EARLY COVID 19 DETECTION WITH CHEST X-RAY IMAGE USING MACHINE LEARNING

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ABSTRACT

The emergence of SARS-COV2 from Wuhan at the end of December 2019 has spread to 200 countries is the leading cause of deaths. Belonging to be β-COV with single-strand RNA attacks the human respiratory system. The COVID-19 symptoms appear after incubation. The appearance of symptoms varies depending on the age and status of the immune system. Globally, current trials are on vaccines and focused on plasma therapy with the survivor's plasma. The image processing technologies has been implemented to find out the corona using chest X-ray image. The identification of the features co-ordinates will be undergone with machine learning sub domain an emerging technology. Logistic regression classification classifies the feature which are all been used there.

Keywords: Covid – 19, X-ray image & Machine learning

1. INTRODUCTION

1.1 PANDEMIC DIEASE CORONA

Corona virus disease (COVID-19) is an infectious disease caused by a newly discovered corona virus. Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. The best way to prevent and slow down transmission is to be well informed about the COVID-19 virus, the disease it causes and how it spreads. Protect yourself and others from infection by washing your hands or using an alcohol based rub frequently and not touching your face. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it's important that you also practice respiratory etiquette (for example, by coughing into a flexed elbow). The sudden spike in the number of patients with COVID-19, a new respiratory virus, has put unprecedented load over healthcare systems across the world. In many countries, the healthcare systems have already been overwhelmed. There are limited kits for diagnosis, limited hospital beds for admission of such patients, limited personal protective equipment (PPE) for healthcare personnel and limited ventilators. It is thus important to differentiate which patients with severe acute respiratory illness (SARI) could have COVID-19 infection in order to efficiently utilize the limited resources.

1.2 IMAGE PROCESSING

Digital image processing consists of the manipulation of images using digital computers. Its use has been increasing exponentially in the last decades. Its applications range from medicine to entertainment, passing by geological processing and remote sensing. Multimedia systems, one of the pillars of the modern information society, rely heavily on digital image processing. The discipline of digital image processing is a vast one, encompassing digital signal processing techniques as well as techniques that are specific to images. An image can be regarded as a function $f(x, y)$ of two continuous variables x and y. To be processed digitally, it has to be sampled and transformed into a matrix of numbers. Since a computer represents the numbers using finite precision, these numbers have to be quantized to be represented

digitally. Digital image processing consists of the manipulation of those finite precision numbers. The processing of digital images can be divided into several classes**:** image enhancement, image restoration, image analysis**,** and image compression. In image enhancement, an image is manipulated, mostly by heuristic techniques, so that a human viewer can extract useful information from it. Image restoration techniques aim at processing corrupted images from which there is a statistical or mathematical description of the degradation so that it can be reverted. Image analysis techniques permit that an image be processed so that information can be automatically extracted from it. Examples of image analysis are image segmentation, edge extraction, and texture and motion analysis. An important characteristic of images is the huge amount of information required to represent them. Even a gray-scale image of moderate resolution, say 512×512, needs $512 \times 512 \times 8 \approx 2 \times 10^6$ bits for its representation. Therefore, to be practical to store and transmit digital images, one needs to perform some sort of image compression, whereby the redundancy of the images is exploited for reducing the number of bits needed in their representation.

1.3 MACHINE LEARNING

The Israeli Ministry of Health publicly released data of all individuals who were tested for SARS-CoV-2 via RT-PCR assay of a nasopharyngeal swab. During the first months of the COVID-19 pandemic in Israel, all diagnostic laboratory tests for COVID-19 were performed according to criteria determined by the Israeli Ministry of Health. While subject to change, the criteria implemented during the study period included the presence and severity of clinical symptoms, possible exposure to individuals confirmed to have COVID-19, certain geographical areas, and the risk of complications if infected. Except for a small minority who were tested under surveys among healthcare workers, all the individuals tested had indications for testing. Thus, there was no apparent referral bias regarding the vast majority of the subjects in the dataset used in this study; these contrasts with previous studies, for which such bias was a drawback. In addition, all negative and positive COVID-19 cases this dataset were confirmed via RT-PCR assay. In this paper, we propose a machine-learning model that predicts a positive SARS-CoV-2 infection in a RT-PCR test by asking eight basic questions. The model was trained on data of all individuals in Israel tested for SARS-CoV-2 during the first months of the COVID-19 pandemic. Thus, our model can be implemented globally for effective screening and prioritization of testing for the virus in the general population.

