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A Modified CNN Models for Pneumonia Detection Using Deep Learning Framework

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***Abstract*—A large percentage of people get pneumonia, a viral illness, particularly in developing and impoverished nations where there is a lack of healthcare infrastructure, pollution, and crowded, unhygienic living circumstances. Pericardial effusion, a condition where fluid accumulates in the chest and causes difficulty breathing, is brought on by pneumonia. Rapidly identifying the existence of pneumonia is a challenging step in order to increase survival chances and acquire therapeutic services. One area of artificial intelligence that is used in the effective creation of prediction models is deep learning. The most popular method of diagnosing pneumonia is X-ray tomography, while there are other methods as well, such as pulse oximetry and CT scans. However, analyzing chest X-rays (CXR) is a challenging procedure that is vulnerable to subjectivity. In this study, two CXR image datasets were used to train a deep learning (DL) model for the detection and classification of pneumonia. The Convolutional Neural Network approach is used in this study's classification procedure. The CNN method was chosen for this study's classification because it can automatically and independently extract features, allowing the data to be used without the need for pre-processing. This allows the data to still yield high-quality extraction features and accurate classification results.**

***Keywords*—Chest X-Rays, Deep Learning (DL), Convolutional Neural Network (CNN), Res Net , CT-scan and MRI imaging.**

I. INTRODUCTION

Numerous pathogens, including bacteria, viruses, fungi, and parasites, may cause pneumonia, a dangerous lung infection that can impact one or both lungs. The illness causes inflammation in the lungs' air sacs, which may fill with pus or fluid and impede the flow of oxygen into the blood. Cough, fever, chills, trouble breathing, chest discomfort, exhaustion, and sometimes nausea are the symptoms that result from this. Particularly among susceptible groups including the elderly, young children, those with compromised immune systems, and people with long-term respiratory conditions, pneumonia may vary in severity from mild to fatal [10].

Antibiotics are usually used to treat bacterial pneumonia, which is brought on by bacteria such as Staphylococcus aureus, Haemophilus influenzae, or Streptococcus pneumonia. Antibiotics may not be effective for viral pneumonia, which may be caused by influenza, respiratory syncytial virus (RSV), or corona viruses like the one that causes COVID-19. In these cases, supportive care or antiviral medications may be required [11].

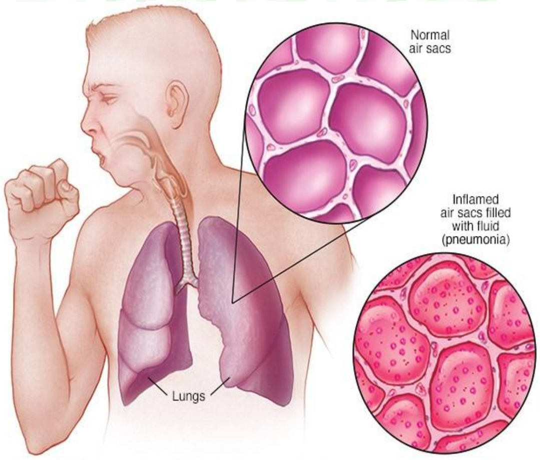

Fig. 1 Pneumonia

Pneumonia is often categorized according to its location and cause. The most prevalent kind, community-acquired pneumonia (CAP), occurs outside of medical facilities. Hospital-acquired pneumonia (HAP) happens during a hospital stay and is often caused by bacteria resistant to antibiotics, whereas healthcare-associated pneumonia (HCAP) may develop in persons who have had close contact with healthcare surroundings. A form of HAP known as ventilator-associated pneumonia (VAP) primarily affects people who have spent a lot of time on a ventilator [15].

When germs reach the lungs by the circulation, aspiration, or inhalation, the pathophysiology of pneumonia starts. Once within the lungs, these microorganisms cause inflammation in the alveoli—tiny air sacs where gas exchange takes place—by inciting an immunological reaction. Normal lung function is disrupted by the collection of fluid, cells, and debris caused by inflammation. The immune reaction may be more severe in cases of bacterial pneumonia, leading to consolidation, in which the buildup of exudate causes the afflicted lung tissue to solidify and become rigid. Inflammation may be broader and more extensive in viral pneumonia, often impacting both the lung tissue and the airways [12][13].

Age, smoking, alcohol use, long-term health issues including diabetes, heart disease, and asthma, as well as compromised immunity from illnesses like HIV or chemotherapy, are risk factors for pneumonia. Living situations, such as in congested areas, and environmental variables, such as air pollution, might further raise the risk. Young children and the elderly are particularly vulnerable to pneumonia since their immune systems may not be as strong. Additionally, inhaling food, liquids, or vomit into the lungs may result in illnesses like aspiration pneumonia, which often affects people with neurological impairments or swallowing issues [17].

