, nasal and throat samples are taken to carry out the test. The RT-PCR test is more reliable than antibody and antigen test. RNA in the blood sample is taken for the detection of the virus.

The symptoms of COVID-19 19 pandemic are Fever, Coughing, breathing problem, Fatigue, Body pain, Headache, Sore throat, Nausea, Diarrhea[17,18]. The fight against this pandemic can be ensured by keeping safe distance in public place, use face mask and hand sanitizer, obeying the rules of authorities, giving support to society and respecting the health workers and social workers.

2. PROPOSED METHOD

The proposed method of pandemic modelling is divided in two stages. i.e deep learning stage and resource allocation stage. In deep learning stage, a Convolutional Neural Network(CNN)[1-3] is used to extract hidden insights of the data accurately using an image analytics . Firstly, the audio data need to converted into images[4,5] as shown in figure1.The proposed CNN model has 5 convolution layers, each with its own activation and regularization, followed by a max pooling and is fed into 3 fully connected layers with ReLU activation, soft-max output[6-8] and categorical cross entropy loss. The input for convNet is a image of audio wave which passes through first Convolutional layer with filters 3x3x16 and a stride =1. The input image dimensions changes from [9x13x3]
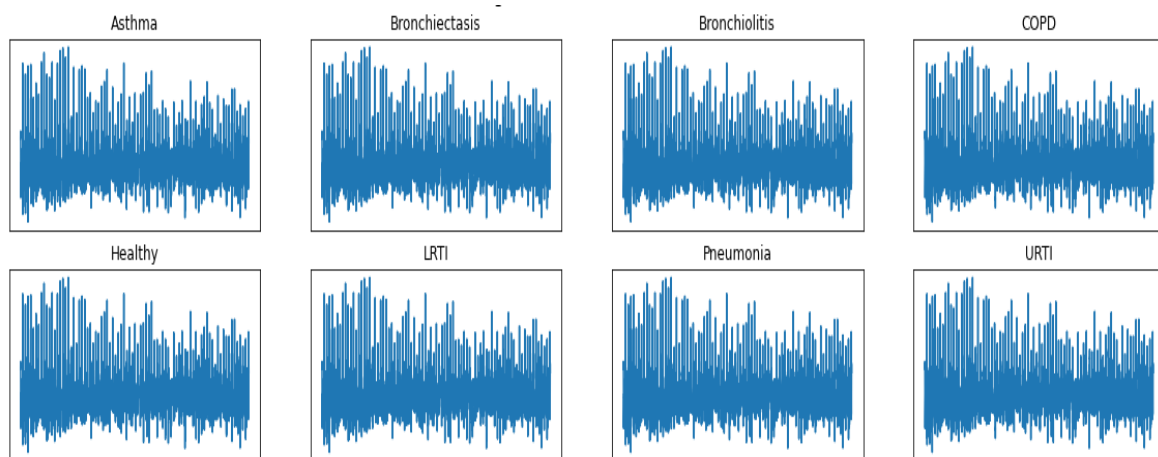
$$(N -F + 2P)/S+ 1 \qquad (1)$$

where N = input image size; F= filter size ;P= padding ; S= stride, respectively. Second Convolutional layer have 32 feature maps, size 3x3 and a stride=1. The third and fourth Convolutional layer has 64 feature maps, size 3x3 and a stride = 1 and 128 feature maps, size 3x3 and a stride = 1 respectively .The fifth layer is a max pooling layer with filter size 2×2 and a stride = 1. This layer performs down sampling of data and the output of which dropout by a factor. The fully connected layer is fed into a soft-max classifier with 8 class labels. Resource allocation stage involves scientific data analysis to various lung diseases including COVID-19. Resource allocation stage involves preparation of duty charts of police officials including health workers should be based on their immunity indicators such as age, previous diseases history, lifestyle diseases, etc.

