

## APPLICATION OF CNN MODEL ON MEDICAL IMAGE

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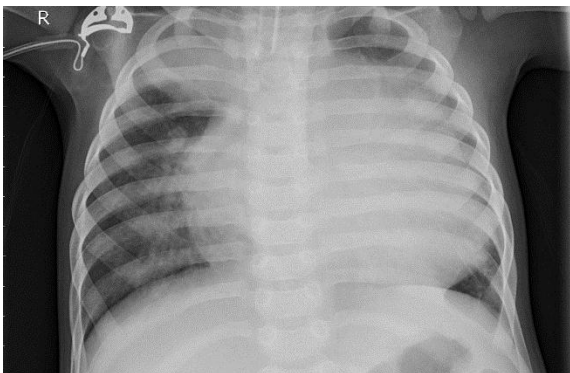
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**Abstract** - There have been several studies that have used deep learning techniques to detect disease from medical images such as chest X-rays or CT scans. These techniques involve training a model on a large dataset of labeled images, where the model learns to recognize patterns and features that are indicative of disease related to chest infection. One example of a study that used deep learning for this purpose was published in the journal Radiology in 2017. In this study, the authors trained a convolutional neural network (CNN) on a dataset of chest X-rays and found that the CNN was able to accurately classify images as normal or infected with an AUC (area under the curve) of 0.97. Another example is a study published in the journal Chest in 2018. The authors found that their model had an accuracy of 89.6% and an AUC of 0.94. Overall, the use of deep learning and for disease detection shows promising results and has the potential to improve the accuracy and efficiency of the diagnosis process.

**Key Words:** Deep Learning, CNN, Chest X-Ray Images.

### 1. INTRODUCTION

Traditionally, Various diseases have been diagnosed using clinical symptoms, physical examination, and imaging tests such as chest X-rays. However, these methods can be subjective and may not always provide accurate results.



Deep learning technique offer a potential solution to improve the accuracy and efficiency of disease diagnosis. These techniques involve training a model on a large dataset of labelled images, where the model learns to recognize patterns and features that are indicative of diseases related to chest. One approach that has been widely used is transfer learning, which involves pre- training a model on a large dataset and then fine-tuning it on a smaller, specific dataset for a particular task.

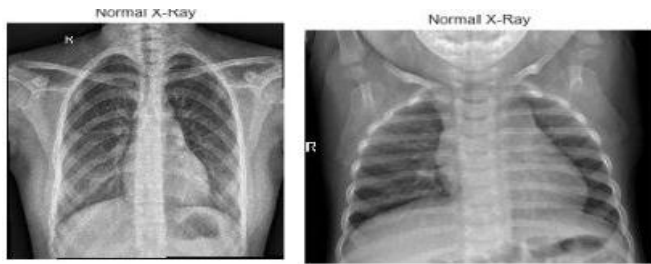
CNN Architectures has been applied to disease detection using chest X-rays with promising results. For example, a study published in the journal Radiology in 2017 used a convolutional neural network (CNN) trained on a large dataset of chest X-rays and found that the CNN was able to accurately classify images as normal or Disease with an AUC (area under the curve) of 0.97.

Overall, the use of deep learning for disease detection using chest X-rays as the dataset shows promise as a way to improve the accuracy and efficiency of diagnosis and has the potential to benefit patients and healthcare systems.

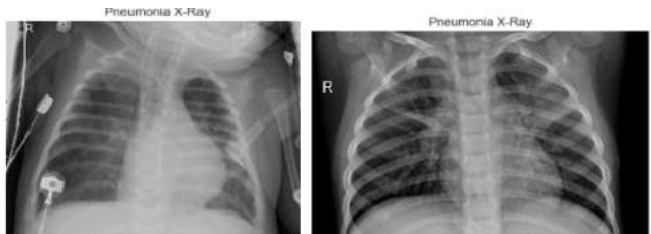
### 2. DATASET

**The Lung Infection in Chest X-ray Images dataset:** This dataset contains over 3453 chest X-ray images. It has been widely used in research studies. Overall, these datasets provide a diverse range of chest X-ray images that can be used to train and evaluate models for disease detection.