1.4 DESCRIPTION

X-ray is an imaging technique that is used to investigate fractures, bone displacement, pneumonia, and tumor. X-rays have been used for many decades and provide an astonishingly fast way of seeing the lungs and, therefore, can be a helpful tool in the detection of COVID-19 infections. They are capable of generating images that show lung damage, such as from pneumonia caused by the SARS-CoV-2 virus. Since X-rays are very fast and cheap, they can help to triage patients in places where the healthcare system has collapsed or in places that are far from major centers with access to more complex technologies. Furthermore, there are portable X-ray devices that can be easily transported to where it is needed. X-Ray image make use of the principles of X-ray in an advanced manner to examine the soft structures of the body. It is also used to obtain clearer images of organs and soft tissues. On the other hand, X-rays use less radiation, thus using an X-ray is faster, less harmful, and presents lower cost than a CT scan. Narin et al. [8] proposed an automatic detection of COVID-19 using chest X-rays and CNNs. Apostolopoulos et al also proposed the automatic detection of the disease but analyzing three classes: COVID19, common pneumonia, and normal conditions. Right presently, the majority of tests being utilized to diagnose Covid-19 are hereditary tests known as Switch Transcription Polymerase Chain Response (RT-PCR). These tests are very accurate. Indeed, in the event that there's as it was a modest sum of infection in the patient test, it can be identified and measured. In any case, it is worth noticing that PCR test is exceptionally complicated, time devouring and exorbitant. So, not all healthcare offices have the ability to perform it. Seeing these restrictions, a stand-in approach to distinguish the illness can be radiography scanning, where chest

radiography pictures can be analyzed to detect the nearness of, or the indications of the novel corona virus. Studies appear that infections having a place to this family illustrate critical appearance in radiographic pictures [2], in this manner, it can be said that classification with the assistance of radiographic pictures, such as chest X-ray (CXR), can be precise but at the same time much quicker and less costly than the PCR test. Moreover, chest X-rays are prudent than other radiological tests like CT checks and accessible in nearly each clinic.

1.5 ORGANIZATION OF THE REPORT

The report consists of the introduction in chapter 1 which tells about the introduction of the domain developed with the implementation procedure. Chapter 2 contains the literature survey and chapter 3 consist the existing, proposed implementation of the system. Chapter 4 explains the modules with the system architecture and the chapter 5 explains the data flow system for the project continued with the result and conclusion in chapter 6. Chapter 7 contains the conclusion and future enhancement with the references and appendix.

1.6 LITERATURE REVIEW

2.1 TITLE: COVIDGR DATASET AND COVID-SDNET METHODOLOGY FOR PREDICTING COVID-19 BASED ON CHEST X-RAY IMAGES AUTHOR: PDFS. Tabik ; A. Gómez-Ríos; J. L. Martín-Rodríguez; I. Sevillano-García; M. Rey-Area; D. Charte; E. Guirado; J. L. Suárez - YEAR: 2020

Currently, Coronavirus disease (COVID-19), one of the most infectious diseases in the 21st century, is diagnosed using RT-PCR testing, CT scans and/or Chest X-Ray (CXR) images. CT (Computed Tomography) scanners and RT-PCR testing are not available in most medical centers and hence in many cases CXR images become the most time/cost effective tool for assisting clinicians in making decisions. Deep learning neural networks have a great potential for building COVID-19 triage systems and detecting COVID-19 patients, especially patients with low severity. Unfortunately, current databases do not allow building such systems as they are highly heterogeneous and biased towards severe cases. This article is threefold: (i) we demystify the high sensitivities achieved by most recent COVID-19 classification models, (ii) under a close collaboration with Hospital Universitario Clínico San Cecilio, Granada, Spain, we built COVIDGR-1.0, a homogeneous and balanced database that includes all levelsof severity, from normal with Positive RT-PCR, Mild, Moderate to Severe. COVIDGR-1.0 contains 426 positive and 426 negative PA (PosteroAnterior) CXR views and (iii) we propose COVID Smart Data based Network (COVID-SDNet) methodology for improving the generalization capacity of COVID-classification models. Our approach reaches good and stable results with an accuracy of 97.72% ± 0.95%, 86.90% ± 3.20%, 61.80% ± 5.49% in severe, moderate and mild COVID-19 severity levels. Our approach could help in the early detection of COVID-19. COVIDGR-1.0 along with the severity level labels are available to the scientific community through this link https://dasci.es/es/transferencia/ open-data/covidgr/.

2.2 TITLE: MODEL DECISION SUPPORT SYSTEM FOR DIAGNOSIS COVID-19 USING FORWARD CHAINING: A CASE IN INDONESIA AUTHOR: Henderi; Miftah Maulana; Harco Leslie Hendrie S. Warnars; Didik Setiyadi; Taufik Qurrohman - YEAR: 2020

The government in Indonesia and its staff work together to make tactical steps to prevent the spread of COVID-19 in the community. From the ministerial level to the heads of the provinces, regencies, and even the government. Therefore, this study aims to make a model decision support system to diagnose patients exposed to Covid-19, such as people in control, patients in oversight, and those who are positive for the Covid-19 Virus. Model decision support system development aims to provide information about the development of COVID- 19 and help the community in diagnosing themselves related to COVID-19 infection. In this study, the authors use the forward chaining method in application to get conclusions from the symptoms of the Covid-19. This research resulted in an application that patients exposed to the Covid-19, and it's also provided a solution for healing from patients. And this could be a reference for patients before consulting further with the doctor.

