

PNEUMONIA & RESPIRATORY DISEASE PREDICTION

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PROJECT IDEA

Project Idea

Problem:

- Pneumonia is a leading global cause of death, especially among children and the elderly. Diagnosis requires expert chest X-ray interpretation, but many hospitals—particularly in Egypt—face a shortage of radiologists. This results in delays, heavy workload, and up to 20% missed cases, increasing the risk of severe complications.

Proposed Solution:

- An AI-powered Universal Radiologist that detects pneumonia in both children and adults. The system uses DenseNet121 and Multi-Stage Sequential Transfer Learning trained on the RSNA, NIH, and CheXpert datasets, ensuring high sensitivity and reliable performance across different ages, imaging conditions, and hospital equipment.

Project Idea (cont.)

Unique Value Proposition:

- Accurate for both pediatric and adult patients
- ~91% sensitivity, minimizing missed pneumonia cases
- Offline and runs on standard laptops—ideal for low-resource hospitals
- Trained on large, diverse datasets, ensuring strong generalization

END USER + FEATURE

End Users + Features

Primary End Users:

1. Radiologists & Medical Staff :

Need fast decision support to reduce workload and diagnostic errors.

2. Hospitals & Clinics (Especially Low-Resource Settings):

Need an affordable, offline diagnostic tool due to lack of radiologists.

3. Emergency & Triage Units :

Require quick screening to identify high-risk pneumonia cases.

4. Healthcare NGOs & Rural Medical Programs:

Need portable, reliable tools for remote screening where experts are unavailable.

Key Features:

1. Automated Pneumonia Detection

Uses DenseNet121 to predict pneumonia probability from X- rays.

2. Universal Model (Adults + Children)

Works accurately across age groups thanks to sequential transfer learning.

3. High Sensitivity (~91%)

Reduces risk of missed pneumonia cases during triage.

4. Offline Application

Runs locally on standard laptops—no internet required.

5. Preprocessing Engine

Automatically converts, resizes, and normalizes X-rays for consistent analysis.

6. Clear, Simple Diagnostic Output

Shows binary prediction and confidence score.

End Users + Features(cont.)

How Features Solve User Problems:

Radiologists & Medical Staff

- Get fast, reliable triage assistance → reduces fatigue and workload.
- High sensitivity ensures fewer missed pneumonia cases.

Hospitals & Low-Resource Clinics

- Offline system works without cloud or expensive hardware.
- Helps compensate for radiologist shortages.

Emergency & Triage Teams

- Quick probability output helps identify urgent cases immediately.
- Supports rapid decision-making during high patient flow.

Rural & NGO Healthcare Programs

- Portable, lightweight tool supports diagnosis where specialists are unavailable.
- Works consistently across different patient demographics and imaging equipment.

DATA STRUCTURE

Data Structure

Data Collection:

Data collected from **three major public X-ray datasets**:

- **RSNA (26K images)** – Pediatric
- **NIH (112K images)** – Adult
- **CheXpert (224K+ images)** – Mixed ages, high diversity

All files collected as **JPEG/PNG images** (no CSV tables used for features).

Data Storage:

- Stored locally in **folder-based structure** (Normal /Pneumonia).
- No cloud or database used—simple directory storage for portability.
- Used by TensorFlow Data Generators during training.

Data Structure

Data Shape & Characteristics:

1. Image resolutions differ by dataset → standardized later.
2. Final model input shape: **$320 \times 320 \times 3$ (RGB)**
3. **Class imbalance exists** (normal cases are more frequent).

4. **Balanced through:**

Augmentation:

- **Sequential training across datasets**
- **Sensitivity-focused threshold (0.15)**

Preprocessing Pipeline:

1. Convert grayscale → **RGB (3 channels)**
2. Resize to **320×320**
3. Normalize pixels to **[0,1]**
4. Apply augmentation during training:
 - Rotation, Zoom, Flip
 - Prevents overfitting and improves balance

Data Structure

Preprocessing Pipeline:

- **Training:**
Images loaded by Keras generators → preprocessed → fed into DenseNet121.
- **Inference:**
User inputs image path → preprocessing engine runs → model outputs probability & diagnosis.

PROGRAMMING LANGUAGE & FRAMEWORKS

Programming Languages + Frameworks

Programming Languages :

- **Python** — Core language for model training, preprocessing, and deployment.

