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ANTICIPATION OF COVID-19 DISEASE USING HYBRID CNN BASED CLASSIFICATION FOR DEEP LEARNING APPLICATIONS

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ABSTRACT
One of the most deadly and destructive illnesses affecting individuals today is the corona virus assault, often known as COVID-19. Due to communal transmission, the Corona virus infection has spread throughout the whole world. Early disease detection, even in asymptomatic situations, with accurate diagnosis, may reduce the patient's death rate. Therefore, it is crucial to develop an autonomous detection system that, with its quick and precise results, stops the spread of the corona virus. Computed tomography (CT) and chest X-ray pictures are two common medical imaging modalities used to identify COVID-19 patients and offer an early prognosis. To identify hidden patterns, deep learning techniques from the medical field are applied. In this study, convolutional neural networks (CNNs) are used to extract the chest's X-ray properties for prediction. Predictions are created utilising patterns created from patient data in order to improve the health plan. The properties of the chest X-ray image are fused to the CNN model training, which assists in classification development. When assessing the model's performance during testing, generalised data are taken into account. The suggested CNN-based algorithms outperform existing cutting-edge classification methods in terms of categorization and illness prediction.

Keywords: Covid-19, feature extraction, CNN model, prediction

1. INTRODUCTION
The COVID-19 epidemic, which started in December 2019, has killed more than 800,000 people worldwide and infected more than 20 million more [1]. On January 30, 2020, the World Health Organisation declares COVID-19 a worldwide health emergency. (WHO). CT imaging of the chest can help in the clinical diagnosis of COVID-19. However, the number of people suffering from the corona virus is rapidly increasing due to a shortage of radiologists and medical professionals. The classification of COVID-19-assisted CT images of the chest requires the creation of automated algorithms [2]. The COVID-19 classification with chest classification makes use of a number of beneficial machine learning approaches. [3]. In some circumstances, an efficient risk prediction model provides precision medicine recommendations for adjusting clinical therapy to each patient's needs, therefore extending the time to full recovery. Allowing the emergency department can improve patient flow and decrease waiting times [4]. Predicting patient outcomes requires extensive study utilising a variety of data sources, including radiographic, laboratory, and clinical information. A recent study on COVID-19 prognosis/risk prediction methodologies revealed that the majority of writers are biassed for one of two reasons, despite the fact that some of them have reported optimistic outcomes [5].
Due to the frequent emergence of major issues in patients and the use of first clinical encounters, there is a lack of clinical follow-up data for many published studies addressing the inaccurate categories used by the machine learning. [6]. The second problem is that a lot of studies are unable to use recent clinical data in their study and instead rely on measurements of the most recent predictor that are now available

from electronic medical records. Artificial intelligence (AI) is utilised to address a wide range of complex problems [7].
The thinking, learning, planning, information representation, and searching are among the AI subfields. The Deep Learning (DL) and Machine Learning (ML) algorithms, which are branches of AI, produce intelligent models for the aim of recognising a certain job. The main branch of AI that requires the least amount of expertise to solve problems is ML, which is characterised by statistical models and a new algorithmic modelling mindset. The next significant model after this ML is the DL subset of ML. In previous years, several individuals have used DL algorithms.
But a lot of data is required to solve it. The fact that these ML and DL methods are being applied in a number of studies in the technological, medical, and military sectors [8] is promising. These disciplines in the conflict also presented ML and DL approaches based on cutting-edge AI not long after the COVID-19 crashed. In order to help emergency departments swiftly and effectively analyse CT scans and calculate COVID-19 patient risk levels, a computational approach based on machine learning is developed in this study.

Machine learning methods to use for covid-19

The machine learning discipline has made amazing development during the last ten years. The combination of ML and deep learning techniques greatly increases computational capability [9]. Consequently, a number of applications are embracing the machine learning concept. The main use of machine learning in the fight against it may be the COVID-19 pandemic. With the use of machine learning, several researchers are investigating numerous tactics to tackle COVID-19 [10]. The many machine learning applications cover a wide spectrum of challenges related to the virus. For instance, COVID-19 diagnostic employs ML and DL to analyse medical pictures, protects medical staff members from patients who are impacted, and determines the severity of the patient's condition so that subsequent treatment may be determined.Models for the accurate prediction of disease outbreaks are built using social media data and COVID-19 case data. These models also learn the transmission list and the impacts of the transmission path [11]. The employment of the ML and DL in public surveillance and epidemic prevention is quite similar to that of airport security inspections, when patients are recognised and epidemics are detected [12].
In the COVID-19, four different types of machine learning algorithms are employed.