Allocation of social workers on various geographic location can be based on immunity level of individuals obtained from Machine learning classifiers. The K means clustering, decision tree, SVM are competitive data classifiers are suitable for handling large data classification and predicting immunity score for health officials and social workers .An active cloud database helps to monitor and recorded of the data continuously. The statistical module also consists of AI and thermal camera is programmed to measure the social distancing and temperature. Geo-location of peoples from containment zones can be closed monitored by GPS and can be alerted to ensure proper isolation from community spreading of diseases.
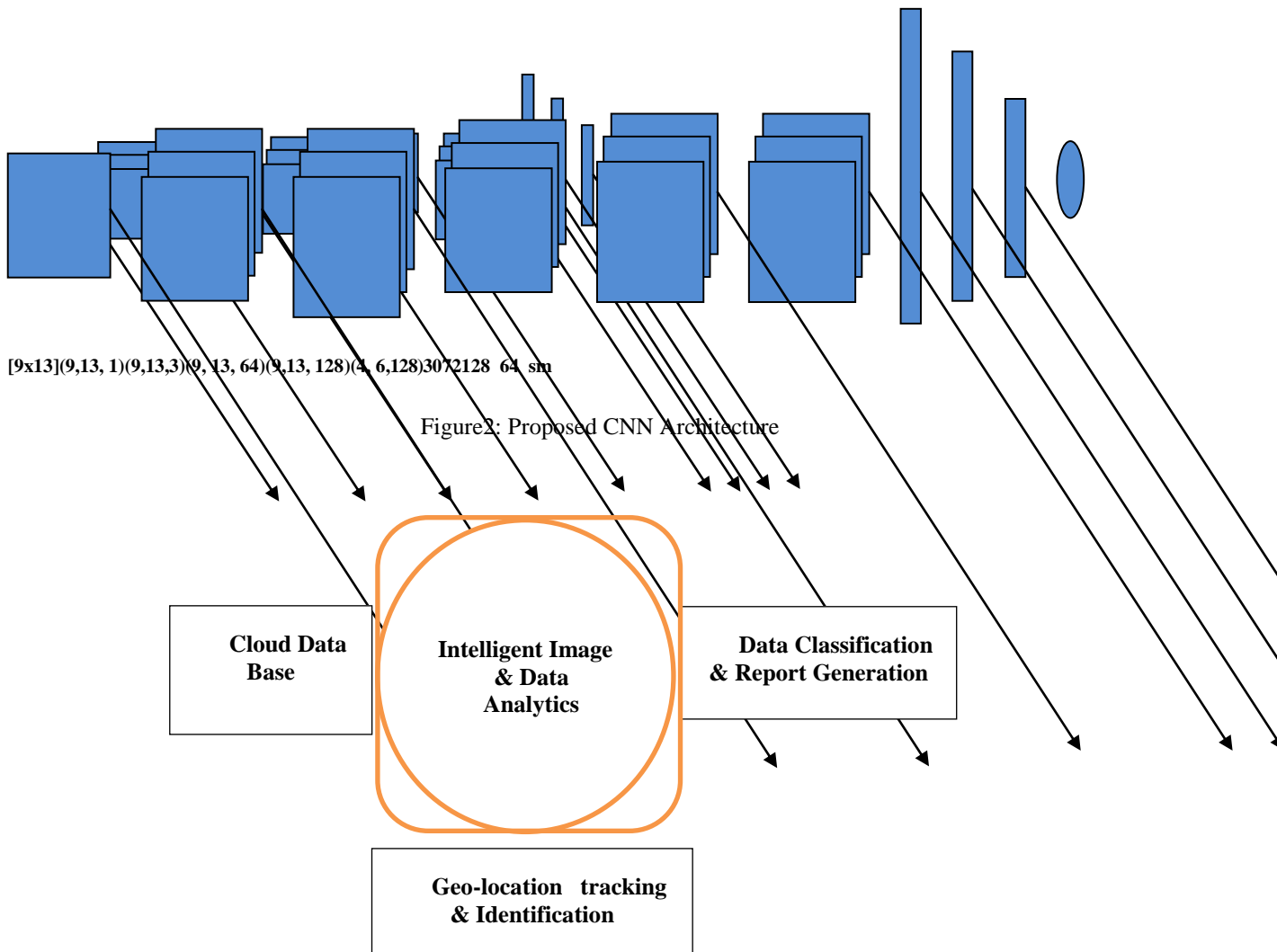