A combination of clinical evaluation, history collection, and diagnostic procedures such chest X-rays, blood and sputum cultures, and sometimes a CT scan are used to diagnose pneumonia. These tests aid in determining the causal agent, confirming the existence of pneumonia, and directing the proper course of therapy. In order to assist doctors decide on the right degree of therapy, the severity of the illness is often evaluated using instruments such as the CURB-65 score or the Pneumonia Severity Index (PSI), which include variables including age, vital signs, and concomitant disorders [19].

The etiology of the illness determines how to treat pneumonia. Antibiotics are often used to treat bacterial pneumonia; the medication selection is dependent on the presumed infection and patterns of local resistance. Antiviral drugs may be recommended for viral pneumonia, especially if influenza or the respiratory syncytial virus is the origin of the illness. To assist control symptoms, supportive therapies including oxygen therapy, fluids, and painkillers are often used. Patients may need to be admitted to the hospital in severe instances, and in the worst situations, mechanical ventilation may be required to help with breathing [20].

Pneumonia may be prevented by immunization and lifestyle modifications. Important preventative measures include vaccinations such as the yearly flu shot, which helps prevent influenza, and the pneumococcal vaccine, which guards against Streptococcus pneumonia. Frequent hand washing and appropriate coughing technique are two examples of good hygiene habits that can stop the spread of respiratory diseases. Quitting smoking is essential since it affects the lungs and makes one more susceptible to illnesses.

II. Proposed Method

This study follows an experimental research method, to achieve the objective of this thesis. A study that follows a scientific research strategy is known as experimental research. The goal of experimental research is to find a link between two variables: the dependent and independent variables. A correlation between a specific property of an entity and the variable being researched is either supported or rejected when an experimental research study is completed. so, in this thesis, the research is conducted to determine the availability of disease or not on mammogram images.

To do this, the process flow that is shown in Figure 2 is used, which comprises three primary steps.

Machine learning, particularly image classification techniques using deep learning models, offers a promising solution for automating the detection of pneumonia from chest X-ray images. This project aims to develop a machine learning-based system capable of classifying chest X-ray images into pneumonia-positive or normal categories with high accuracy and minimal diagnostic delay. The proposed solution should be robust, sensitive, and specific, with the potential to support clinical decision-making and improve healthcare outcomes, especially in under-resourced settings.

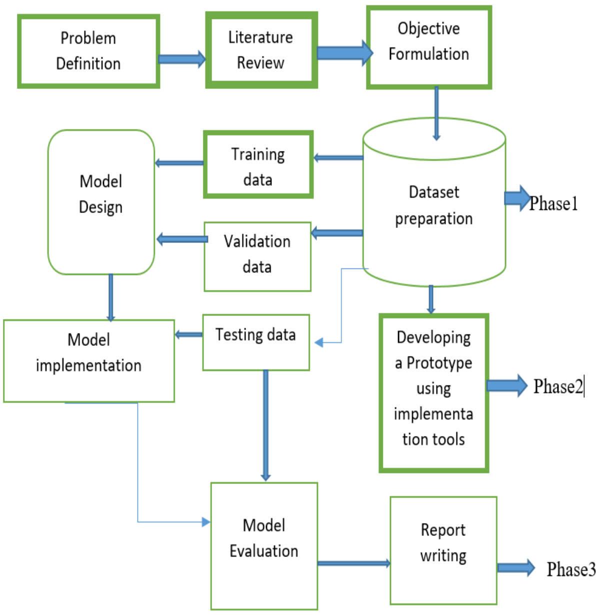

Fig. 3 Research Flow Model

A. *Data Preparation*

Obtaining the data necessary to train the neural network model is crucial if we wish to use neural networks or deep learning algorithms in our research. Breast cancer mammography imaging data are the primary input for the model in this thesis. However, there isn't a publicly accessible database with thousands of breast cancer photos of Ethiopian women that we could obtain and use to train the algorithm. So, we collected mammogram images of breast cancer from hospitals in Ethiopia with the help of Physicians and medical experts. All diseased and healthy images are collected from a Korean hospital.

