
An Interactive Computer Aided System for Detection and Analysis of Pulmonary TB

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Abstract

Nowadays Digital Image processing plays a significant part in medical imaging systems for an early diagnosis of the problems. Pulmonary Tuberculosis Diagnosis and treatment has been a challenge to medical as well as to research community. Forecasting at an early stage of lung situation in this problem may help the patient and medical professional to overcome the future consequences. The main objective of this work is to develop an Interactive computer aided system (CAD) for chest x-rays to assist in providing the required information for a medical expert.

Keywords: pulmonary, lungs, segmentation, image

Introduction

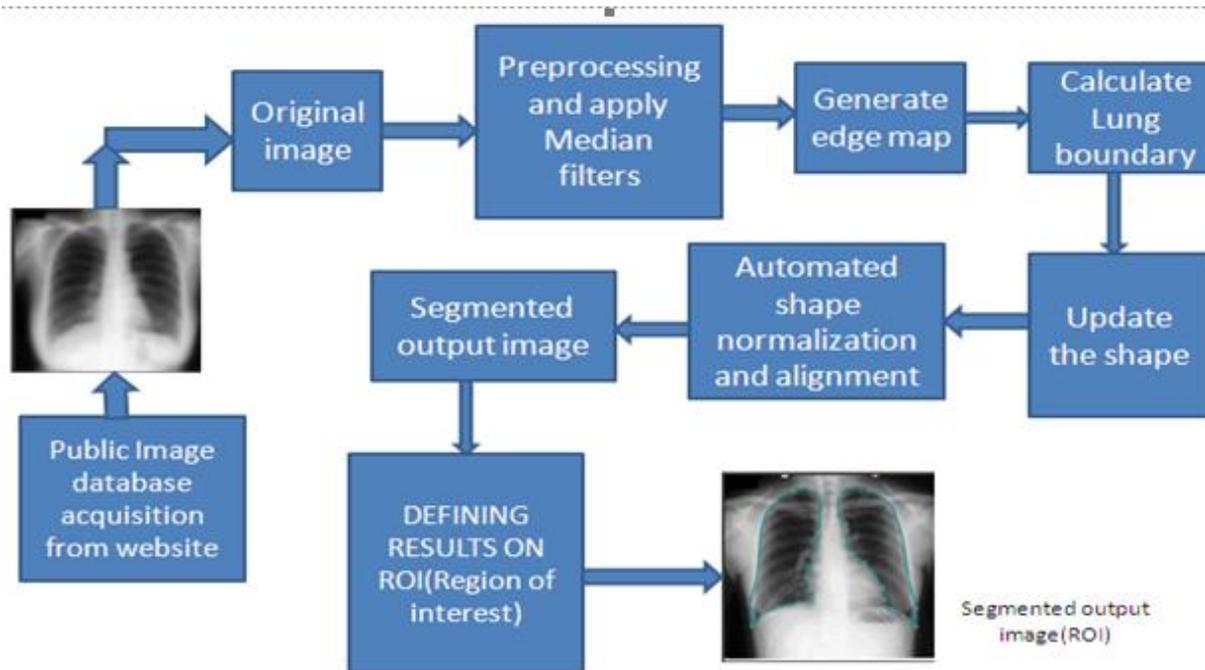
Tuberculosis (TB) remains one of the world's major health concerns. The preponderance of the TB burden is located in Africa, followed by the Asian countries. Of the eight million people developing TB every year, nearly two-thirds live in Asia and the Pacific region [7]. TB control efforts such as the (BCG) vaccine given to more than a quarter of a million people in South India have shown no efficacy [2]. But most of the cases are from Indian rural areas where proper health awareness campaigns and availability of medicines is rare and complicated. Chest radiography is becoming increasingly important in the fight against TB, because existing screening diagnostics such as sputum staining have become less reliable in populations with a high prevalence of HIV/AIDS. Most studies conducted have proven that an early measurement of physiological parameters may help detection of diseases related to lung. Thus it becomes crucial for early detection of the problem at early stage. Pulmonary TB is chosen as application domain in this work because main part of the body which gets destructed is lungs due to TB. In most of the cases the death rates due to TB are more due to

ignorance and lack of knowledge about the problem. Small precautionary measures such as maintaining neatness and proper medications are required. Significance of our proposal is that we are going to develop a completed Interactive diagnosis system for Lung Tuberculosis should comprise of several parts including filtering, detection and feature extraction. In reality feasible segmentation demands more than accuracy [1,2]. Methods such as level set [3, 4], Markov random field [5,6] and other on the go strategies [11] can give acceptable segmentation, but to edit the produced segments is never a trouble-free achievement. Segmentation for medical purpose often needs corrective measure if the software wants FDA approval [8, 9]. When a software does provide the obligatory measure, the operation is likely to be tedious or taxing (a quick example is Segment CMR [12]). In this method design of an algorithm will take place which is an interactive and automatically show how much of the lung part is affected in the chest x-ray provided. As it is said that an image is worth more than thousand words image processing is the domain which will reach the common man easily for perception of the ailment and create self-motivation among the people to take precautionary measures to prevent TB.