2.3 TITLE: COVID-19 Cases in Iraq; Forecasting Incidents Using Box - Jenkins ARIMA Model AUTHOR: Hadeel I. Mustafa; Noor Y. Fareed - YEAR: 2020

The pandemic outbreak of COVID-19 created panic all over the world. The mathematical principle in developing forecasting models aims to predict the number of future infections is considered crucial at this stage. The present investigation aims to analyze the time series using the Box-Jenkins method (Diagnostic, The Estimate, and selection, Forecasting) to find the best ARIMA model (Autoregressive Integrated Moving Average) for predicting the numbers of people infected with Covid-19 disease in Iraq. The data used were collected in the period between 1 -March and 31- July. The results showed that the appropriate forecasting model is ARIMA (2,1,5). Depending on this model, they predict the numbers of those infected with COVID-19 daily and for thirty days. Predictive values are consistent with original series values, indicating the efficiency of the model.

2.4 TITLE: Development and evaluation of an AI System for early detection of Covid-19 pneumonia using X-ray (Student Consortium) AUTHOR: Mohit Mishra**;** Varun Parashar**;** Rushikesh Shimpi - **YEAR: 2020**

This paper aims to integrate AI (Artificial Intelligence) with medical science to develop a classification tool to recognize Covid-19 infection and other lung ailments. Four conditions evaluated were Covid-19 pneumonia, non-Covid-19 pneumonia, pneumonia and normal lungs. The proposed AI system is divided into 2 stages. Stage 1 classifies chest X-Ray volumes into pneumonia and non-pneumonia. Stage 2 gets input from stage 1 if X-ray belongs to pneumonic class and further classifies it into Covid-19 positive and Covid-19 negative.

2.5 TITLE: Fuzzy Rule-Based System for Predicting Daily Case in COVID-19 Outbreak AUTHOR: Pınar Cihan - YEAR: 2020

The Covid-19 outbreak appeared in Wuhan in December 2019 and spread rapidly all over the world. The Covid-19 disease does not yet have a clinically proven vaccine and drug for treatment. The most important physical factors in reducing the spread of the epidemic are washing hands, reducing social distance and using a mask. Today in addition to clinical studies, computer-aided studies are also widely carried out for Covid-19 outbreak. Artificial intelligence methods are successfully applied in epidemic studies. In this study, fuzzy rule basing system (FRGS) used to predict the number of Covid-19 daily cases. As a result of the study, the number of daily cases was successfully estimated with FRGS (R^2 = 0.96, MAE = 186 and RMSE = 254).

3.1 EXISTING SYSTEM

In the existing system, the prediction of the COVID-19 is difficult where the samples of the patient will be taken and the result analysis will take 24 hours. The classification over the chest X- Ray image in the survey papers does not produce any good accuracy where they are below 65%. There are several more research works to detect the presence of Covid-19 virus in the human lungs with the help of CT scan. In the existing system, a multi-task, self-supervised AI model have been developed for the diagnosing of the Covid-19 virus in human lungs with the help of CT scan images, with an accuracy of 89%. An automatic segmentation and quantification of the lungs is done it describes a fully automatic framework to detect coronavirus affected lungs from chest CT scan images and differentiated it from other lung diseases. As can be observed, most of the works related to Covid19 detection from CXR images have utilized individual deep learning models e.g. DenseNet, ResNet, Xception, etc. None of the works have tried to combine the models to multiply their capability of classification. Various works done on Ensemble Learning with Deep Neural Networks show that ensembling learning methods are superior in prediction than an individual model and also helps in preventing overfitting.

3.2 PROPOSED SYSTEM

In our proposed system, logistic regression classification system is implemented on the classification of the Covid-19, Pneumonia and normal cold with their stages level are known. The classification is made by the Training and Testing system where the feature extracted values are tested. The extracted feature values are known with the Gaussian feature extractor which carries out the pixel value from the pre-processed image. Thus the classification tends to get out the complete managing of the levels and stages of the Disease. In real life, we always prefer to come up with medical diagnosis based on multiple medical expert views. Combined opinion of the medical experts helps in reaching to a more reliable conclusion. Following the same philosophy, multiple benchmark linear regression models have been adopted in our proposed work. They have been trained individually to make independent predictions. Then the models are combined, using a new method of weighted average ensembling technique, to predict a class value. This new proposed ensembling method is expected to make the prediction more robust.

4. MODULE DESCRIPTION

Image Acquisition

The image acquisition method will make dataset combinations of the chest X-ray images. Multiple amount of dataset with the images are collected from https :// www .kaggle. com / pault imoth mooney /chest -xray-pneumonia. In genuine life, we continuously favor to come up with therapeutic determination based on different restorative master sees. Combined opinion of the restorative specialists offer assistance in coming to a more solid conclusion. Taking after the same logic, multiple benchmark Regression Classifiers models have been embraced in our proposed work. They have been prepared separately to create autonomous forecast.



ce of stages

Pre-Proc Normal x ray Pneumonia COVID 19

Image pre-processing is the title for operations on pictures at the least level of reflection whose point is an advancement of the picture information that smother undesired mutilations or upgrades a few picture highlights critical for advance handling. Its strategies utilize the impressive repetition in pictures.

