Pulmonology Department:

This report aims to explore the application of deep learning techniques to analyze Chest X-ray images, assisting doctors in diagnosing respiratory diseases. The primary focus of this project is to classify Chest X-ray images into two categories: Normal and Pneumonia, which are crucial for identifying respiratory infections.

The project initially achieved a remarkable 99% accuracy using the EfficientNet B0 model, a state-of-the-art deep learning architecture that has shown great promise in image classification tasks. This model was selected for its efficiency and high performance in handling medical imaging data. In the next phase, the model was improved by utilizing a Kaggle dataset, which is divided into three parts: Train, Test, and Validation. Each of these parts contains 4 folders, representing different categories: Normal, COVID-19, Pneumonia, and Tuberculosis. These categories are essential in distinguishing various types of lung conditions, which aids in better diagnosis and treatment planning.

The data preparation process involved constructing a DataFrame for both the training and testing datasets. Each row in the DataFrame contains information about the image path, image width, image height, and the label associated with each image. This structured approach helps streamline the model’s training process and ensures that the data is correctly formatted for deep learning tasks.

Next, an Exploratory Data Analysis (EDA) was performed on both the training and testing datasets to better understand the data distribution. This analysis included plotting the distribution of each class (Normal, Pneumonia, etc.) to check for any imbalances in the data, which could affect the model’s performance. Additionally, the distribution of image width and height in the dataset was examined, providing insights into the variations in image dimensions, which are crucial for image resizing and preprocessing.

Next Steps:

The next step in the project was to concatenate the Train and Test DataFrames into a single unified DataFrame. This allowed for easier data management and preprocessing. The images were then converted to RGB format to standardize their color channels, ensuring compatibility with the model. To meet the input requirements of the EfficientNet B0 model, each image was resized to 224x224 pixels, which is the expected input size for this model.

Further EDA was performed on the combined dataset to gain a deeper understanding of the overall data distribution, ensuring the model would be trained on a representative sample of the data. Following this, the data was split into X_train (input features) and y_train (target labels), preparing it for training. The dataset was then divided into separate Train and Test sets, ensuring that the model would be able to generalize well to unseen data. To facilitate training, One-Hot Encoding was applied to the labels, converting categorical labels into a binary matrix suitable for model input.

With the data fully prepared, the EfficientNet B0 model was trained on the data, achieving 99% accuracy in classifying the Chest X-ray images into the relevant categories. The model’s performance was thoroughly evaluated using a Confusion Matrix, which helped assess the model’s ability to correctly classify images and identify areas for improvement. Key performance metrics such as Accuracy, Precision, and Recall were calculated, providing a comprehensive evaluation of the model’s effectiveness in diagnosing the conditions.

Finally, a function was developed to test the trained model, generating predictions based on new data. This function also produced a detailed medical report, summarizing the results and providing actionable insights to assist doctors in making informed decisions regarding the diagnosis and treatment of patients.