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AN EFFECTIVE APPROACH TO PREDICT COVID-19 USING DEEP LEARNING ALGORITHMS VIA X-RAY IMAGES

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Abstract - — *ML models have long been employed in numerous application areas that required the detection and prioritization of risk variables. Several prediction approaches are widely employed to deal with forecasting challenges. Deep learning (DL) has shown beneficial in medical imaging, and in the aftermath of the recent COVID-19 epidemic, some research has begun to investigate DL-based solutions for the aided detection of lung disorders. This study highlights the use of DL approaches for the interpretation of lung ultrasonography (LUS) pictures, as well as the capacity of ML models to predict the number of forthcoming patients affected by COVID-19, which is now regarded as a possible threat to humanity. In this experiment, two conventional deep learning models, RCNN and CNN, were utilized to anticipate the threatening elements of COVID-19. The project's results show that it is a promising mechanism for using these technologies in the current context of the COVID-19 pandemic. For prediction, this study employs a new combination technique. For training, many types of data sets are employed, which boosts the accuracy of our project.*

Keywords—: RCNN, CNN, Deep Learning, Machine Learning, COVID-19.

1. INTRODUCTION

Due to the fast worldwide SARS-CoV-2 pandemic, medical equipment was in short supply. Aside from a global lack of mouth masks and mechanical ventilators, testing capacity has been severely constrained. As a result, suspected patients and healthcare employees received priority testing. However, thorough testing and diagnosis are critical for effectively containing the pandemic. Indeed, nations that were able to do large-scale testing of potentially affected persons, paired with extensive citizen surveillance, were able to significantly control the SARSCoV-2 virus. Because most nations lack testing capability, the necessity for the search for alternate approaches to diagnose COVID-19 has increased. Furthermore, the latest lab test, reverse transcription polymerase chain reaction (RT-PCR) arrays, remains highly dependent on swab technique and location.

COVID-19 pneumonia can quickly develop into a life-threatening disease. The radiological scans of over 1,000 COVID-19 patients revealed various ARDS-like symptoms, such as bilateral and multi-lobar glass ground opacifications (mostly posteriorly and/or peripherally dispersed). As a result, chest computed tomography (CT) has been proposed as a feasible option for COVID-19 diagnosis. While RTPCR can take up to 24 hours and numerous tests to get clear findings, CT diagnosis can be substantially faster. However, there are substantial limitations to using chest CT: it is expensive, exposes patients to radiation, necessitates lengthy cleaning after images, and is dependent on radiologist interpretation.

Ultrasound imaging, a more generally available, cost-effective, safe, and real-time imaging method, has recently gained popularity. Lung ultrasonography (LUS) is increasingly being employed in point-of-care settings for the identification and treatment of acute respiratory diseases. In certain situations, it was more sensitive than a chest X-ray in identifying pneumonia. Clinicians have recently detailed the use of LUS imaging in the emergency room for COVID-19 diagnosis. The findings point to distinct LUS features and imaging biomarkers for COVID-19 patients, which might be utilized to detect these individuals as well as regulate the respiratory effectiveness of mechanical ventilation. Because of its broad range of applicability and inexpensive cost, ultrasonic imaging is a highly beneficial tool when patient inflow surpasses the usual hospital imaging infrastructure capacities. It is also accessible to low- and middle-income nations because to its low price. However, interpreting ultrasound pictures can be difficult and error-prone due to a high learning curve.

1.1 EXISTING SYSTEM

The existing system suggests us the previous works done in a specific domain, where we can refer to and get ideas from. Many farming or agriculture assistance systems have been implemented or proposed focused in only a particular aspect or crop.

In a research paper, the scholars proposed a system to predict the amount of fertiliser needed for a specific crop banana, as well as regression methods for future plantations using Neural Networks. Nitrogen (N), phosphorus (P), and potassium (K) are the three most important soil nutrients for crop growth. The amount of NPK in the soil varies depending on where you live. The requirements for each crop differ as well. In this paper, a model is built to recommend the amount of fertiliser needed for the banana crop [1].