Gaussian Extractor

Gaussian feature extractor is chosen for producing raster form outline. The commonsense application cases in image analysis and include extraction for COVID 19 tests recommend that the raster form outline is smooth sufficient for quantitative examination, and is accommodating for Chest X- ray highlight extraction and for inconsistency distinguishing proof. As compared to cruel filter and middle channel, the Gauss channel is successful both in sifting speed and in form map's quality for the condition that filter width be 9~15 and σbe 0.2~0.6.

$$G(i,j) = ke^{\frac{i^2+j^2}{\sigma^2}} \qquad (6.1)$$

Thus the above equation (1) denotes the contour map feature extraction list. The complete analysis list is denoted by the identification of the Gaussian channel values which will be shown with the denoting the map values. The extracted ordinary values will make an identification of the complete channel features. The smooth dark lines are forms created with Gauss filtration, whereas the gray parts are forms produced

without filtration. It is apparent that the spatial areas are steady in common, and the forms with Gauss filtration are more concise and smoother than that without filtration.

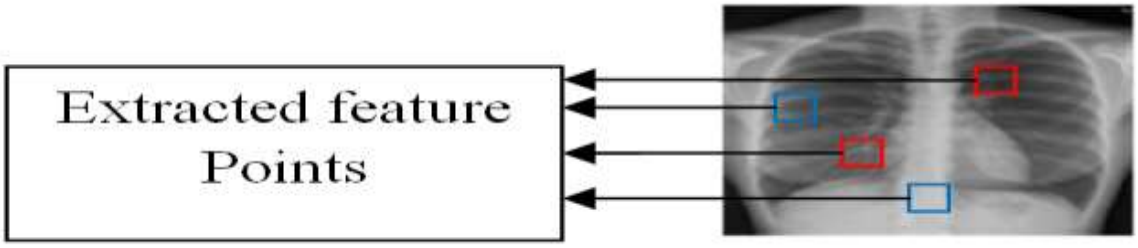

Fig 2 Explains the extracted feature pixels in the image

In a few conditions, the positive chest X-ray image anomaly is so noteworthy that it can be clear distinguished indeed some time recently feature strengthening, as in figure 3. But in most circumstances, particularly at the starting organize of IT peculiarity improvement; the positive image inconsistency is fluffy both in spatial area and creating heading.

Regression Classifier

The proposed system for exact forecast of COVID-19 utilizing the chest X-ray pictures through deep highlight learning demonstrate with Regression classifiers and machine learning classifiers comprised of the ResNet152 architecture for the preparing with afterward utilizing the concerned highlights to classify the chest X-ray images using machine learning classifiers.

A ResNet152 22 demonstrates was prepared for the classification of Pneumonia and Ordinary patients. ResNet is known to be distant better; a much better; a higher; a stronger; an improved, a stronger profound learning engineering because it is moderately easy to optimize and can attain higher exactness. Due to a expansive number of layers within the arrange design, it has tall time complexity. This complexity can be decreased by utilizing a bottleneck plan. Assist, there is always a issue of vanishing angle, which is settled utilizing the skip associations within the organize.