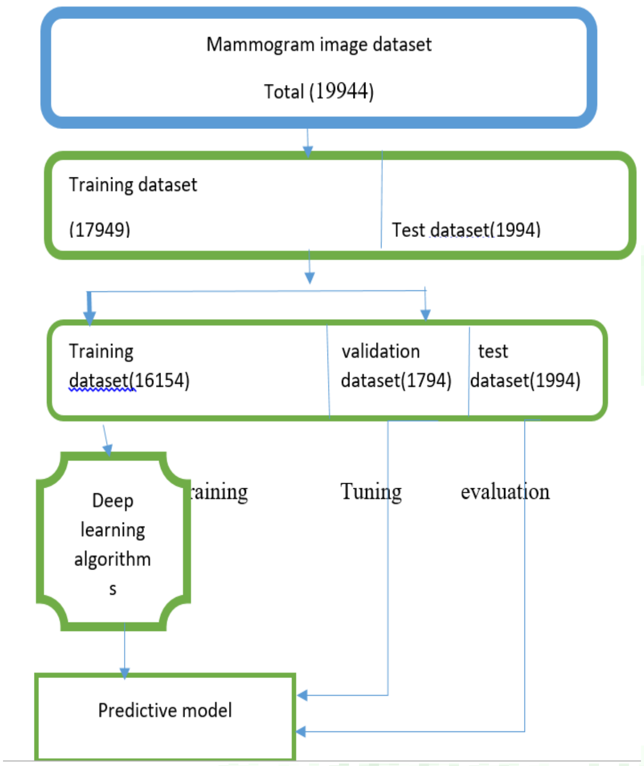

Fig. 4 Data Partitioning.

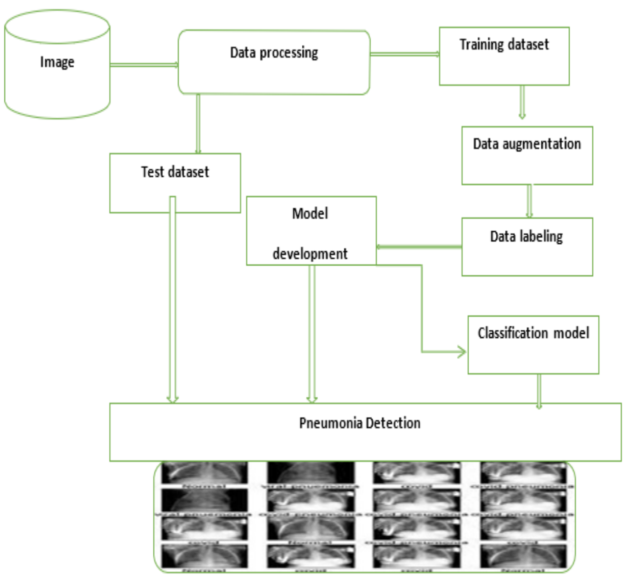

Fig. 5 the proposed Architecture for Pneumonia Detection

```
model =tf.keras.models.sequential([
        tf.keras.layer.conv2D(16,(3,3),activation='relu', input_shape=(417,417,3))
        tf.keras.layers.maxpooling2D(2,2),
        tf.keras.layers.conv2D(32,(3,3),activation='relu'),
        tf.keras.layers.maxpooling2D(2,2),
        tf.keras.layers.conv2D(64,(3,3),activation='relu'),
        tf.keras.layers.maxpooling2D(2,2),
        tf.keras.layers.Flatten(),
        tf.keras.layers.Dense(512,activation='relu'),
        tf.keras.layers.Dense(1,activation='sigmoid')
])
model.compile(optimizer=RMSprop(lr=0.001, loss='binary-crossentropy', metrics=['acc']))
```

```
history= model.fit(training_set,
                epochs=30,
                verbose=1,
                validation_data=
                validation_set)
```

Fig. 6: CNN model

III. Simulation & Result

In this section the result or outcomes of Convolutional Neural Network (CNN) method. After data cleaning and preprocessed of the above data set apply the deadheartbeads provides a comprehensive analysis of building a Convolutional Neural Network (CNN) model to detect pneumonia from chest X-ray images.