1. Medical diagnostics
2. Contac tracking
3. Drug development
4. Forecasting

The number of new infections was appropriately predicted by the deep learning algorithms. Recurrent neural networks outperform conventional methods like ARIMA models for forecasting time series [13]. Recurrent neutral networks were used by researchers to anticipate the frequency of new infections and the spread of illnesses as well as to take into consideration changing long-short-term memory networks [14]. As a result, it is the machine learning model's most important application.
It is possible to employ computer vision to improve medical diagnostics. Human accuracy scores are nearly on par with machine learning models in many photo recognition tasks. Therefore, using the COVID- 19 patient chest Xray images, the image recognition software can unquestionably recognise the symptoms of a virus. The only means to identify or diagnose the virus is through a costly technique for chest X-ray scans, but many countries do not currently have suitable medical facilities for testing.
According to earlier research, utilising the deep leaning techniques, COVID-19 may be identified based

on the chest X-ray picture with an accuracy of 99%. With the use of artificial intelligence and clever contact tracing, authorities may locate individuals who have been infected with viruses. By using various artificial intelligence-based software systems, investigations have been done to track the transmission of viruses. For new discoveries in several domains, researchers have used machine learning algorithms as a guide [15]. In order to produce novel medications, chemical compositions are examined with the use of variation auto encoders. Making a COVID-19 vaccine may be possible by using the already available flu vaccinations in auto encoders. An earlier study found that COVID-19 could be accurately recognised from a chest X-ray image with 99% accuracy by using deep leaning techniques. Authorities may find people who have been infected with viruses by using artificial intelligence and deft contact tracking. Investigations on the spread of viruses have been conducted utilising a variety of AI-based software systems. Researchers have employed machine learning algorithms as a roadmap for new discoveries in several fields [15]. Chemical compositions are evaluated using variation auto encoders in order to create new drugs. Using the flu vaccines that are presently accessible in auto encoders may make it possible to create a COVID-19 vaccine. An earlier study found that COVID-19 could be accurately recognised from a chest X-ray image with 99% accuracy by using deep leaning techniques. Authorities may find people who have been infected with viruses by using artificial intelligence and deft contact tracking. Investigations on the spread of viruses have been conducted utilising a variety of AI-based software systems. Researchers have employed machine learning algorithms as a roadmap for new discoveries in several fields [15]. Chemical compositions are evaluated using variation auto encoders in order to create new drugs. Using the flu vaccines that are presently accessible in auto encoders may make it possible to create a COVID-19 vaccine.

2. HYBRID CNN BASEDCLASSIFICATION

The suggested CNN uses X-ray images that were taken from the COVID Lung dataset. The framework for the COVID-19 illness approach's hybrid CNN-based categorization and prediction is shown in Fig. 1 below. In the suggested framework, there are two modules: preprocessing and CNN.

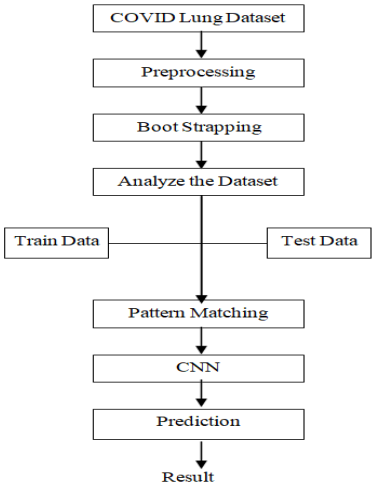

Fig. 1: Hybrid CNN Based Classification

COVID Lung Dataset

The X-ray datasets are extracted using two datasets in this approach. The 79 photos at Dataset (2020) are divided between the viral pneumonia and bacterial pneumonia in dataset 1. On Kaggle, Dataset 2 contains 28 images of average people and 78 images of COVID-19 patients. The quantity of the training

dataset affects the performance of deep learning models. The COVID-19 data set is quite tiny compared to the enormous dataset used by deep learning models, making it impossible to calculate the generality and toughness of these models. The Keras Image Data Generator class is used to resolve this issue by fusing the CNN network with massive X-ray images. The settings for image augmentation are defined by the image generator class made available by Keras. The capabilities of Keras include shift, random rotation, dimension reordering, whitening, and fips.

Data Pre-processing
The real-life information contains a significant quantity of noisy data as well as missing data. Therefore, it is necessary to remove these noisy data through the pre-processing step in order to make accurate predictions. The suggested model's framework is depicted in Fig. 1. The data that was gathered also includes missing information and noise. Filling in the missing numbers and eliminating the noise yields efficient and precise outcomes. The activities involved in transformation include aggregation, normalisation, and smoothing, which alter one type of data into another type of data.

Boot strapping
The block exposes the programmable parameters, which may be changed between 0.1 and 1.0.

