DETECTION OF COVID, PNEUMONIA AND NORMAL THROUGH CHEST X-RAYS USING MACHINE LEARNING AND IMAGE PROCESSING

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Abstract—This study presents a machine learning approach utilizing convolutional neural networks (CNNs) for the prediction of COVID-19, pneumonia, and normal chest X-ray images. Through the integration of Flask and Postman, a user-friendly web interface is developed, enabling users to upload X-ray images for classification. Leveraging Flask's framework, the trained CNN model is deployed, providing real-time predictions on the uploaded images. This streamlined system offers a rapid and accurate method for diagnosing COVID-19, pneumonia, and normal cases from chest X-ray images, facilitating efficient triage and medical decision-making.

Keywords—Machine Learning, CNN, Flask, Postman.

Introduction-The emergence of the COVID-19 pandemic has highlighted the critical importance of accurate and timely diagnosis in combating infectious diseases. Chest X-ray imaging has been widely utilized as a primary diagnostic tool for identifying respiratory conditions, including COVID-19 pneumonia. However, manual interpretation of X-ray images by healthcare professionals can be time-consuming and prone to subjective interpretation, especially in high-demand situations such as a pandemic. To address these challenges, machine learning (ML) techniques, particularly Convolutional Neural Networks (CNNs), have shown promise in automating the diagnosis of respiratory diseases from chest X-ray images. By leveraging ML algorithms, these systems can rapidly analyse large volumes of medical imaging data and provide accurate predictions, aiding clinicians in making timely treatment decisions. This study focuses on the development of an ML-based system for the prediction of COVID19, pneumonia, and normal cases from chest X-ray images. The system integrates advanced ML models with web-based technologies, including Flask and Postman, to create a userfriendly interface accessible to healthcare professionals. The objectives of this research are twofold: first, to develop a CNN model capable of accurately classifying chest X-ray images into COVID-19, pneumonia, or normal categories, and second, to deploy the trained model within a web application framework for real-time prediction and evaluation. The proposed system has the potential to revolutionize the diagnosis and management of respiratory diseases by providing a rapid and reliable tool for frontline healthcare workers. By automating the analysis of chest X-ray images, the system can expedite the identification of COVID-19 cases, facilitate appropriate treatment strategies, and optimize healthcare resource allocation. In this paper, we present the methodology, implementation, and evaluation of our ML-based system for the prediction of COVID-19, pneumonia, and normal images using chest X-rays. We discuss the dataset preparation, model development, integration with Flask and Postman, and the potential impact of our system on clinical practice. Additionally, we highlight the challenges and future directions in this field, emphasizing the importance of ongoing research and collaboration to enhance the accuracy, scalability, and accessibility of ML-driven diagnostic tools for respiratory diseases.

Technologies: Machine Learning using Python,
Flask for Front-End Development
Platforms: Anaconda – jupyter for machine learning and Flask
Libraries: NumPy, Pandas, Scikit-learn The goal of the proposed system is to offer an automatic system to detect the covid-19,pneumonia and normal using the chest x-rays.

I. LITERATURE SURVEY (RELATED WORK)

The authors have proposed a COVID-19 detection system. Deep learning models coupled with the Social Mimic Optimization algorithm have been employed for this purpose. X-ray images serve as the input for this system. Despite achieving high accuracy, the validation of the model on diverse datasets and its decision interpretability remained inadequately explored. This study represents a significant advancement in the field of medical imaging for COVID-19 detection, leveraging cutting-edge deep learning techniques. However, further investigation is needed to ensure the robustness and generalizability of the model across different patient demographics and clinical scenarios. [1]

Another noteworthy paper offers a review of deep learning methodologies used in COVID-19 detection and diagnosis. Despite summarizing different approaches, the paper lacked original research and standardized evaluation metrics. The review provides valuable insights into the current landscape of deep learning applications in combating the COVID-19 pandemic, highlighting the need for more rigorous evaluation and validation protocols in future research endeavours. [2]