In a different paper proposed system's goal is to assist farmers in cultivating crops for higher yield. The crops chosen for this work are based on important crops from the chosen location. Rice, Jowar, Wheat, Soyabean, Sunflower, Cotton, Sugarcane, Tobacco, Onion, Dry Chili, and other crops have been chosen. Crop yield data is compiled from various sources over the last five years. Scholars proposed the system in 3 steps: a. Soil Classification b. Crop Yield Prediction and c. Fertilizer Recommendation [2].

A paper published at IEEE predicts the yield of nearly all types of crops grown in India. This script is novel because it uses simple parameters such as state, district, season, and area to predict crop yields in whatever year the user desires. The paper predicts yield using advanced regression techniques such as Kernel Ridge, Lasso, and ENet algorithms, as well as the concept of Stacking Regression to improve the algorithms [3].

Rainfall regimes, P application rates, soil P content, and field management practices such as field bund and open ditch construction can all influence phosphorus losses in rice-wheat cropping systems. Heavy rainfalls shortly after P applications, in particular, cause significant P loss, and P loss increases with increasing P application rates and soil P content. During the rice-growing season, P concentrations in field ponding water regulate P concentrations in surface runoff. The construction of open ditches can increase phosphorus loss during the winter wheat growing season. As a result, we propose that rice-wheat cropping systems be managed to avoid heavy rain events while also balancing crop P removal (20–30 kg P ha–1 in this study). Furthermore, appropriate water management practices are recommended, such as increasing the capacity of field ponding water or using controlled irrigation in conjunction with natural drying of the field rather than open ditches during the wheat growing season [4].

1.2 PROBLEM STATEMENT

COVID-19 is now affecting numerous nations throughout the world, including India. A few nations, like India, the United States, Germany, Italy, and others, are dealing with its spread in the community transfer phase, which means that one infected individual can infect more than 100 persons with whom he comes into touch. So, the approach is to identify sick people and place them in quarantine to prevent further transmission. Existing diagnosis processes for identifying the infected individual are time-consuming, which slows diagnosis when dealing with a high number of cases. As a result, to address this issue, we devised a methodology that can efficiently categorize COVID-19 positive and negative situations ahead of time. The aim is to use an automated machine learning-based model to categorize persons as COVID-19 positive or COVID-19 negative. As an input parameter, the model uses X-ray pictures that depict the disease's early symptoms.

2. PROPOSED SYSTEM

ML models have long been utilized in a variety of applications requiring the identification and prioritization of peril factors. To deal with forecasting issues, several prognostication methodologies are extensively utilized. Deep learning (DL) has shown utilizable in medical imaging, and during the recent COVID-19 outbreak, some research has commenced to investigate DL-predicated solutions for the enhanced diagnosis of lung quandaries. This work emphasizes the application of DL techniques for the interpretation of lung ultrasonography (LUS) images, as well as the faculty of ML models to estimate the number of upcoming COVID-19 patients. which is now regarded as a possible threat to humanity. In this experiment, two conventional deep learning models, RCNN and CNN, were utilized to anticipate the threatening elements of COVID-19. The project's results show that it is a promising mechanism for utilizing these technologies in the current context of the COVID-19 pandemic. For prognostication, this study employs an incipient amalgamation technique. For training, many types of data sets are employed, which boosts the precision of our project.