Analyze the Dataset
Daily sliding window analysis of confirmed cases is required for the first and second peak as well as beginning point detection. The conclusion of the probability distributions parameters is based on the work done at the simulator's core. Through supervised learning, the intervention effectiveness score is calculated, and it is also used to determine the population of research data.

Pattern Matching
Validation, testing, and training are the three components that are separated from the images, and this may be done in the pattern matching block. This pattern matching may be used to detect the patterns of image data by conducting pattern creation on the training data and comparing the patterns of the test data with the trained history data. The trained model is evaluated using the validation set, which is split into 5 folds after being separated into 5 smaller sections. Choose one of these five folds to use as training data, and the other four to use as test data.

Convoultional Neural Network (CNN) The proposed CNN model has 38 layers in total, including 6 dropout layers, 6 max pooling levels, 6 convolutional (Conv2D) layers, 8 batch normalisation layers, 8 activation function layers, 3 fully connected layers, and 1 flatten layer. For the CNN model's input, a picture with the form (150, 150, 3)—i.e., an RGB image 150 by 150—is employed. All Con2D layers use a 3 3 size kernel after increasing it every two Con2D layers.
The binary classification of CNN uses the binary cross entropy (BCE) loss function. Only one output is required for data classification because it is a binary classification from two provided classes. Give the output value to the sigmoid activation function in the case of a BCE loss function. The sigmoid activation function's output ranges from 0 to 1. The actual class mistakes and projected class errors are found using the sigmoid activation function. To reduce learning model losses, the "Adam" optimizer is employed to modify the learning rate and attribute weight.
Predictions
The suggested technique is simulated using the intervention effectiveness ratings in order to determine

the intervention's future relative impact. After becoming familiar with the simulation settings, this may be done for a particular nation or people. Scores for effectiveness are based on illness progression patterns throughout time, such as the second peak in June.

3. RESULTS

The performance indicators used for this study's evaluation include precision, accuracy, F-score, recall, specificity, sensitivity, and AUC. The aforementioned performance measurements are defined by four terms: True Negative (TN), True Positive (TP), False Negative (FN), and False Positive (FP). Positive in this context means that the patient has a positive test result, while negative means that the patient has a negative test result. Therefore, it is evident that the term FP designates a patient who is not ill but whose test results are positive, whereas TP designates a patient who is ill and whose results are negative. Similar to how FP designates patients with negative reports who do not have any diseases whereas FN designates patients with negative reports who have.

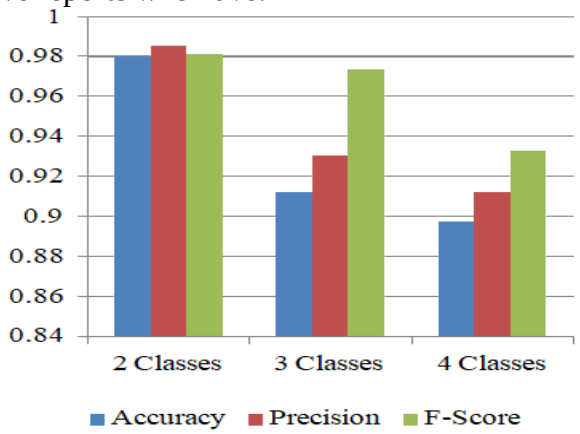

Fig. 2: CNN Performance Analysis

Fig. 2 illustrates the proposed method of CNN performance analysis for categorizing and forecasting COVID-19 disorders. It can be demonstrated that for the three scenarios—that is, for the 2 classes, 3 classes, and 4 classes as well—more than 90% accuracy is attained. As indicated in the figure, the improved Precision and F-score values are also attained.

Table1: Comparative Analysis of Performance Metrics For The Classifiers

Model	Classes	Accuracy	Precision	F-Score
Proposed CNN	2	0.9802	0.9851	0.9812
	3	0.9123	0.9306	0.9735
	4	0.8975	0.9123	0.9328
VGG16	2	0.9768	0.9806	0.9793
	3	0.8895	0.9216	0.9523
	4	0.8751	0.8924	0.9131

CONCLUSION

Utilizing the chest's X-ray images Deep learning and convolution neural network-based classification are utilized in this study to separate COVID-19 sufferers from healthy people. Calculating the generality and robustness of these models is impossible since the COVID-19 data set is so small in comparison to the huge dataset utilized by deep learning models. The CNN network and huge X-ray pictures may be combined to tackle this issue using the Keras Image Data Generator class. Many classes (as 2, 3, and 4)

are used to assess CNN's performance, including healthy individuals, COVID-19 patients, people with bacterial pneumonia, and people with viral pneumonia. F-score values, precision, and accuracy are only a few of the metrics used in models like AlexNet, VGG16, and the suggested CNN model for performance evaluation. It is evident from the findings that the CNN model performs better than other models.

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