Chest X-ray images (anterior-posterior) were selected from retrospective cohorts of pediatric patients one to five years old from Guangzhou Women and Children's Medical Center, Guangzhou. Analysis of chest x-ray images was done on all chest radiographs that were initially screened for quality control by removing all low-quality or unreadable x-ray images. The diagnoses for the images were then graded by two expert physicians before being cleared for training in the AI system. To check the grading errors, the evaluation set was confirmed by a third expert.



**Fig-1:** Normal CXR Images



**Fig-2:** Infected CXR Images

### 3. METHODOLOGY

The methodology for using deep learning techniques to detect and predict disease varies depending on the specific approach and datasources used. Here is a general outline of the steps that may be involved in this process:

1. Data collection: A dataset of chest X-ray images is obtained, such as the Lung Infection in Chest X-ray Images, which consists of a large number of labeled images with various chest diseases. The dataset includes both "Disease" and "Normal" categories.
2. Data preprocessing: The chest X-ray images are preprocessed to enhance the quality and prepare them for model training. Preprocessing steps may include resizing the images, normalizing pixel values, and augmenting the data to increase the diversity and quantity of the training set.
3. Model selection: Suitable and deep learning models are chosen for the disease detection task. Commonly used models include convolutional neural networks (CNNs) and transfer learning models. It involves utilizing pre-trained models on large datasets and fine-tuning them on the specific chest X-ray dataset.
4. Model Training: The selected model is trained using the preprocessed chest X-ray images. The training process involves feeding the images into the model, optimizing the model parameters through backpropagation, and minimizing the loss function.
5. Model Evaluation: The trained model is evaluated using a separate test set of chest X-ray images. Evaluation metrics such as accuracy, precision, recall, and area under the curve (AUC) are calculated to assess the performance of the model in detecting diseases accurately.

6. Model deployment: If the model performs well, it can be deployed in a clinical setting to assist with a disease diagnosis. This may involve integrating the model into a computer-aided diagnosis system or using it to generate a probability score that can aid decision-making.

Overall, the methodology for disease detection using deep learning involves a number of steps that require careful consideration and optimization to achieve good performance.

### 4. MODELS

Several types of deep learning models have been used for Disease detection. We have used the following methods for Disease detection:

#### 4.1 Convolutional neural networks (CNNs)

These are a type of deep learning models that are particularly well-suited for image classification tasks. They consist of multiple layers of interconnected nodes that are trained to recognize patterns and features in images. CNNs have been widely used for disease detection and have achieved good results in a number of studies.

We Build a separate generator for valid and test sets. We cannot use the same generator for the previously trained data because it normalizes each image per batch, meaning that it uses batch statistics. We should not be able to do batch tests and validations of data, because in the real-life scenario we don't process input images in a batch as it is not possible. We will have the advantage of knowing the average per batch of test data. That is why we need to do is to normalize input test data using the statistics functions from the training dataset.

#### 4.2 DenseNet

DenseNet is a type of convolutional neural network (CNN) that has been used for various image classification tasks, including disease detection. It was introduced in a paper published in the journal Computer Vision and Pattern Recognition in 2017. One of the key features of DenseNet is that it uses dense connectivity, which means that each layer in the network is connected to all of the preceding layers. This allows the network to learn more efficiently and reduces the risk of overfitting. There have been a number of studies that have used DenseNet for disease detection using chest X-ray images. For example, a study published in the journal Biomedical Signal Processing and Control in 2019 used DenseNet to classify chest X-ray images as normal or infected. Overall, DenseNet has shown good performance for disease detection using chest X-ray images and may be a promising approach for this task. However, it is important to carefully evaluate the performance of different models and choose the one that is most suitable for a particular dataset and task.