Wang, Lin, and Wong's article presented a tailored deep convolutional neural network architecture for COVID-19 detection from chest X-ray images. While demonstrating high sensitivity and specificity, concerns were raised about its generalization to diverse populations and clinical settings. This work represents a significant contribution to the development of AI-based diagnostic tools for COVID-19, emphasizing the importance of addressing issues related to model generalizability and scalability in real-world healthcare settings. Further research is warranted to enhance the clinical utility and reliability of such deep learning models in routine clinical practice. [3]

II. System implementation (Methodology)

Image acquisition or capturing is the first step in any image processing application. The camera captures image of leaves and saves them in formats such as.PNG,.JPG,.JPEG and so on Image preprocessing: Image preprocessing is used to create a more appealing and complete version of the captured image. Then system employs the following image preprocessing steps:

RGB image to grayscale image conversion

The image has been resized.

The image has been filtered.

Image Conversion from RGB to Grayscale

Feature Extraction:

In the CNN model, convolutional layers automatically perform feature extraction by convolving learned filters over input images, capturing hierarchical representations of features like edges and textures. Pooling layers down sample and reduce dimensionality. Activation functions associated with convolutional layers aid in feature extraction during forward pass. Through backpropagation, the model adjusts filter weights to extract relevant features for classifying input images into categories like COVID-19, pneumonia, and normal.

Detection and Classification:

Model evaluation was conducted post-training by inputting pre-processed test images into the trained CNN model. Predictions were generated and compared with ground truth labels to compute metrics like accuracy, precision, recall, and F1-score. This process assessed the model's generalization to unseen data and its classification accuracy across classes (COVID-19, pneumonia, normal). Objective evaluation guided further refinement or deployment. Additionally, a confusion matrix visualized the distribution of true positive, true negative, false positive, and false negative predictions, enhancing understanding of the model's performance in chest X-ray classification.

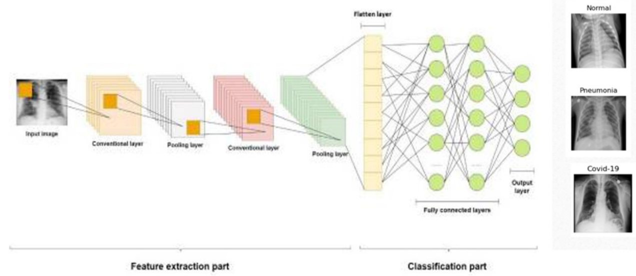

Fig.1.Architecture of The Model

III. Experiments & results

After machine is trained successfully with selected model. It should check for accuracy with test data. If results are accurate then our model is ready for deployment. The results of our system as follows:

The Machine learning model which will tell us the uploaded chest x-ray of patient is normal or having pneumonia or covid. For this, a dataset is required which can be downloaded from the Mendeley website where the dataset is organized into 2 folders (train, test). In this we have three subfolders namely COVID, Pneumonia and Normal .CNN will give 94% accuracy.

IV. Evaluation metrics

We measure the performance of our multiple disease prediction using confusion matrix. Though there are other measures like precision, recall, F1 score here in our model we used confusion matrix to test the performance.

V. Conclusion

The development of accurate models for detecting COVID-19, pneumonia, and normal conditions from chest X-rays holds promise for medical diagnosis. Advancements in model architecture and integration of clinical data show potential for improved diagnostic accuracy. Future research should prioritize enhancing interpretability, robustness, and real-time deployment capabilities, necessitating collaboration among machine learning experts, radiologists, and healthcare professionals. These advancements have the potential to revolutionize medical imaging diagnostics and enhance patient care outcomes.

VI. Future work

While our current model primarily addresses COVID-19, pneumonia, and normal conditions in chest X-rays, future iterations aim to broaden its applicability by incorporating additional disease categories. By expanding the model's scope, we anticipate enhanced diagnostic capabilities for a wider range of respiratory illnesses. This evolution will not only bolster diagnostic accuracy but also contribute to more comprehensive patient care. Collaboration among researchers, clinicians, and machine learning experts will be pivotal in refining the model and ensuring its effectiveness in diverse healthcare settings. Ultimately, these advancements hold the potential to revolutionize medical imaging diagnostics, improving patient outcomes on a broader scale.

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The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page

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