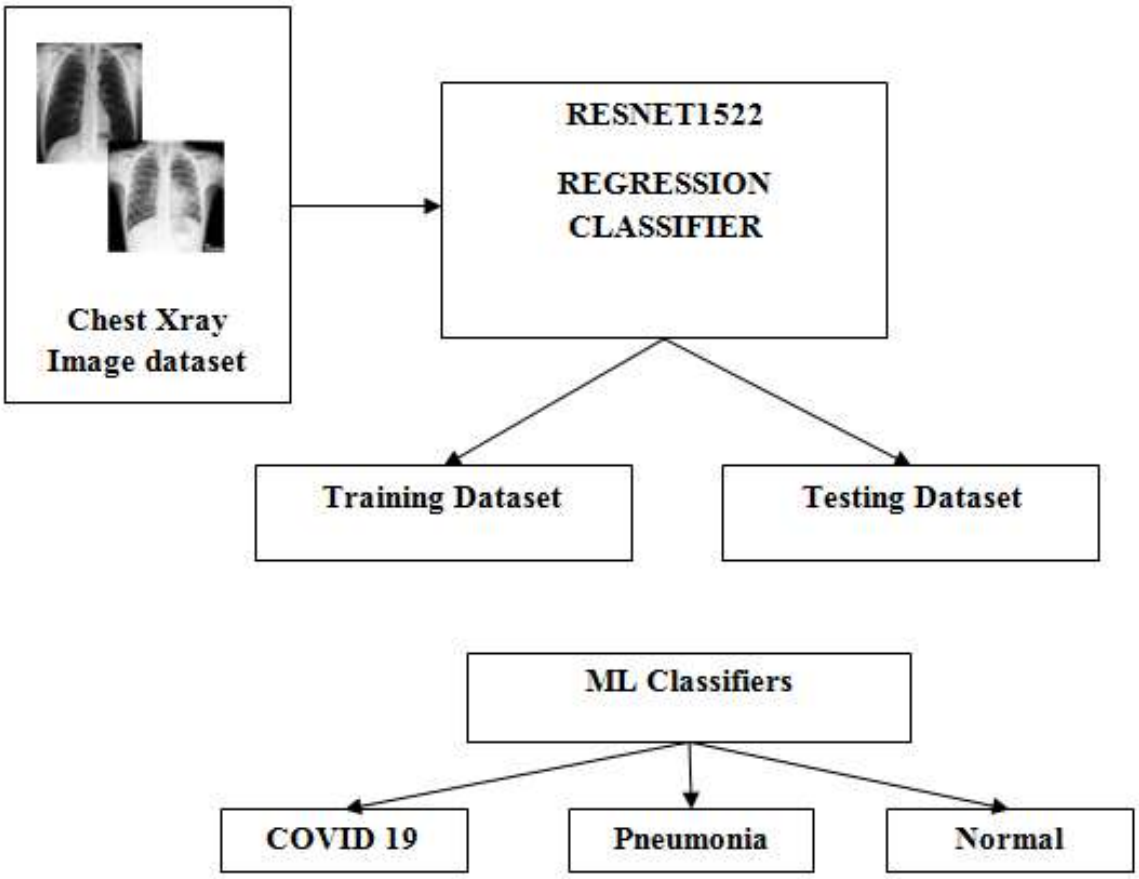

Fig 3 Gives the regression classifier analysis system with the identification of the COVID 19

Training and Testing

For training the system initialize our demonstrate with pre-trained weights from resNet52 implementation by Weng et al. [12], and after that taking after the two organize training process depicted underneath:

Within the to begin with step, DenseNet's spine weights are solidified and as it were the final fully associated layer is prepared. Preparing is performed utilizing Adam optimizer with taking after parameters: $\beta 1 = 0.9$, $\beta 2 = 0.999$, and learning rate $10{-}4$. We use mini-batches of measure 16, and prepare for almost 30 ages. The demonstration with the least approval misfortune is chosen for following arrange.

Within the moment arrange, the organize weights are initialized from over, but the entire organize is prepared end-to-end (all layers), utilizing the same hyper parameters. We utilize mini-batch measure of 8 in this organize due to memory imperatives, and prepare for 10 ages. Once more, the show with least approval loss is chosen for testing.

To guarantee that preparing misfortune due to COVID-19 does not get veiled by preparing misfortune due to other classes, we consider as it were a random subset of pneumonia information in each clump. The estimate of this subset should neither be as well little, which can lead to over fitting on the COVID-19 information, nor too huge to veil the COVID-19 misfortune, and is settled observationally. In each batch we take information from classes Normal, Bacterial Pneumonia, Viral Pneumonia and COVID-19 within the proportion 5: 5: 5: 1. In case of the three lesson classification network, this proportion is 7: 7: 1. With the trained dataset the testing are undergone with multiple image data analysis.

5. USE CASE DIAGRAM

Use case diagrams are usually referred to as behavior diagrams used to describe a set of actions (use cases) that some system or systems (subject) should or can perform in collaboration with one or more external users of the system (actors). In software and systems engineering, a use case is a list of actions or event steps typically defining the interactions between a role (known in the Unified Modeling Language as an actor) and a system to achieve a goal. The actor can be a human or other external system. An actor in the Unified Modeling Language (UML) "specifies a role played by a user or any other system that interacts with the subject." "An Actor models a type of role played by an entity that interacts with the subject (e.g., by exchanging signals and data), but which is external to the subject." UML Use Case Include. Use case include is a directed relationship between two use cases which is used to show that behavior of the included use case (the addition) is inserted into the behavior of the including (the base) use case.

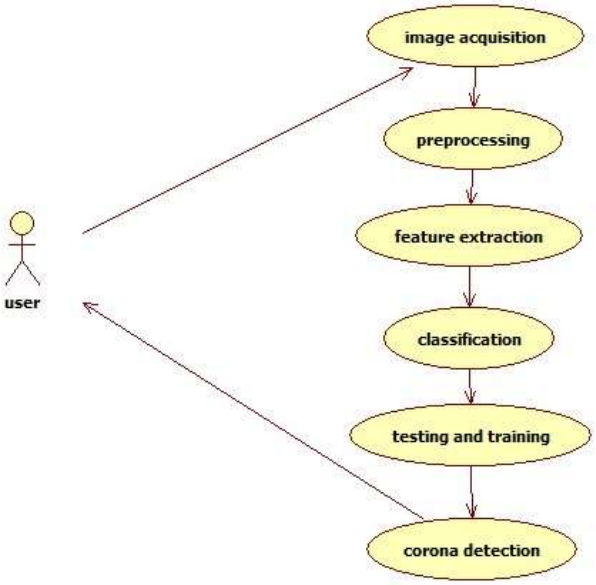

Fig 4: Use Case Diagram

6.1 ACTIVITY DIAGRAM

We use Activity Diagrams to illustrate the flow of control in a system and refer to the steps involved in the execution of a use case. We model sequential and concurrent activities using activity diagrams. So, we basically depict workflows visually using an activity diagram. An activity diagram focuses on condition of flow and the sequence in which it happens. We describe or depict what causes a particular event using an activity diagram. UML models basically three types of diagrams, namely, structure diagrams, interaction diagrams, and behavior diagrams. An activity diagram is a behavioral diagram i.e. it depicts the behavior of a system.