Proposed Work

The proposed research work bring about various steps, the first step filters the image, in the second step generation of Edge map is done and automated shape normalization and alignment is used to detect region of Interest. As the result of above steps, lungs remained after affected to TB are extracted. In this regard a block diagram is drawn to show the process flow in a pictorial representation.

Fig. 1. Block Diagram of Proposed Method



Original Image is processed through shape updating at a point to extract the exact lung part. It involves normalization of the shape with respect to edges and shape alignment involves in creation of a framework.

A. Process flow

This research work mainly involves with following steps which are briefed in an obvious manner.

- Step 1: Median Filtering
- Step 2: Generating Edge Map
- Step 3: Updating the shape
- Step 4: Interactive shape Normalization and alignment
- Step 5: Segmented output Image

Simulation tool used

In this research the input images acquired from various public databases were simulated using Matlab (Matrix Laboratory), a high-level Technical Computing language (R2010a version and above) on an Intel Core i5 PC at 2.5GHZ with a total physical memory of 4 GB RAM. There are more than 100 toolboxes available in Matlab, but only a few such as image acquisition, image processing, fixed point and neural networks tool boxes have been utilized and it also contain a number of block sets, which contain a set of instructions belong to same category or family of execution.

Matlab is a trademark product of Mathworks Inc. which allows matrix manipulations

[13], image is considered as a matrix for operation and output obtained is also stored in form

of a matrix. Matlab has become indispensable these days with researchers who want to design and develop automated and interactive systems, ease of use is also an important part of this tool which made a good usage among research community.

Results and Discussion

A Chest X-Ray image has been considered for simulation which is shown in Figure 2. As image is subjected to the developed algorithm, it goes under various procedures as said above in process flow. Original Image is first filtered to remove noise which is fed to median filtering process. The images acquired by various medical imaging modalities may contain some noise elements, hence filtering is required. Then the image is subjected to Spline procedure, an interactive computer aided system which shows the gradual extraction of lung part which are left after affected by TB.

Fig. 2. Original Image

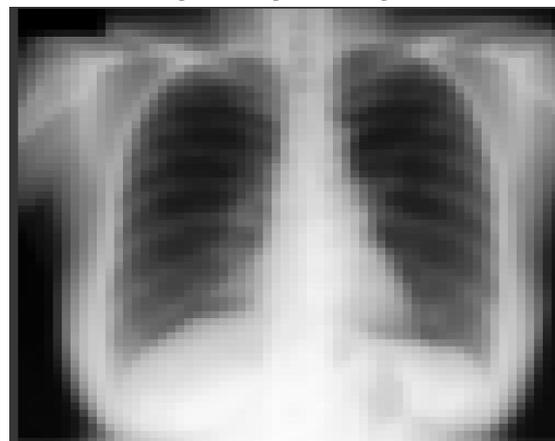


Fig. 3. Filtered Image and shape normalization

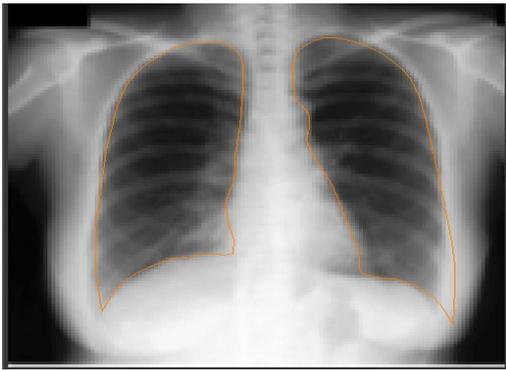


Figure 3 is the filtered image which is obtained by using median filter an image processing method which aims in removing noise without distorting the fine edges and lines of the image. This image also shows the normalization of the shape of the lungs.

