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Implementation of Hybrid Prediction Model for Covid19 Using Machine Learning

Kalyani Dahikar[1], Sangram Dandge[2], Dr. Vaishali Deshmukh[3]
[1, 2, 3]*Department of Computer Science and Engineering, Prof Ram Meghe Institute of Technology and Research Badnera*

Abstract: ***Due to the increase in the number of patients who died as a result of the COVID-19 virus around the world, researchers are working tirelessly to find technological solutions to help doctors in their daily work. Quick and correct computing (AI) techniques are required to help doctors in their decisions to predict the severity and mortality risk of a patient. Early prediction of patient severity would facilitate in saving hospital resources and reduce the continual death of patients by providing early medication actions. Currently, X-ray pictures are used as early symptoms in detecting COVID-19 patients. Therefore, in this research, a prediction model has been built to predict different levels of severity risks for the COVID-19 patient based on X-ray images by applying hybrid machine learning approach which predict the COVID-19 disease. In this research first the features are extracted with the help of GLCM algorithm. Then in first approach the COVID-19 disease get predicted with the help of SVM and CNN algorithm. In second approach the COVID-19 disease get predicted by combining SVM and CNN algorithm.***

Keywords: **machine learning; prediction model; COVID-19; CNN; Hybrid Approach;**

I. INTRODUCTION

Predicting the severity risk of any disease at an early stage is a crucial task and has many effects, like reducing the mortality rate, consuming hospital resources, and supporting doctors in their decision making. In the current critical period, during the spread of corona virus around the world and the increasing number of patients and deaths. This paper presents a COVID-19 prediction model that based on X-ray images. Here we used X-ray images as early symptoms for detecting COVID-19 patients. this paper presents a hybrid machine learning approach which predict the COVID-19 disease. In this research first the features are extracted with the help of GLCM algorithm. Then in first approach the COVID-19 disease get predicted with the help of SVM and CNN algorithm. In second approach the COVID-19 disease get predicted by combining SVM and CNN algorithm.

II. RELATED WORK

Tiwari et al. [1] attempted to predict the Covid-19 spread pattern in India using Covid-19 epidemic patterns in China. AI-based techniques can also help the health care professionals in the early detection of disease by correlating the patient symptoms. The authors proposed a forecasting model for predicting affirmed, recouped, and passing cases based on publicly available data (January 22 to April 3) 2020. The forecasting model utilized the timeseries prediction method. The impacts of Covid-19 were predicted for the third and fourth week of April 2020. The forecasting model was developed, using WEKA.

Marino et al. [2] made a similar attempt to predict the Covid19 spread pattern in Italy, one of the earliest affected countries. Rahman et al. [3] predicted Covid pandemic's pattern in Bangladesh. Densely populated areas made this contagious disease more challenging, such as the countries in South Asia. Sharma et al. [4] presented a thorough discussion on the challenges of Covid-19 in South Asia. Apart from predicting spread patterns, machine learning can also help detect affected Covid-19 patients.

Vaishya et al. [5] discussed the importance of AI-based techniques in detecting, monitoring, and tracing Covid-19 cases. Real-time monitoring can help health departments to take advanced measures to counter the spread. Tariq et al. [6] proposed a real-time prediction of spread pattern for Covid-19 in Singapore. Deb and Majumdar [7] proposed a time-series method that analyzed the number of Covid-19 episodes and the frequency pattern. They worked on diverse strategies and performed statistical analyses to analyze the flare-up patterns to highlight the current epidemiological stage of a locale so that the distinctive approaches can be recognized to address the Covid-19 widespread in several nations. As per the current circumstance, it is vital to get the disease cases' early spread patterns to arrange and control the successful safety measures.

Kucharski et al. [8] built a basic SARS-CoV2 transmission model by utilizing diverse data sets to ponder the Covid-19 situation within Wuhan's and surroundings. This model analyzes the conceivable spread of Covid-19. Recently, several studies have been conducted using exploratory data analysis (EDA) based on the available data sets on the epidemiological outbreak of Covid-19, and

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many researchers are trying to work on the Covid-19 outbreak. The main objectives of these studies focus on the occurrence of confirmed cases, deaths, and recovered cases in Wuhan and throughout the world to understand the incredible threats and upcoming planning for such areas [9].