6.2 SEQUENCE DIAGRAM

Sequence diagrams are sometimes called event diagrams or event scenarios. A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. A sequence diagram is an interaction diagram that shows how objects operate with one another and in what order. It is a construct of a message sequence chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages

exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios. Objects as well as classes can be targets on a sequence diagram, which means that messages can be sent to them. A target is displayed as a rectangle with some text in it. Below the target, its lifeline extends for as long as the target exists. The lifeline is displayed as a vertical dashed line.

7.1 INPUT DESIGN

In real life, we always prefer to come up with medical diagnosis based on multiple medical expert views. Combined opinion of the medical experts help in reaching to a more reliable conclusion. Following the same philosophy, multiple benchmark CNN models have been adopted in our proposed work. They have been trained individually to make independent predictions. Then the models are combined, using a new method of weighted average ensembling technique, to predict a class value. This new proposed ensembling method is expected to make the prediction more robust. Our proposed work comprises of three pre-trained CNN models - DenseNet201 [33], Resnet50V2 [34] and Inceptionv3 [35]. The biggest advantage of Dense Convolution Network or DenseNet, shown in Fig. 1, is that it requires comparatively fewer parameters than similar types of traditional CNN. An additional reason to choose DenseNet is that each layer takes the feature maps of all preceding layers as inputs. This helps to strengthen feature propagation and encourages feature reuse. ResNet50v2, shown in Fig. 3, is a contemporary convolutional network which is easier to train than any other deep convolutional neural networks, yields greater accuracy and converges faster. It also addresses the vanishing or exploding gradient problems by the use of "residual blocks" in the architecture. In a residual network, multiple residual blocks stacked up one after another. Each residual block, shown in Fig. 2, is formed of short-cut connections skipping one or more layers. In ResNet50, 3-layer residual blocks are used.

7.2 OUTPUT DESIGN

The consolidated images are first normalized and resized into 224 × 224 shaped images. Then the images are shuffled and splitted into training and testing data, where the test size is 20% and the rest are for training purposes. Thus the training data has 771 images where 438 images are for class 0 and 333 images are for class 1. The testing data has 235 images where 100 images are for class 0 and 135 images for class 1. However, if there are 2 or more images of the same patient, it is ensured that those images are either marked as training data or as test data - but not in both. In case the same patient's images are kept both in training and test data, there is a possibility that the results will be overly promising because of patient overlap. With this, the image folders are ready for training the model followed by testing the efficacy of the trained model. Fast and timely detection of Covid +ve patients are necessary to avoid spreading of the disease and keeping it in control. This research work has been done to detect the Covid +ve patients from Chest X-Ray images in a simple and inexpensive way. In the work proposed in this paper, three state-of-the-art deep learning models have been adopted and ensembled. The proposed model has achieved a classification accuracy of 95.7%. Even more important fact is it has given a sensitivity of 98% i.e. out of 100 Covid +ve patients, 98 can correctly diagnosed by our proposed model. It is believed that this research work along with the GUI interface will help the doctors to detect the affected patients with the help of computer aided analysis, that too within a few seconds. We do believe that this will significantly add a value in the medical field.

7.3 SYSTEM IMPLEMENTATION

The exponential increase in COVID-19 patients is overwhelming healthcare systems across the world. With limited testing kits, it is impossible for every patient with respiratory illness to be tested using conventional techniques (RT-PCR). The tests also have long turn-around time, and limited sensitivity. Detecting possible COVID-19 infections on Chest X-Ray may help quarantine high risk patients while test results are awaited. X-Ray machines are already available in most healthcare systems, and with most modern X-Ray systems already digitized, there is no transportation time involved for the samples either. In

this work we propose the use of chest X-Ray to prioritize the selection of patients for further RT-PCR testing. This may be useful in an inpatient setting where the present systems are struggling to decide whether to keep the patient in the ward along with other patients or isolate them in COVID-19 areas. It would also help in identifying patients with high likelihood of COVID with a false negative RT-PCR who would need repeat testing. Further, we propose the use of modern AI techniques to detect the COVID-19 patients using X-Ray images in an automated manner, particularly in settings where radiologists are not available, and help make the proposed testing technology scalable. We present CovidAID: COVID-19 AI Detector, a novel deep neural network based model to triage patients for appropriate testing. On the publicly available covid-chestxray-dataset [2] dataset, our model gives 90.5% accuracy with 100% sensitivity (recall) for the COVID-19 infection. We significantly improve upon the results of Covid-Net [10] on the same dataset. The main contribution of this work is in proposing a novel deep neural network based model for highly accurate detection of COVID-19 infection from the chest X-Ray images of the patients. Radiographs in the current setting are in most cases interpreted by non-radiologists. Further, given the novelty of the virus, many of the radiologists themselves may not be familiar with all the nuances of the infection, and may be lacking in the adequate expertise to make highly accurate diagnosis. Therefore this automated tool can serve as a guide for those in the forefront of this analysis. We would like to re-emphasize that we are not proposing the use of the proposed model as alternative to the conventional diagnostic tests for COVID19 infection, but as a triage tool to determine the suitability of a patient with SARI to undergo the test for COVID-19 infection. To help accelerate the research in this area, we are releasing our training code and trained models publicly for open access at https://github.com/ arpanmangal/CovidAID. However, we note that both the model and this report merely captures our current understanding of this rapidly evolving problem, that too on very limited data currently available. We will keep updating the model and this report as we get newer understanding and better results.

