Improving Trust in AI-Based Pneumonia Diagnosis through Explainable Deep Learning

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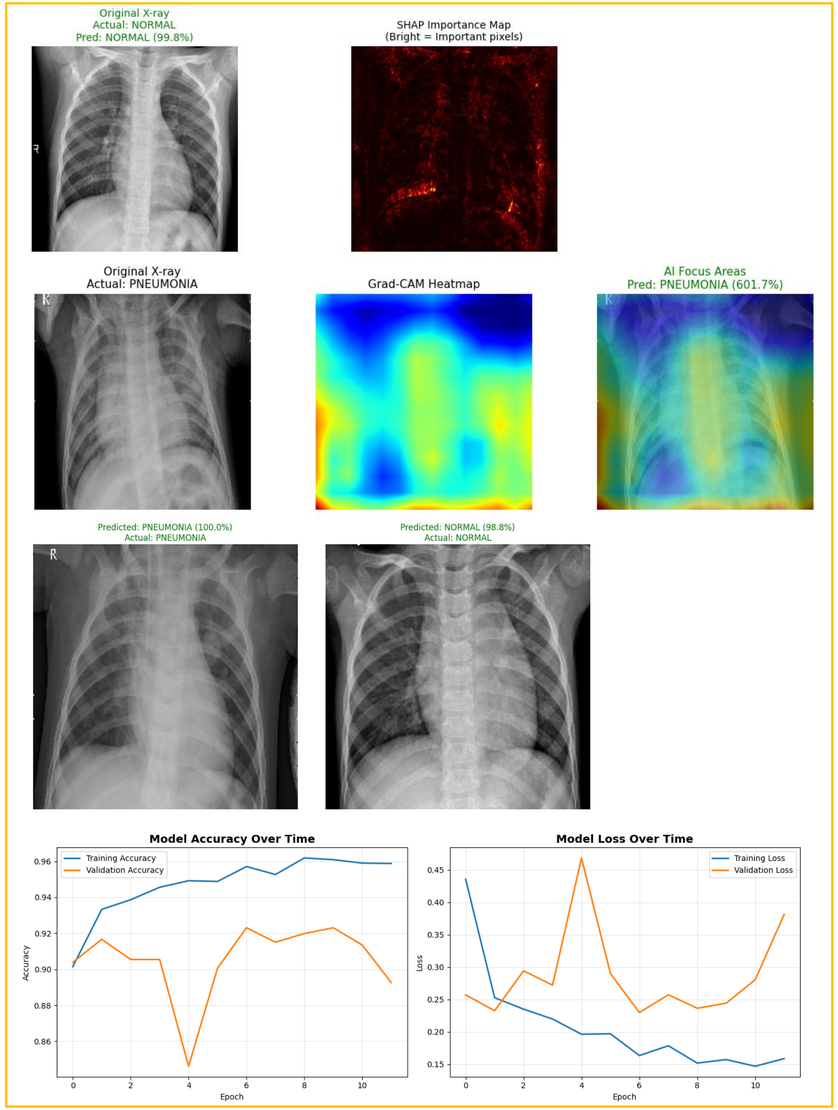
RESEARCH QUESTION: How can explainable deep learning improve transparency and trust in pneumonia detection from chest X-ray images?

PROBLEM

Pneumonia is a major health concern requiring accurate diagnosis. While deep learning models can detect pneumonia from chest X-rays, they often act as “black boxes.” This lack of transparency limits trust in clinical settings, highlighting the need for explainable AI that provides both accurate and interpretable results.

METHODOLOGY

- Dataset: Chest X-ray pneumonia dataset (Kaggle)
- Preprocessing:
  Image resizing (224x224)
  Normalization
  Data augmentation
- Models:
  Baseline CNN
  ResNet-50
  DenseNet-121
- Explainability:
  Grad-Cam
  SHAP
- Evaluation Metrics:
  Accuracy
  Precision/Recall
  F1-score
  ROC_AUC



RESULTS

- Model achieved high accuracy (~95%-96%) in pneumonia classification
- Training and validation accuracy remained stable across epochs
- Loss decreased consistently, indicating effective learning
- Confusion matrix shows strong classification performance
- Grad-CAM highlights relevant lung regions used for prediction
- SHAP provides insights into feature importance and model decisions.

IMPACTS & FUTURE WORK

- Improves trust in AI-assisted medical diagnosis through interpretable predictions
- Enable faster and more reliable clinical decision-making.
- Supports healthcare access in low-resource settings.
- Future work includes expanding to additional diseases and improving model robustness.
- Aims to develop a real-world clinical decision-support system.

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