Tuli et al. [10] have used the Robust Weibull model having iterative weighting for fitting generalized Inverse Weibull distribution. They have predicted the growth behavior of Covid-19 and compared the results with the Gaussian model. The above discussions reflect that AI and machine learning-based techniques have been used to identify/detect Covid-19 cases and their associated details. Still, the Covid-19 prediction is in its preliminary phase. With the change in disease symptoms and its associated information, a continuous effort is required to improve machine learning based forecasting models' performance.

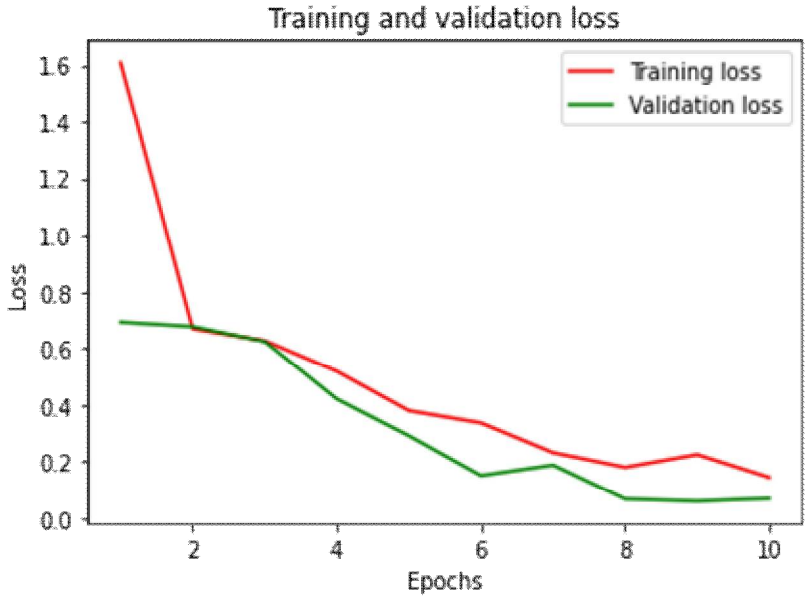
III. METHODOLOGY

In order to use the data (X-ray images) that collect to develop practical artificial intelligence (AI) and machine learning solutions. Then system makes the data which is suitable for machine learning model. After that the features are extracted from raw data with the help of gray-level co-occurrence matrix (GLCM)algorithm . useful data will be ready for further processing. The t x-ray images are divided into training and testing dataset. Then SVM, CNN and Hybrid(CNN+SVM) models are trained over training image dataset. After that tha accuracy will be calculated for all generated models and hybrid approach model shows the highest accuracy.

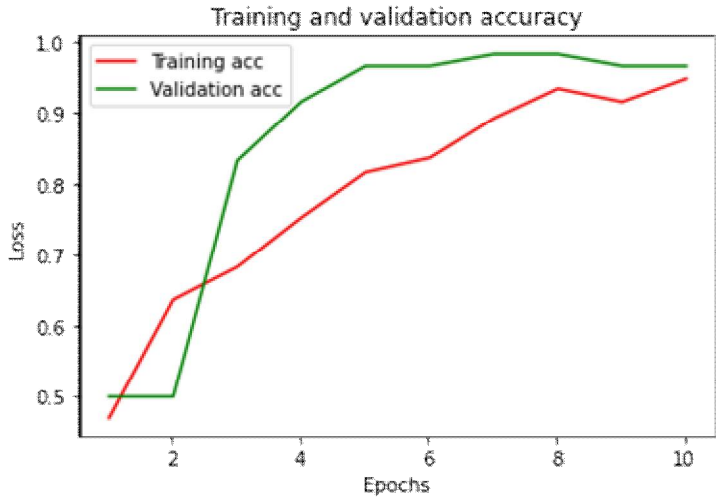
IV. RESULT ANALYSIS

The total chest x-ray images are divided into training and testing dataset and experiment is carried out. In experiment SVM, CNN and Hybrid(CNN+SVM) models are trained over training image dataset. We calculated accuracy for all generated models and hybrid approach model shows the highest accuracy. We validated all three models for training and testing dataset which produced following results shown in graphs and tables below:

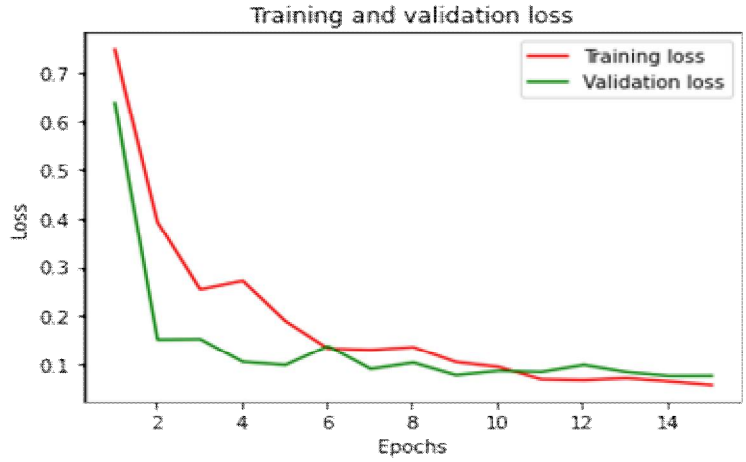
The training loss is a metric used to assess how a deep learning model fits the training data. That is to say, it assesses the error of the model on the training set. Note that, the training set is a portion of a dataset used to initially train the model. Computationally, the training loss is calculated by taking the sum of errors for each example in the training set. On the contrary, validation loss is a metric used to assess the performance of a deep learning model on the validation set. The validation set is a portion of the dataset set aside to validate the performance of the model. The validation loss is similar to the training loss and is calculated from a sum of the errors for each example in the validation set. The graphs for training and validation loss and accuracy for CNN and Hybrid(CNN+SVM) model is shown. Graph 1 describes Training and Validation loss of CNN algorithm. Graph 2 describes training and validation accuracy of CNN algorithm. Graph 3 describes training and validation loss of CNN+SVM algorithms. Graph 4 describes training and validation accuracy of CNN+SVM Algorithms.



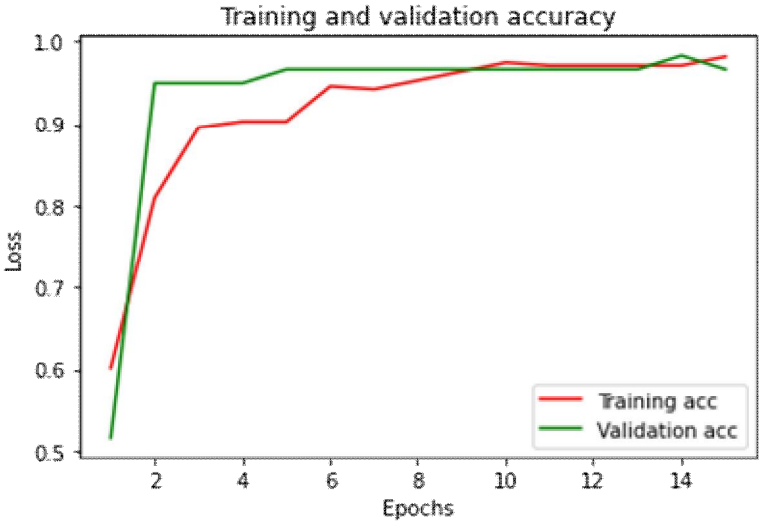
Graph 1: CNN Training and Validation loss



Graph 2: CNN Training and Validation Accuracy



Graph 3: CNN-SVM training and validation loss



Graph 4: CNN-SVM training and validation accuracy

The accuracy of all three models are evaluated for training and validation dataset and results are summarized in table 1. It shows that proposed hybrid approach out performs SVM and CNN.

	SVM	CNN	CNN+SVM
Training Dataset Accuracy	**84.58**	**96.77**	**98.92**
Testing Dataset Accuracy	**93.33**	**94.66**	**96.67**