7.4 SYSTEM TESTING

System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences. Testing is vital to the success of the system. System testing makes a logical assumption that if all the parts of the system are correct, the goal will be successfully achieved. System Testing is a type of software testing that is performed on a complete integrated system to evaluate the compliance of the system with the corresponding requirements. System testing detects defects within both the integrated units and the whole system. The result of system testing is the observed behavior of a component or a system when it is tested. System Testing is basically performed by a testing team that is independent of the development team that helps to test the quality of the system impartial. The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

7.5 OUTPUT TESTING

After performing the validation, the next step is output testing of the proposed system, since no system could be useful if it does not produce the required output in the specified format. Asking the users about the format required by them tests the output generated or displayed by the system under consideration. Hence the output format is considered in two ways-one is on screen and another in printed format.

7.6 USER ACCEPTANCE TESTING

User acceptance of a system is the key factor for the success of any system. The system under consideration is tested for the user acceptance by constantly keeping in touch with the prospective system users at the time of developing and making changes whenever required. This is done in regard to the following point: An acceptance test has the objective of selling the user on the validity and reliability of the

system .it verifies that the system's procedures operate to system specifications and that the integrity of important data is maintained. Performance of an acceptance test is actually the user's show. User motivation is very important for the successful performance of the system. After that a comprehensive test report is prepared. This report shows the system's tolerance, Performance range, error rate and accuracy

8. CONCLUSION

The implementation system is carried out for a fast detection of corona patient using chest X-ray image. Quick and opportune detection of Covid +ve patients is essential to dodge spreading of the infection and keeping it in control. This inquire about work has been done to identify the Covid +ve patients from Chest X-Ray pictures in a basic and reasonable way. Within the work proposed in this paper, three state-of-the-art profound learning models have been embraced and ensemble. The proposed show has accomplished a classification precision of 98.7%. Indeed more critical truth is it has given a affectability of 98% i.e. out of 100 Covid +ve patients, 98 can accurately analyzed by our proposed demonstrate. It is accepted that this investigate work alongside the GUI interface will offer assistance the specialists to identify the influenced patients with the help of computer supported investigation, that as well inside many seconds. We do accept that this will altogether include a esteem in the therapeutic field.