[9x13](9,13, 1)(9,13,3)(9, 13, 64)(9,13, 128)(4, 6,128)3072128 64 sm

Figure2: Proposed CNN Architecture

Fig 3: Data Analysis of proposed model

3. RESULT AND DISCUSSION

The proposed method involves pre-screening COVID-19 and other lung diseases using deep learning and resource allocation stage.The dataset used has been taken from the ICBHI ScientificChallenge databasecontaining 920 audio(.wav).This sounds were recorded using digital stethoscopes and AKG C417L Microphone ,3M Littmann Classic II SE Stethoscope,3M Litmmann 3200 Electronic Stethoscope, WelchAllyn Meditron Master EliteElectronicStethoscope. The sounds are classified into COPD: Chronic Obstructive Pulmonary Disease ,LRTI: Lower Respiratory Tract Infection, URTI: Upper Respiratory Tract Infection, asthma, pneumonia and bronchiolitis. The sample rate of the dataset is 44100 hertz. We split the dataset into 90% for training and 10% for testing and validation and have trained the model for 25 epochs to get an accuracy of 89%. In CNN , the minimum validation loss and highest validation accuracy in between 10 to 15 epochs. Figure 4&5 shows the accuracy vs no of epochs and loss vs no. of epochs graph using CNN model
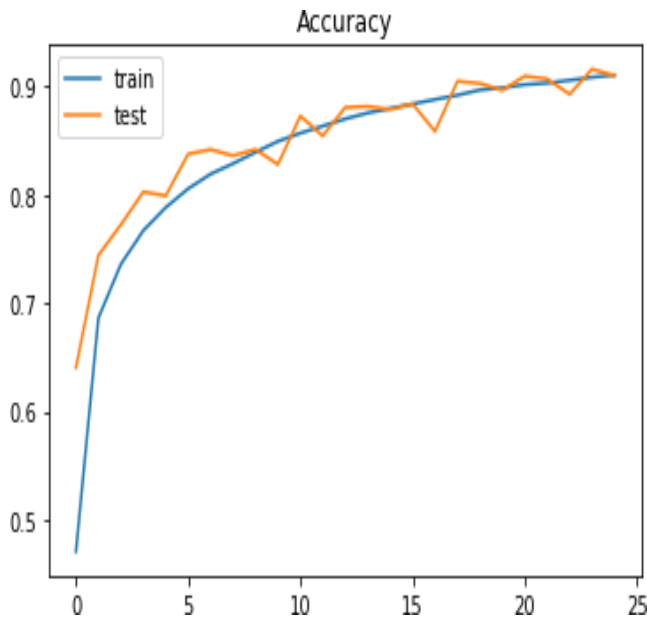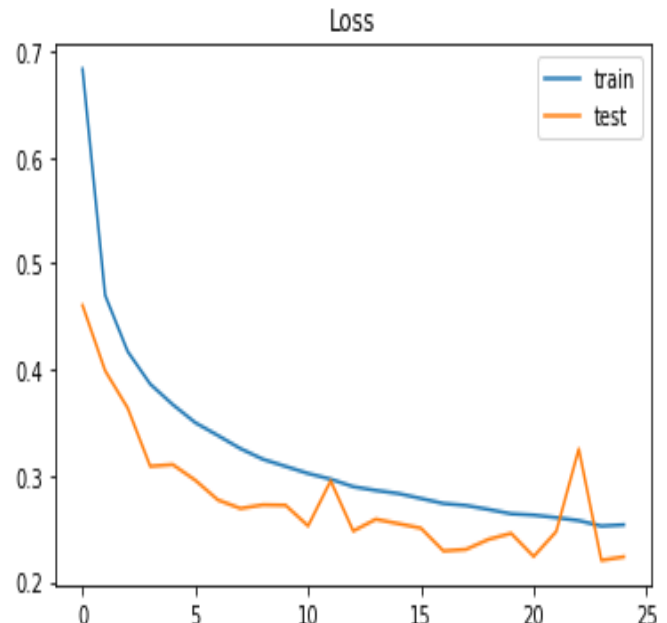

Fig 4: Accuracy vs Epochs   Fig 5: Loss vs Epochs

4. CONCLUSION

The pandemic COVID-19 19 is statistically modeled using deep learning networks and intelligent image analytics. The proposed method predicts various lung disorders and covid-19 accurately, so it can be used as a pre-screening technique. The disease modelling helps to identify various lung disorders and predict the symptoms of COVID-19. However, the medical tests should be done for ensuring the virus. The resource planning helps to control the communal spread of virus and efficient allocation of resources.

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