Fig. 4. Shape alignment and segmentation

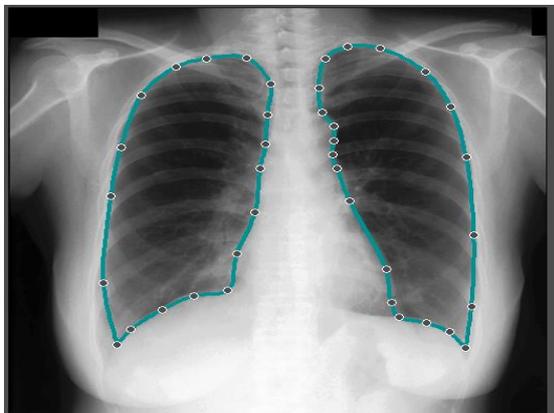
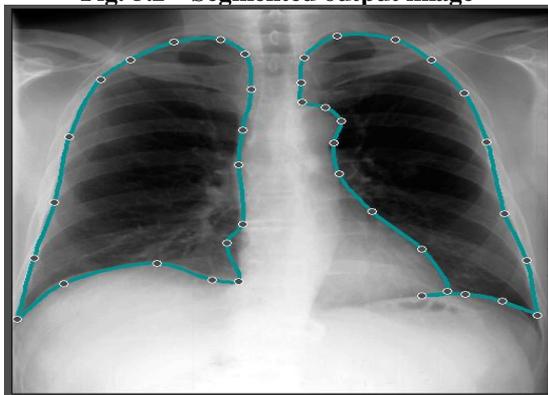


Figure 4 is the image obtained after shape alignment using interactive procedure, which helps in locating the ROI i.e. unaffected part of lungs. It draws itself a contour, which finally aims to locate ROI depending upon the intensity values. The borders of contour are very effective in appearance depicted by dot points joining at edges of the lung part remained after TB has affected, which can be easily understood even by a common man to create awareness about TB and its consequences if proper medication and care is not maintained.

Fig. 5.2nd Segmented output image



As an instance we also simulated other two x-rays which are shown in Figure 5 and 6, which clearly indicate the region of Interest.

Fig. 6. 3rd Segmented output image

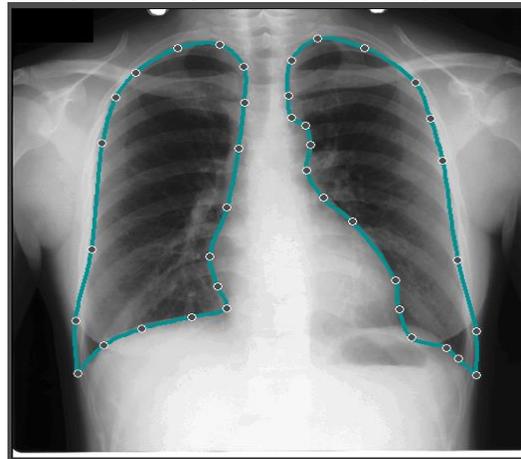
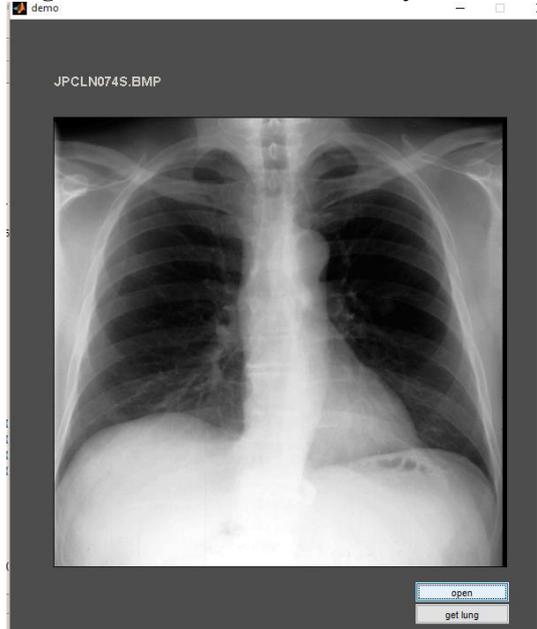


Fig. 7. Demo of Interactive GUI System



As an example a demo GUI of ongoing research will be as shown in Figure 7 where a Chest X-ray is provided and get lung button is clicked. will get a interactive segmented output image which will be easy to perceive.

Conclusion

In this work the Chest X-ray image has been considered for simulation. The results obtained have been analyzed with respect to the ROI (damaged part of the lungs) which has been observed obviously. This research work is primarily useful as an Interactive automatic CAD system for pulmonary Tuberculosis affected lungs. As a future scope the images resulted can be verified for statistical approaches to find image attributes which will be helpful in parametric analysis. . The end product of this research will be a simple GUI (Graphical User Interface) which will be supplied

to health professionals in rural areas of India to educate and create awareness.

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