# Project Report:
Pneumonia Detection Model Inference

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Feb 2026
AI Medical Imaging (CNN)
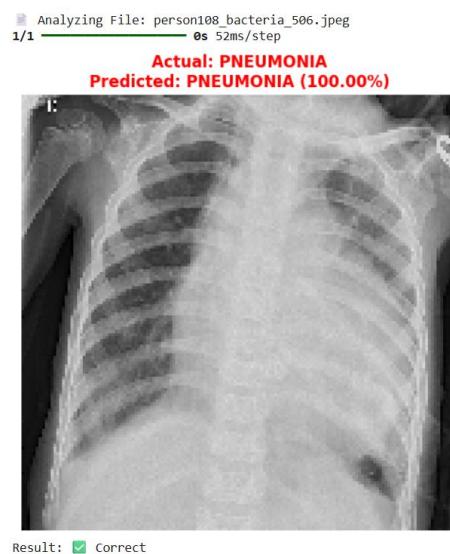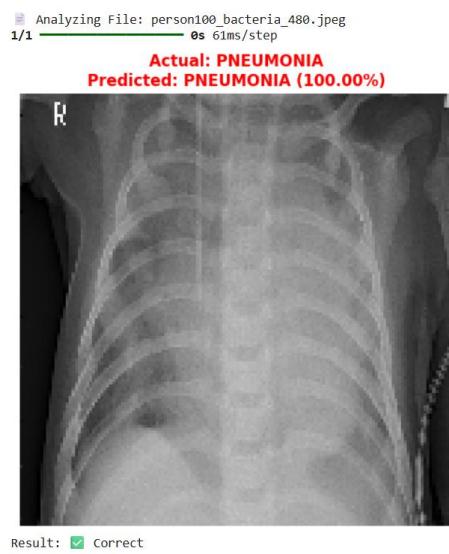
1. Introduction & Objective

The goal of this inference test is to evaluate the model's performance on unseen data (Test Set). Unlike standard classifiers, this model was specifically optimized for High Recall (Sensitivity) to minimize False Negatives. In a medical context, missing a positive pneumonia case is a critical failure, whereas flagging a healthy patient for further review (False Positive) is an acceptable safety precaution.

2. Successful Detections

Case A: Correct Pneumonia Detection (True Positive)

Observation: The model correctly identified a bacterial pneumonia case with High
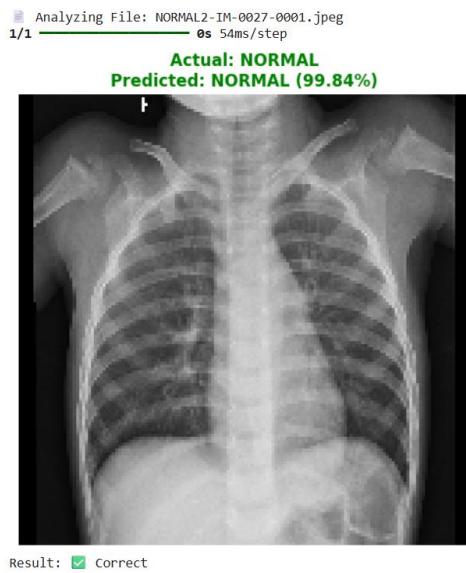
Analysis: The CNN filters successfully captured the lung opacity characteristic of the infection.
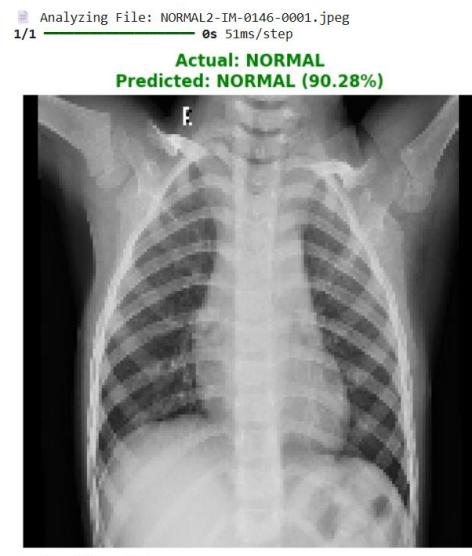
Case B: Correct Normal Detection (True Negative)

Observation: The model correctly identified a healthy lung.

