COMP39/9900 Computer Science/IT Capstone Project
School of Computer Science and Engineering, UNSW

Project Number: P27

Project Title: Development of Smartphone-Based Tuberculosis Detection Application

Project Clients: Dr Reza Argha

Project Specializations: Mobile application development; Artificial Intelligence (Machine/Deep Learning, NLP); Software development.

Number of groups: 2

Background:

Tuberculosis (TB) remains a significant global health threat, contributing to high mortality rates worldwide. This infectious disease is primarily caused by the bacterium Mycobacterium tuberculosis (Mtb), with pulmonary tuberculosis (PTB) being the most common manifestation affecting the lungs. However, TB can also manifest in extrapulmonary sites (EPTB).

In recent years, there has been a growing body of research focused on leveraging deep learning (DL) techniques for the detection of TB using medical imaging modalities, particularly chest X-ray (CXR) images. These DL models hold promise for enhancing the accuracy and efficiency of TB diagnosis.

Building upon this foundation, our project aims to further advance TB detection capabilities by integrating a state-of-the-art DL model into a user-friendly smartphone application. By harnessing the power of smartphone cameras, our app will enable users to capture images of their CXR and promptly analyse them for signs of TB. This innovative approach has the potential to revolutionise TB screening and diagnosis, particularly in resource-limited settings where access to specialists and other diagnostic methods may be limited.

Requirements and Scope:

- Develop a mobile-friendly version of a state-of-the-art DL model for TB detection using CXR images.

- Integrate the DL model into a user-friendly smartphone application.

- Enable users to capture CXR images using the smartphone camera.

- Implement real-time image analysis capabilities for TB detection.

- Ensure the application's compatibility with a wide range of smartphone devices.

- Provide user-friendly interfaces and clear instructions for ease of use.

- Enable users to capture chest X-ray (CXR) images using the smartphone camera within the app.

- Implement image preprocessing techniques to enhance image quality and reduce noise.

- Provide options for adjusting image brightness, contrast, and orientation for optimal

analysis.

- Integrate a pre-trained deep learning model for TB detection into the mobile application.

- Implement real-time image analysis and TB detection using the integrated model.

- Present TB detection outcomes (e.g., positive, negative) along with confidence scores or probabilities.

- Provide visualizations or explanations of key features used by the model for TB detection.

- Allow users (clinicians) to provide feedback on diagnostic results (e.g., accuracy, usability) through the app.

- Enable users to track their TB screening history and view previous diagnostic reports.

- Comply with healthcare data privacy regulations and ensure adherence to ethical guidelines.

- Provide comprehensive documentation for installation, usage, and troubleshooting of the mobile application.

Required Knowledge and skills:

- Proficiency in deep learning frameworks such as TensorFlow or PyTorch for developing TB detection models.

- Experience with convolutional neural networks (CNNs) and other deep learning architectures for image classification and segmentation.

- Expertise in mobile application development using React Native for cross-platform compatibility.

- Proficiency in JavaScript, JSX, and React Native APIs for building responsive and interactive user interfaces.

- Experience with native modules and device APIs for accessing smartphone camera, storage, and other hardware features.

- Experience with version control systems (e.g., Git) and collaborative development platforms (e.g., GitHub, GitLab) for code management and collaboration.

- Ability to work effectively in multidisciplinary teams, including developers, designers, healthcare professionals, and project stakeholders.

Expected outcomes/deliverables:

- Implement deep learning algorithms to analyze captured CXR images for signs of tuberculosis.

- Provide real-time feedback on TB detection results, including confidence scores and diagnostic recommendations.

- Ensure fast and responsive performance, with minimal latency in image capture and analysis.

- Optimize algorithm efficiency to reduce computational resources and battery consumption on smartphones.

- Implement error handling mechanisms to gracefully handle unexpected errors or disruptions.

- Conduct thorough testing and validation to identify and address potential software bugs or issues.

- Design intuitive and user-friendly interfaces that are easy to navigate and understand.

- Provide clear instructions and tooltips to guide users through the image capture and analysis process.

- Incorporate feedback mechanisms to gather user input and suggestions for improving application usability.

- Ensure compatibility with a wide range of smartphone devices and operating systems (e.g., Android, iOS).

- Conduct compatibility testing on different device models, screen sizes, and resolutions to ensure consistent performance.

- Prepare comprehensive user documentation and tutorials for installing, configuring, and using the smartphone application.

- Include step-by-step instructions, troubleshooting tips, and frequently asked questions (FAQs) to assist users.

- Develop training materials for healthcare professionals and users on the proper use and interpretation of TB detection results.

Supervision:

Dr Reza Argha

Additional resources:

TBC