TOPIC PROPOSAL

AI-Powered Early Pediatric Pneumonia Detection: Integration with Electronic Medical Records in Algeria

Team Members: - Bouhmidi Amina Maroua
-Labani Nabila Nour El houda

Supervisor: Dr. Abderrahmane Khiat
Institution: University of Saida

Medical Advisor: Dr. Aimer Mohammed Djamel Eddine

1. PROBLEM & CONTEXT

The Challenge: Pneumonia accounts for 15% of deaths in children under five globally, claiming over 740,000 lives annually. In Algeria, the healthcare system faces critical diagnostic obstacles: overcrowded emergency departments (200-300 pediatric cases daily with 6-24 hour diagnostic delays), severe shortage of pediatric radiologists (approximately 1 per 500,000 children), diagnostic variability between radiologists (70-85% agreement), and limited rural access (40% of children in areas requiring 50-100 km travel for X-ray services).

Why Now: Recent convergence of technological and policy developments (2019-2024) makes AI-powered pneumonia detection feasible: deep learning breakthroughs in medical imaging with transfer learning, COVID-19 acceleration of respiratory AI research, cloud GPU accessibility (Google Colab), Algeria's Digital Health Strategy (2021-2022) implementing Electronic Medical Records (DEM) across public hospitals, and CNAS digital transformation creating infrastructure for AI integration.

2. PROPOSED SOLUTION

We will develop a CNN-based pneumonia detection system using the Kaggle Pediatric Chest X-Ray dataset (5,863 labeled images: 1,583 normal, 4,273 pneumonia). Our approach employs transfer learning with pre-trained architectures (VGG16, ResNet50, DenseNet121) to achieve 90%+ accuracy with 95%+ sensitivity. The system will be trained on Google Colab and designed for integration with Algerian hospital Electronic Medical Records using HL7/FHIR standards. Model interpretability will be ensured through Grad-CAM visualizations showing which lung regions influence predictions.

2.1 Methodology Overview

Dataset: Kaggle Pediatric Chest X-Ray Pneumonia dataset, 70/15/15 train/val/test split, with data augmentation (rotation, flip, zoom, brightness) and class weighting to address imbalance.

Models: Baseline custom CNN (75-80% expected) →Transfer learning with VGG16/ResNet50/DenseNet121 (90-93% expected) → Optional ensemble of top performers.

Training: Google Colab GPU, TensorFlow/PyTorch, Adam optimizer, binary cross-entropy loss, early stopping.

Evaluation: Sensitivity $\geq 95\%$ (critical for medical screening), Specificity $\geq 85\%$, Precision, F1-score, AUC–ROC, confusion matrix analysis, and Grad-CAM interpretability visualizations.

3. Scientific Justification

1. **PLOS Digital Health (2025)** – Demonstrates AI pneumonia detection in low-resource settings achieves clinical-grade accuracy, directly validating feasibility for Algeria's context.

2. **PMC / PubMed Central (2024)** – Documents AI–EHR integration improving diagnostic capabilities through HL7/FHIR standards, providing a technical roadmap for DEM integration.

3. **Healthcare / MDPI (2022)** – Reports real-world deployment achieving a 22% reduction in diagnostic time with maintained 91% accuracy, proving clinical viability and ROI.

4. **WHO (2024)** – Pneumonia statistics establishing global and regional burden, contextualizing the problem's urgency.

4. Expected Deliverables

- Trained CNN models achieving 90%+ accuracy and 95%+ sensitivity

- Reproducible Jupyter notebooks (Google Colab) with a complete training pipeline

- Performance evaluation report with metrics benchmarking and error analysis

- Technical documentation describing methodology, architecture, and integration approach

- Final presentation with a live demonstration of model predictions

5. Team Roles

Project Manager: Bouhmidi Amina Maroua – Coordinates timeline, deliverables, and team communication.

Data Engineer: Bouhmidi Amina Maroua – Dataset management, preprocessing, and augmentation.

ML Engineer: Labani Nabila Nour El Houda – Model development, training, and optimization.

Documentation Lead: Name – Technical reports, presentations, and GitHub documentation.

6. CONCLUSION

This project addresses a critical healthcare challenge in Algeria through state-of-the-art AI, aligning with national digital health priorities. The convergence of recent technological advances, Algeria's DEM implementation, and established clinical need creates an ideal opportunity for impactful research. We are confident this project demonstrates technical competence

while addressing genuine Algerian healthcare challenges, and we respectfully request approval to proceed.

References

[1] Detection of pneumonia in children through chest radiographs using artificial intelligence in a low-resource setting, *PLOS Digital Health*, September 2025. `https://journals.plos.org/digitalhealth/article?id=10.1371/journal.pdig.0000713`

[2] The role of artificial intelligence for the application of integrating electronic health records and patient-generated data, *PMC (PubMed Central)*, 2024. `https://pmc.ncbi.nlm.nih.gov/articles/PMC11141850/`

[3] Diagnostic Performance of a Deep Learning Model Deployed at a National COVID-19 Screening Facility, *Healthcare (MDPI)*, January 2022. `https://mdpi.com/2227-9032/10/1/175/html`

[4] World Health Organization, *Pneumonia in Children – Fact Sheet*, WHO Official Website, 2024.