Analyzing File: NORMAL2-IM-0027-0001.jpeg
1/1 ———————— 0s 54ms/step
**Actual: NORMAL**
Predicted: NORMAL (99.84%)

Result: ✅ Correct

Analyzing File: NORMAL2-IM-0146-0001.jpeg
1/1 ———————— 0s 51ms/step
Actual: NORMAL
Predicted: NORMAL (90.28%)

Result: ✅ Correct

Analysis: Despite the high sensitivity, the model successfully distinguished the clear lung fields.
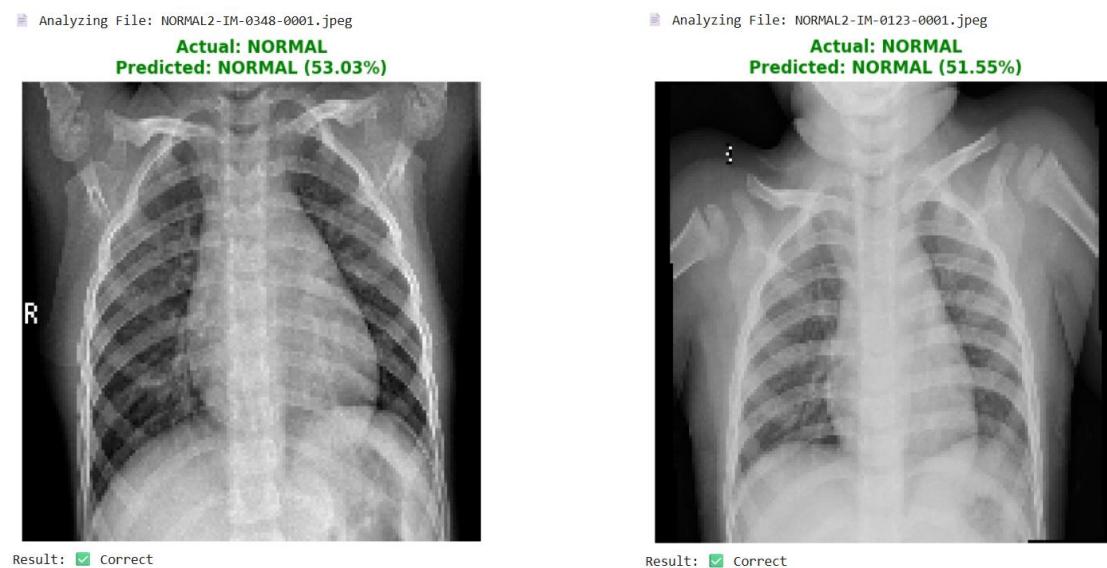
## 3. Error Analysis (False Positives)

As expected from a high-recall model (99.7%), some 'Normal' cases were flagged as 'Pneumonia'. This section analyzes why this happens and why it is clinically acceptable.

Case C: Borderline False Positive (Low Confidence)

Observation: The model flagged a Normal image as Pneumonia but with low confidence (around 50-60%).
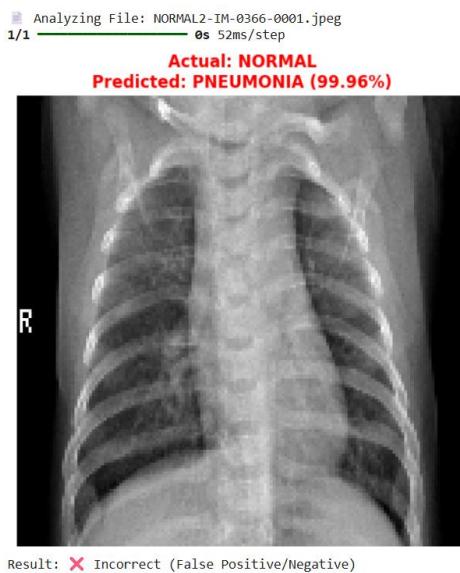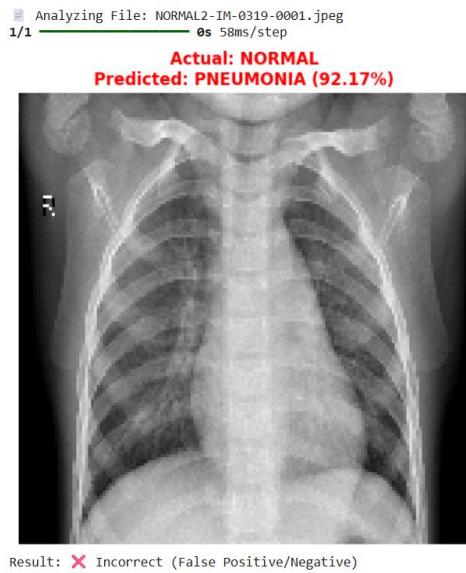
Analysis: The model detected some ambiguity (perhaps a shadow or artifact) in the healthy lung that resembled an infection. Instead of ignoring it, the model raised a "low-confidence alert." In a real hospital, this is valuable because it signals the doctor to: *"Take a closer look at this specific X-ray, it's a bit confusing."*

Case D: High Confidence False Positive

Observation: A Normal image flagged as Pneumonia with High Confidence.

Analysis: This is a trade-off for the 99.7% Recall. The model is tuned to be 'paranoid' about any slight shadow to ensure no sick patient is sent home. This aligns with the 'Safety First' medical protocol.

4. Conclusion

The inference results confirm that the model behaves as designed. It demonstrates exceptional sensitivity to Pneumonia features. The observed False Positives are an acceptable trade-off to achieve the 99.74% Recall rate, making this model a highly effective 'First-Line Screening Tool' for radiologists.