Computer-aided detection for Tuberculosis

Country of origin | The Netherlands

Health problem addressed

Tuberculosis is the second deadliest infectious disease in the world. With early detection and proper treatment, most people with tuberculosis can fully recover. Combined efforts and investment in Tuberculosis detection can help to save millions of lives worldwide.

Solution description

Digital X-rays can efficiently make large numbers of chest radiographs at low cost. Computer Aided Detection software (CAD) can immediately analyse these digital images. The CAD software gives a probability percentage normal vs. abnormal consistent with TB.

CAD follows the processing steps:

• Lung shape analysis
• Clavicle detection
• Texture analysis.

Texture within the lung fields and the shape of the extracted lung fields are compared with a training database obtained from thousands of training images. Based on this analysis a grade for the image is computed. Based on the grade and the expected prevalence in the population, the probability that the image contains signs of TB is calculated.

Functionality

The software can be configured to run automatically after a digital X-ray has been made: the image is sent automatically to a separate computer on which the CAD software is installed, the program performs the quality check and the image analysis steps and the result is stored on disk.

Developer’s claims of solution benefits

Present technologies are time consuming and quality/temperature sensitive or costly for hundreds of tests. With a portable digital X-ray even remote groups can be screened at low cost as the incremental costs of digital X-ray and CAD are very low. Studies done by universities and Zambart show that the sensitivity and specificity of the software to diagnose culture positive TB from chest radiograph is the same as done by clinical officers and CRRS certified human observers (no significant difference in performance).

Future work and challenges

Challenges ahead:

1. Creating a computerized decision support by combining X-ray signs with clinical symptoms.
2. Evaluate CAD with GeneXpert (cartridge-based, automated diagnostic test ) as an efficiency “filter” in TB screening to determine who gets GeneXpert.
3. Regulatory approval.

User and environment

Users: physician, technician

Training: a 3-hours training is provided on a laptop or PC.

Settings: rural, urban, ambulatory, primary, and secondary.

Solution specifications

Solution is used to support: Telemedicine; Electronic Health Record/Electronic Medical Record; mHealth; Health Research.

Software/Hardware requirements: Laptop or computer with MS Windows, Intel Pentium preferably i7, 8 GB RAM 120 GB HDD, Calculation time depends on amount of RAM and type of processor. CAD4TB is proprietary software that runs on any laptop or PC that meets the above specifications.

Standards: DICOM, HL7

Currently used in: Zambia, South Africa, The Gambia

Evaluation: The CAD software is currently used prospectively in clinical trial to make a selection with TB suspects should undergo other more expensive and time-consuming further testing. The partners CIDRZ and Zambart in Zambia are using the CAD software as a “filter” in TB screening to determine who gets GeneXpert.
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