3. SYSTEM ARCHITECTURE

Algorithms Used:

- RCNN
- CNN

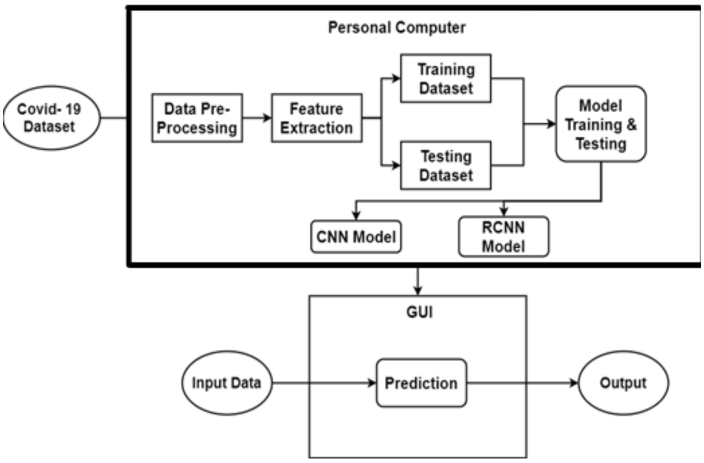


Fig- 1 : Block diagram of Proposed System

4. PROPOSED METHODOLOGY

This project may be divided into three major steps: data processing, model training, and prediction. The primary

prediction technique based on input data is based on an image dataset.

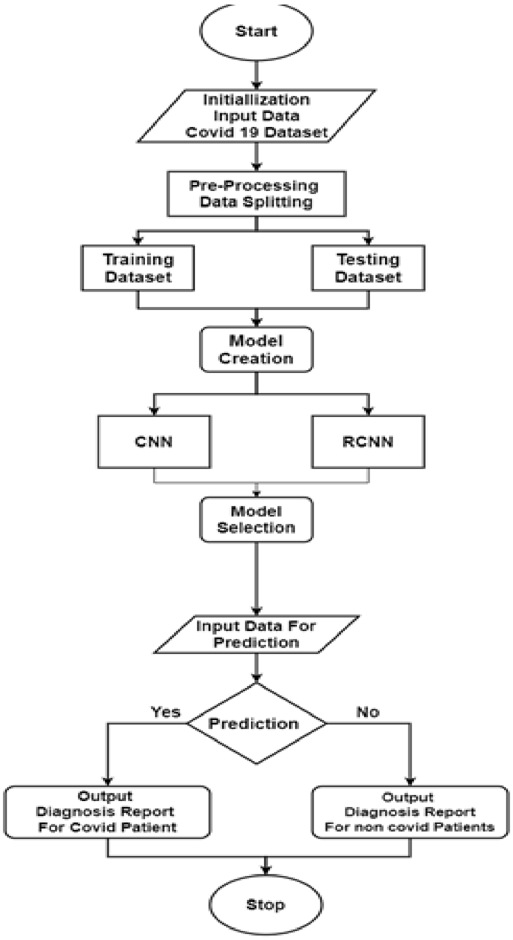


Fig – 2 : System Design

Data Preprocessing: The picture dataset received from the GitHub repository is utilized for the first phase data processing. The collection contains scanning pictures of covid and non-covid patients. Each dataset is divided into training and testing datasets for further processing. Following pre-processing, the dataset is sent into deep learning algorithms for model training.

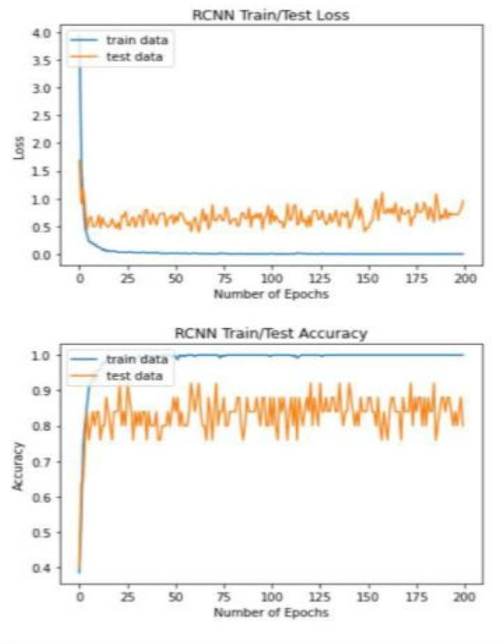
Deep learning is performed on a computer using the Python programming language. The data set can be fed into the system to be processed. The supplied image is filtered, and its features extracted. The model was trained using the TensorFlow artificial intelligence module.

