**Pneumonia and COVID Classifier – Report**

**1. Objective**

This project develops a **Convolutional Neural Network (CNN)** to classify chest X-ray images into three categories:

* **COVID-19**
* **Pneumonia**
* **Normal**

The system aims to support medical professionals in detecting respiratory diseases using imaging data.

**2. Dataset**

* Total images: **~4200 chest X-rays**
* Classes: **COVID-19, Pneumonia, Normal**
* Data split: **80% Training, 20% Validation** using ImageDataGenerator with augmentation (rescaling, rotation, shifting, zoom, shear, flips, brightness adjustment).
* **Dataset Source:** Chest X-Ray Images (COVID, Pneumonia, Normal) – Kaggle

**3. Model Architecture**

The CNN consists of:

* **Convolutional Layers** (32, 64, 128 filters) + **MaxPooling**
* **Flatten Layer**
* **Dense Layer** (128 units, ReLU)
* **Dropout (0.5)** to reduce overfitting
* **Output Layer** (Dense, 3 units, Softmax)

**Loss Function:** Categorical Crossentropy  
**Optimizer:** Adam  
**Metrics:** Accuracy

**4. Training Setup**

* **Epochs:** 20
* **Batch size:** 32
* **Steps per epoch:** 131
* **Callbacks:** Early stopping and checkpointing for stability

**5. Results (Epochs 13–20 excerpt)**

* Epoch 13 → **Accuracy:** 86.4% | **Val Accuracy:** 90.0% | **Val Loss:** 0.2945
* Epoch 15 → **Accuracy:** 87.2% | **Val Accuracy:** 91.9% | **Val Loss:** 0.2502
* Epoch 17 → **Accuracy:** 87.0% | **Val Accuracy:** 91.2% | **Val Loss:** 0.2469
* Epoch 19 → **Accuracy:** 87.6% | **Val Accuracy:** 91.4% | **Val Loss:** 0.2430
* Final Epoch 20 → **Accuracy:** 87.0% | **Val Accuracy:** 90.8% | **Val Loss:** 0.2594

**6. Conclusion**

The CNN successfully classifies chest X-ray images into the three categories with **validation accuracy peaking at 91.9%**. Data augmentation and dropout significantly improved generalization. These results demonstrate the effectiveness of deep learning in medical image classification.