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Telangana AI Rising Grand Challenge

AI-Powered Medical Imaging Diagnostics for Lung Conditions

Introduction

Timely diagnosis is critical for conditions such as Tuberculosis (TB), Chronic Obstructive Pulmonary Disease (COPD), lung cancer, and silicosis, all of which rely heavily on X-ray or CT/MRI imaging for accurate assessment.

AI-based medical imaging diagnostics is emerging as a transformative solution to address this. By automating image analysis and prioritizing critical cases, AI can ease the burden on healthcare professionals, ensure faster patient attention, and improve diagnostics.

This initiative aligns with the state's healthcare priorities, particularly under the National TB Elimination Programme (NTEP) as part of the National Health Mission (NHM). The Innovation Challenge aims to bring together changemakers, visionaries, and problem-solvers to drive grassroots and social innovations where they are needed most.

Limitations Hindering Digital/AI Adoption

1. **Integration with Clinical Workflow**
    - AI solutions must seamlessly fit into existing hospital, clinic, or diagnostic centre IT systems.
    - Lack of user-friendly interfaces for non-technical clinical staff.
2. **Infrastructure Limitations**
    - Limited internet connectivity in remote areas of Telangana can hinder AI processing.
    - Varying hardware and software standards across healthcare facilities.

Proposed Technological Solutions

1. **AI-Enabled Image Analysis**

- Computer vision models to detect and classify abnormalities in medical images, focusing on TB, COPD, lung cancer, and silicosis.
- Automated measurement of lesions or features of interest (e.g., size of nodules).
- Startups may employ multi-label or multi-class classification workflows or develop specialized models for each condition.

2. **Model Integration & Prioritization**
   - Triage system that flags high-risk cases for immediate review.
   - Output probability scores or risk categories to assist clinical decision-making.
   - Ensure reliable detection while minimizing unnecessary false alerts.

3. **Cloud-Based & Edge Computing Options**
   - Cloud-hosted AI for facilities with stable internet connectivity.
   - Edge AI devices in remote clinics for on-site inference without internet dependency.

4. **Security & Privacy Mechanisms**
   - Encryption of patient data at rest and in transit.
   - Role-based access controls and robust user authentication for data confidentiality.

5. **Workflow Integration & Usability**
   - APIs and standards (e.g., DICOM) for seamless integration with hospital PACS (Picture Archiving and Communication System).
   - Intuitive dashboard interfaces for radiologists and clinicians.

Proposed Methodology

1. **AI Model Development**
   - **Model Architecture Guidance:**
     - Utilize modern, efficient, and scalable architectures suitable for constrained hardware or edge devices.
     - Incorporate explainability features to build clinician trust.
   - **Evaluation Guidance:**
     - Focus on clinically relevant metrics, prioritizing recall to ensure critical cases are not missed.
     - Clearly articulate how the model balances precision and recall meeting clinical needs.
     - Models must meet or exceed typical clinical standards to be considered viable.

2. **Pilot & Testing Phase**
   - Deploy in a controlled clinical setting in Telangana to assess real-world performance.
   - Collect feedback from radiologists and clinicians on accuracy and ease of use.
   - Iteratively refine models and user interfaces based on pilot results.
   - Pilot performance should align closely (e.g., within ±5–10%) with reported metrics.

3. **Scaling & Integration**

- Expand deployment across multiple sites, ensuring secure data exchange and load balancing.
- Establish training programs and workshops for clinical staff to encourage adoption.

4. **Governance & Compliance:** Comply with health data protection laws.