Model Training: The second stage is model training. For training purposes, two types of model generation algorithms are used: CNN and RCNN. After building models using dataset supporting characteristics, they are all compared for correctness.

Model Selection: The model that was built is stored for prediction. Prediction is the third phase. A graphical user interface (GUI) is designed to facilitate user interaction.

Input data for Prediction: This GUI includes choices for adding a picture as input, selecting a prediction model, and seeing the expected result. The user can provide scanned image data of a patient, and our technology will forecast whether the patient is affected by covid.

5. OUTCOMES



Graph -1 : Graphical Representation of Loss during training & Accuracy of result

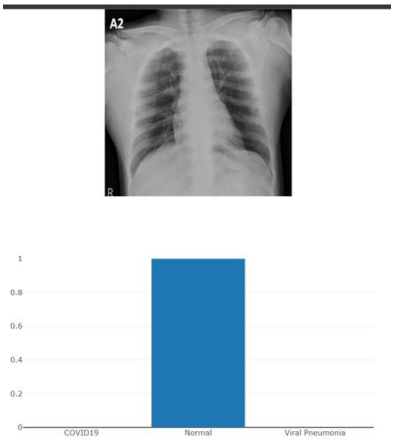


Fig – 3 : Selected image & it's prediction for Non Covid X-ray

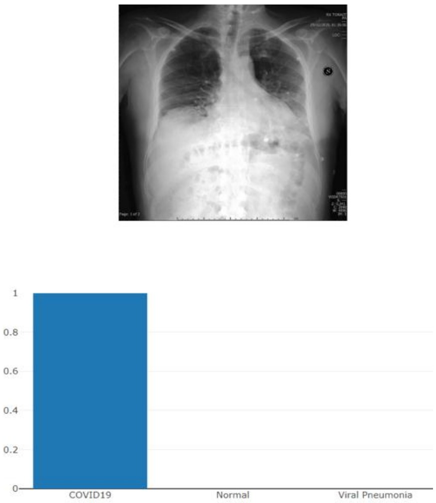


Fig – 4 : Selected Image & Prediction for Covid infected X-ray

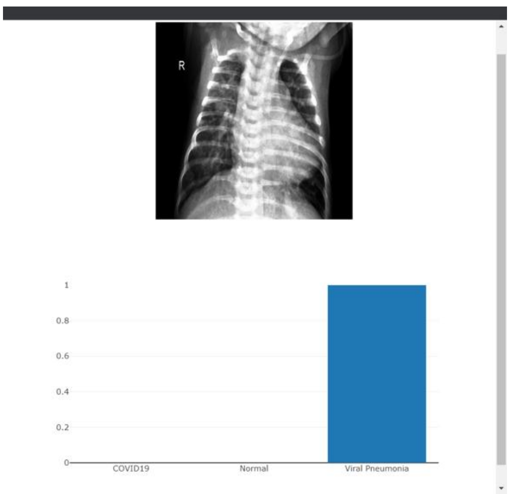


Fig – 5 : Selected Image and prediction for Viral Pneumonia

6. CONCLUSION

In this paper, we present an ensemble based DeQueezeNet model comprised of DenseNet121 and SqueezeNet1.0. The model's performance is evaluated by applying it to X-ray images to predict COVID-19 positive and negative instances. The performance measures of accuracy, precision, and recall are used to evaluate performance. The confusion matrix demonstrates that the suggested approach can accurately detect COVID-19 positive and negative situations. The model's relevance is indicated by its appropriate accuracy and high precision. A comparison study is also conducted using current work on the performance criteria. In which it is noted that the performance of the suggested model is much superior, indicating the model's relevance. Furthermore, it demonstrates that the suggested model is best suited for identifying COVID-19 positive and negative situations.

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