Frameworks & Tools :

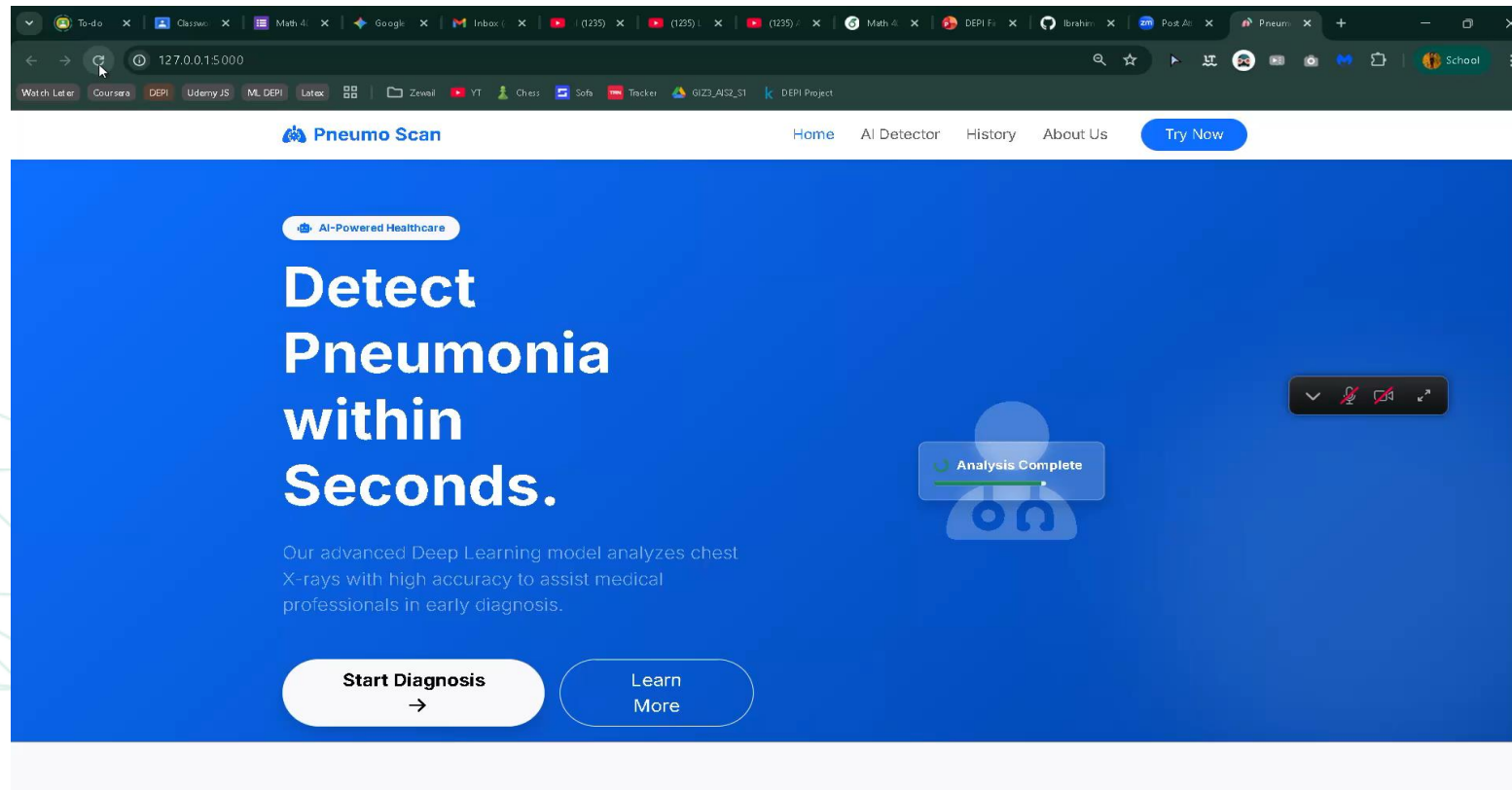
- **TensorFlow 2.16 / Keras 3.0** — Deep learning framework for building and training DenseNet121.
- **NumPy & Pandas** — Data loading, manipulation, and preprocessing.
- **Pillow (PIL)** — Image handling and conversions.
- **Matplotlib & Seaborn** — Visualizing metrics and performance.
- **Kaggle Environment** — GPU training (NVIDIA Tesla T4).

Supporting Technologies :

- **Local Python Runtime (CLI Application)** — Offline deployment.
- **Transfer Learning Pipelines** — Sequential training workflow.
- **Standard Laptops (CPU)** — For inference and real-world usage.

LIVE APPLICATION & TEST

Live Application + Test



Live URL ([click here](#))

DELIVERABLES

Deliverables

- Problem statement ([click here](#))
- Project proposal ([click here](#))
- Documentation ([click here](#))
- Source code ([click here](#))
- Excel Sheet ([click here](#))
- Github ([click here](#))
- Live URL ([click here](#))

PROJECT TEAM & ROLES



Project Team + Roles

- **Abdellatif El Batrawy (Team Leader)** – Coordination, Project Integration, and Shared Model Evaluation
- **Ibrahim Hanafy** – Data Preprocessing, Model Training, and Shared FineTuning
- **Ramez Farouk** – Image Annotation, Captioning Pipeline, and Shared Evaluation
- **Omar El Banna** – Model Optimization, Shared Fine-Tuning, and Performance Assessment
- **Ali Mohamed** – Visualization, Reporting, and Shared Captioning Integration
- **Amr Ghoniem** – Dataset Management, Testing, and Shared Fine-Tuning Tasks

THANKS

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- **Thank you for your attention!**

We welcome any questions, suggestions, or feedback about our project.