Table 1: Training and Testing Accuracy

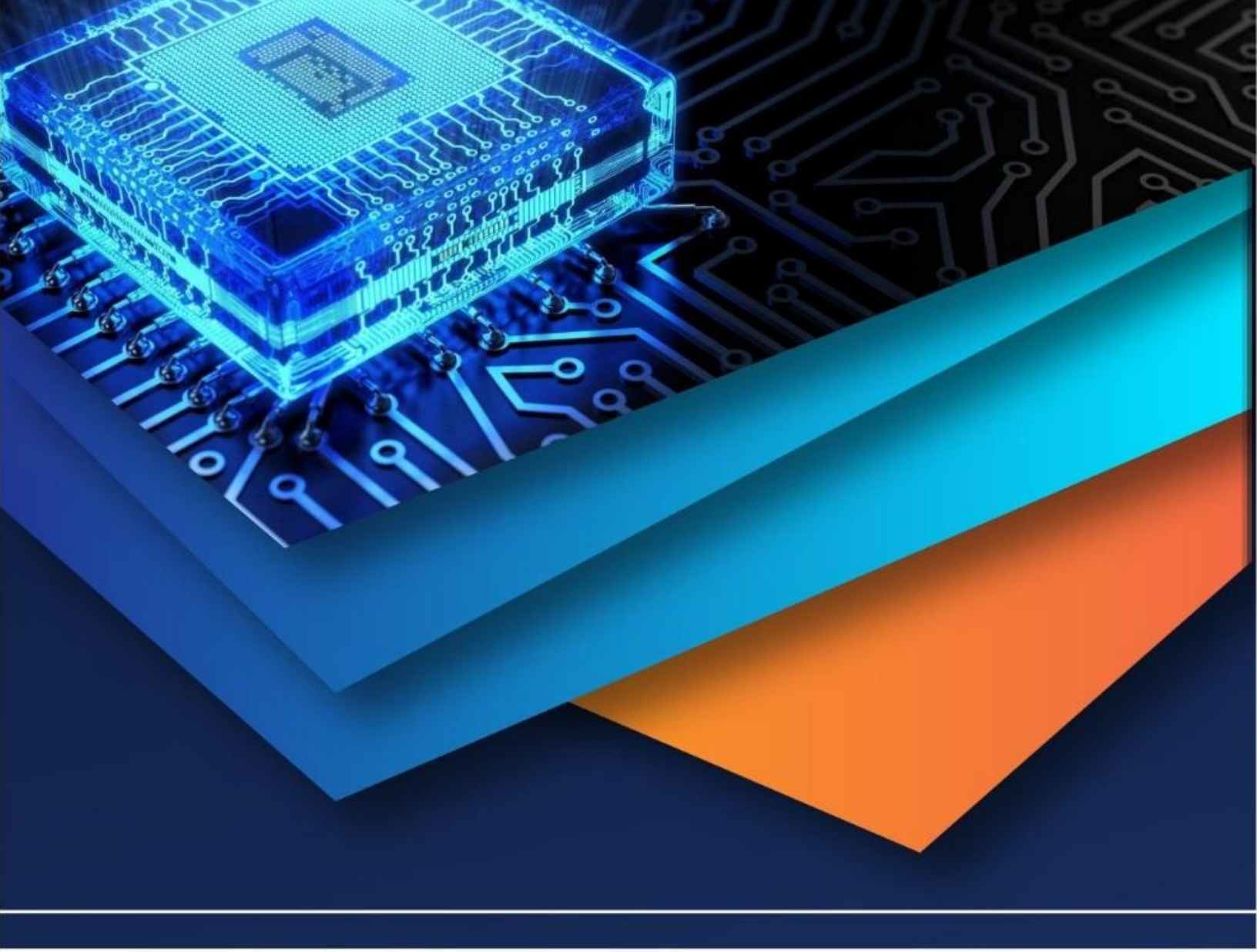
V. CONCLUSION

COVID-19 is a serious infected spread disease like any other wide-spread diseases. Because of the rapid rise in the number of cases during pandemic, causes struggle in healthcare sector to identify suitable and appropriate treatment. Machine Learning methodologies are commonly used as alternative methods for classification and prediction. In this dissertation, hybrid approach is used for the prediction of disease. In the first approach this dissertation extracted the features with GLCM algorithm. And then in second approach the COVID -19 get predicted with CCN and SVM. This study helps us to understand and stop the serious wide spread situation by utilizing the most common features that directly affects the spread of disease. This also serves the purpose of humans in predicting the disease that impacts the disease spread abnormalities and high recovery ratio. We have successfully predicted covid-19 scans, and it shows the possible scope of applying such prediction methodologies in future to perform dieses diagnosis work. In future, this generated model can be validated against new X-ray images data that is made public.

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