Testing results

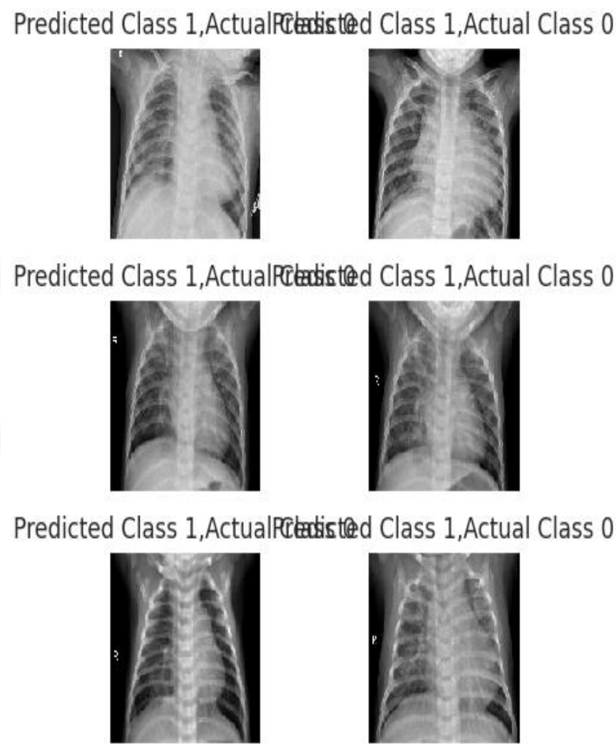

Fig.7 Testing results set X-ray Images

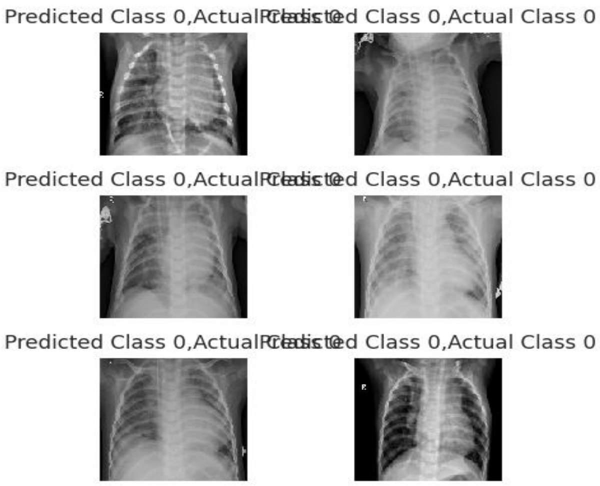

Fig. 8 Testing results set X-ray Images

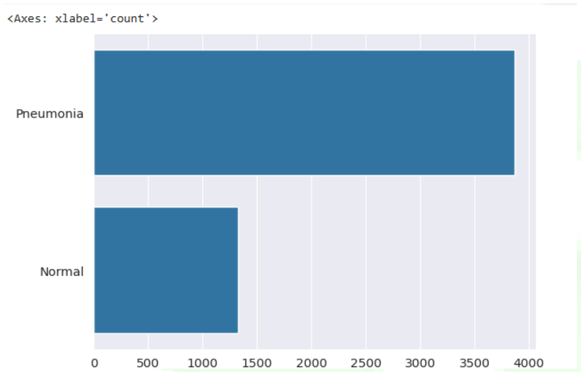

Fig.9 Dataset Amount of X-ray Images

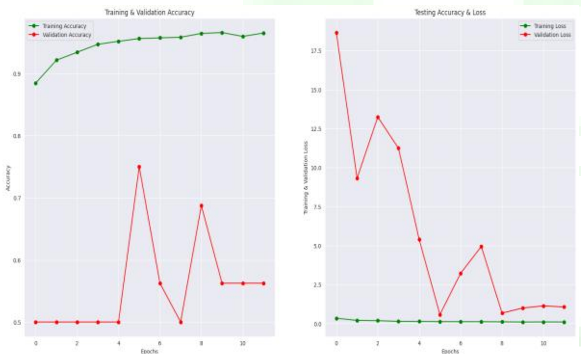

Fig.10 Plotting of Training & Validation Accuracy and Testing Accuracy & Loss

5.4 Confusion Matrix

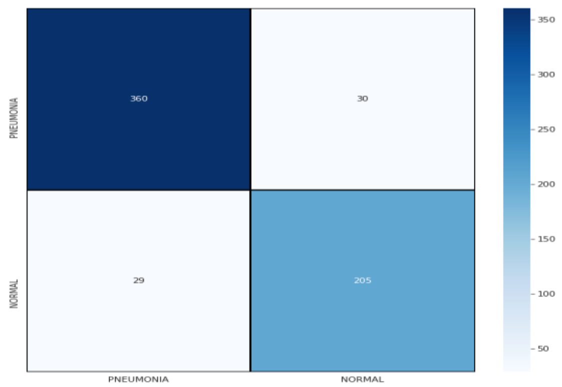

Fig. 11 Confusion Matrix

Result Accuracy

In the above section discuss the accuracy result compression of Convolutional neural network algorithm. The resultant accuracy of proposed work is near around 91.19%.

Table I The values of precision of classification made on real time dataset

	precision	Recall	f1-score	support
Normal (Class 1)	0.85	0.88	0.87	234
Pneumonia (Class 0)	0.93	0.91	0.92	390

IV. CONCLUSION

The use of deep learning algorithms to diagnose pneumonia from medical pictures has shown great promise for improving clinical decision-making's precision, speed, and effectiveness. When it comes to identifying pneumonia symptoms from chest X-rays and CT images, Convolutional Neural Networks (CNNs) and other deep learning models have shown exceptional performance, often outperforming conventional diagnostic techniques. In our proposed work we have use the real time dataset and our presented work shows the outstanding accuracy result. The resultant accuracy of proposed work is near around 91.19%.

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