**Pneumonia Detection Using CNN with PyTorch**

**Problem Statement**

Pneumonia is a lung infection that inflames the air sacs (alveoli), causing symptoms like cough, chest pain, fever, and difficulty breathing. It can range in severity and is usually caused by viruses or bacteria. Risk factors include conditions like COPD, asthma, diabetes, and a weak immune system. Diagnosis is based on symptoms, physical exams, and tests like chest X-rays and blood work. Pneumonia can be categorized based on where it was acquired, such as community- or hospital-acquired.

Pneumonia is a serious illness, and quick detection is crucial for treatment. This project aims to use deep learning to identify pneumonia in chest X-ray images using a convolutional neural network (CNN) in PyTorch.

**Context**

With more medical images available, using deep learning to analyze these images can help doctors diagnose pneumonia faster and more accurately. This project will train a CNN model to classify X-ray images as normal or pneumonia.

**Criteria for Success**

The project will be considered successful if it achieves the following:

* Achieves at least 90% accuracy in classifying X-ray images.
* Shows improvements over simpler models.
* Provides explanations for the model's predictions.
* Helps healthcare professionals make better decisions.

**Scope of Solution Space**

The solution space includes:

* Collecting and preparing chest X-ray images for analysis.
* Building a CNN model for image classification.
* Evaluating the model’s performance using accuracy and other metrics.
* Creating visual aids to help understand the model’s decisions.
* Developing a simple tool for healthcare providers to use the model.

**Constraints**

* The project relies on the quality of the available dataset.
* Model performance may vary based on the images used.
* Implementing the model in hospitals may require approvals.

**Stakeholders**

* Doctors and healthcare providers: Want to improve diagnosis and patient care.
* Radiologists: Looking for tools to assist in their work.
* Hospital management: Interested in new technologies to enhance services.

**Data Sources**

The main data source is the "Chest X-Ray Images (Pneumonia)" dataset from Kaggle, which contains images labeled as normal or pneumonia.

**Project Steps**

**Data Acquisition**: Download the dataset and prepare the images.

**Data Cleaning:** Process the images for consistency.

**Exploratory Data Analysis (EDA):** Examine the data to understand its distribution.

**Model Development:** Build and train a CNN model using PyTorch.

**Model Evaluation:** Test the model's accuracy and performance.

**Visualization:** Use tools to explain how the model makes predictions.

**Documentation**: Write up the findings and insights.

**Presentation**: Create a presentation to share results with stakeholders.