9. SCREENSHOTS

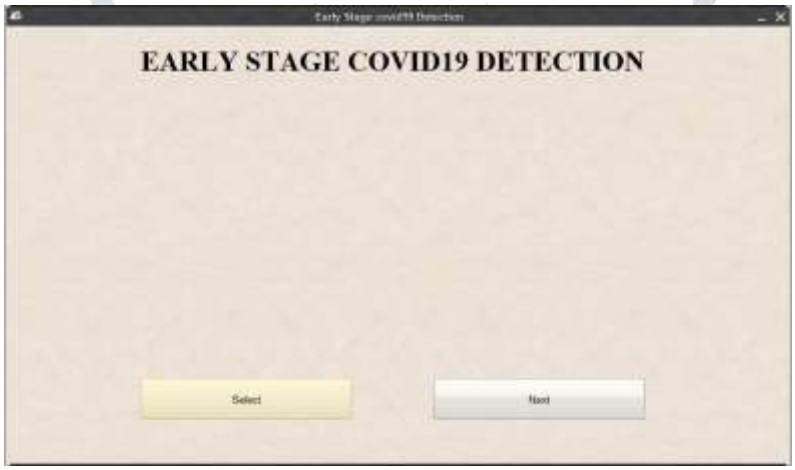

Fig 5 Early Stage COVID 19 detection

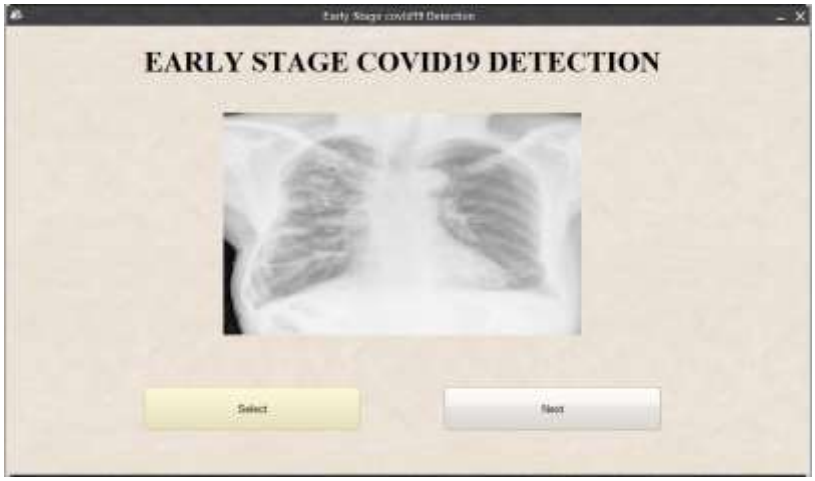

Fig 6 Image acquisition

Fig 7 Two phases of machine learning

Fig 8 Image grayscale conversion

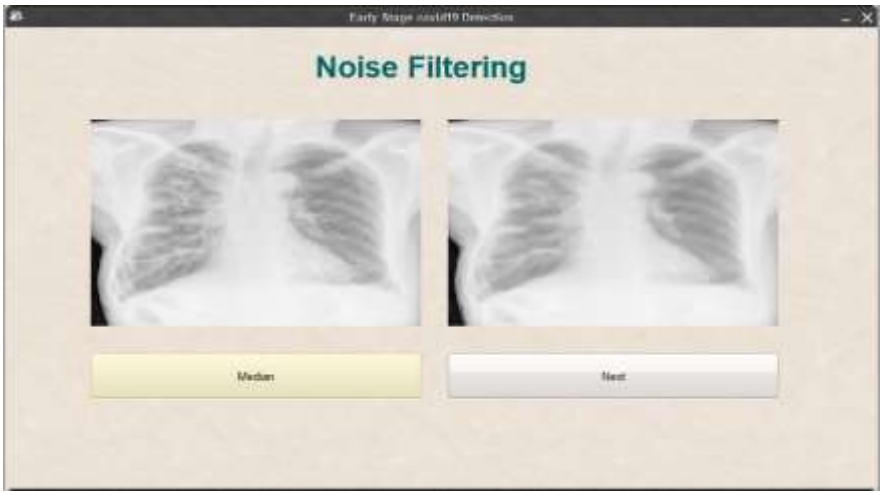

Fig 9 Noise filtering

Fig 10 Feature extraction

Fig 11 Classification results and training

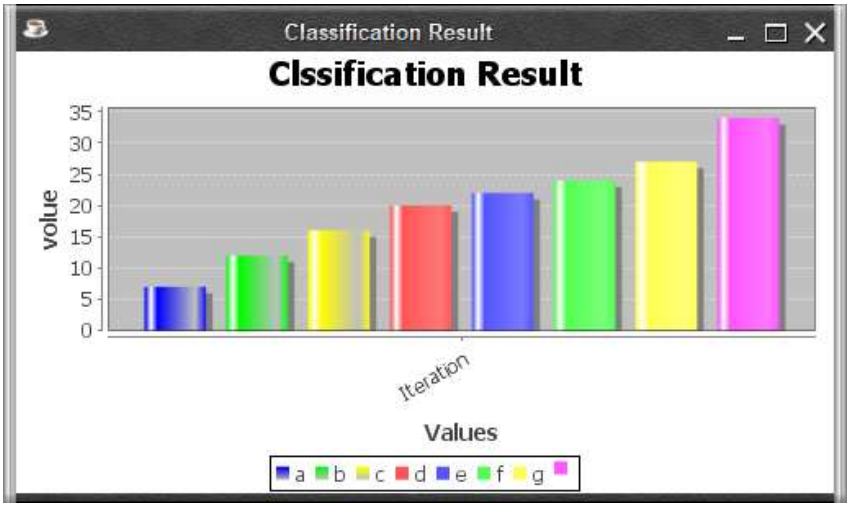

Fig 12 Extracted Feature value

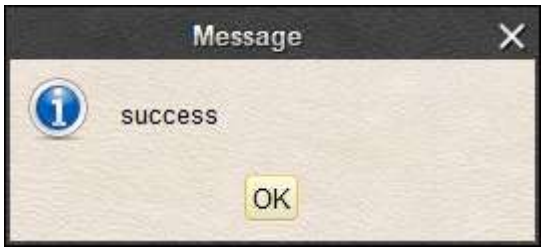

Fig 13 Trained successfully from the given features

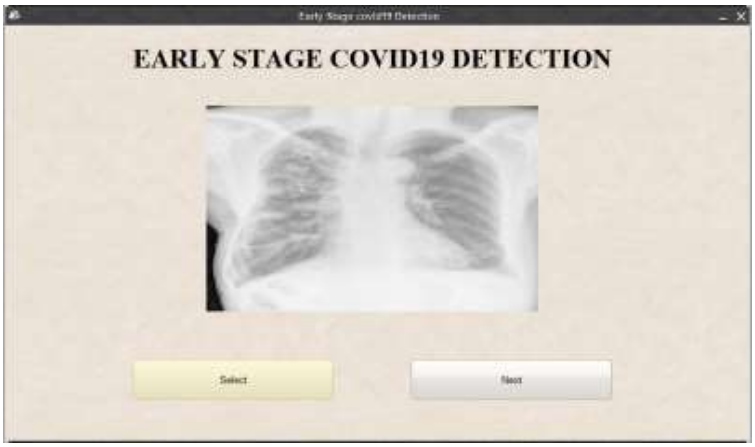

Fig 14 Testing phase

Fig 15 Testing phase selection

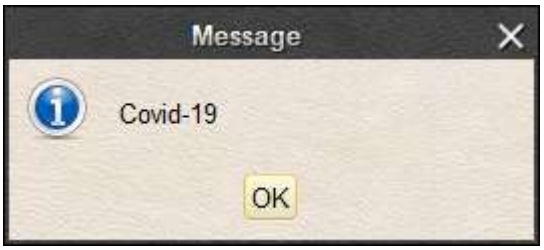

Fig 16 COVID Prediction

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