

Healthcare Intervention in Local Hospitals

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Motivation & Goal

- ▶ The field of healthcare is a ground to number of problems with a potential 'engineering solution'
- ▶ The problems are best understood by interacting with the clinicians at local hospitals
- ▶ Visit local hospitals like TMH, Hinduja to find out what possible engineering solution can be delivered

- ▶ Made two visits to Hinduja Hospital
- ▶ Interacted with Dr. Devendra Desai , Gastroenterologist
- ▶ Interacted with Dr. R B Deshpande, Histopathologist

Image analysis of digitised Tuberculosis smear samples : The Problem I

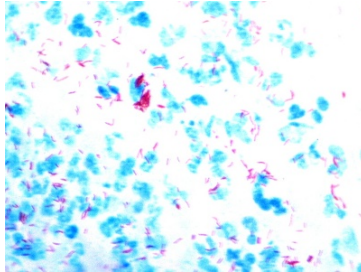


Figure: Digital Image of a TB Smear Slide

- It is possible to digitise the TB smear slides in the form of images

Image analysis of digitised Tuberculosis smear samples : The Problem II

- ▶ The images further can be analysed using a software that would mark out the positions of the bacteria
- ▶ The analysis differs from one clinician to the other because of the different perception of colours
- ▶ This would help the clinicians to study the TB samples even remotely
- ▶ A digital image can be easily shared between doctors and the doctors can pass on their individual feedback after analysing the image through this image-analysis package

The Solution

- ▶ A cross platform GUI to analyse images
- ▶ The software allows loading files , perform analysis on images and mark the regions of interest
- ▶ The resulting image can be visualised side by side with the original to get an idea of the potentials spots where bacterium could be present
- ▶ Since the perception of 'pink' differs from clinician to clinician to adjust the cutoff levels for image segmentation based on 'pink' color

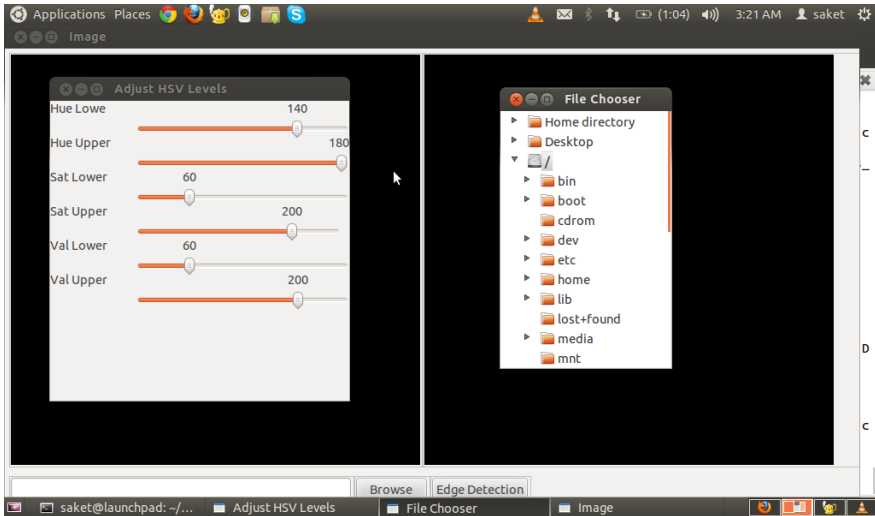


Figure: The File Chooser and the Threshold adjuster

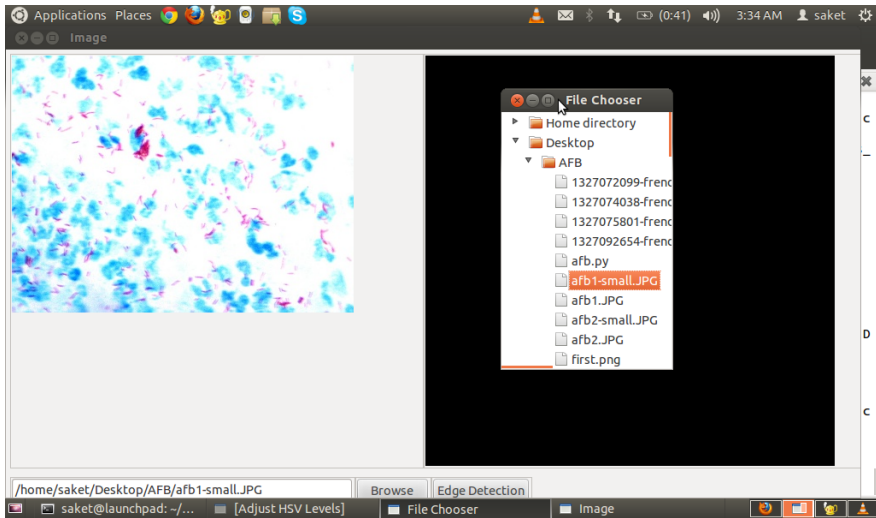


Figure: Loading Image by Selecting the File

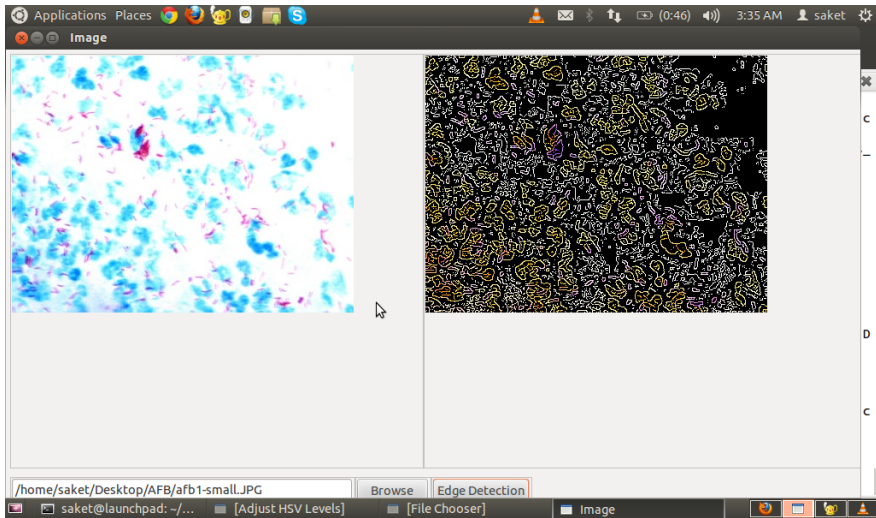


Figure: Detecting Edges

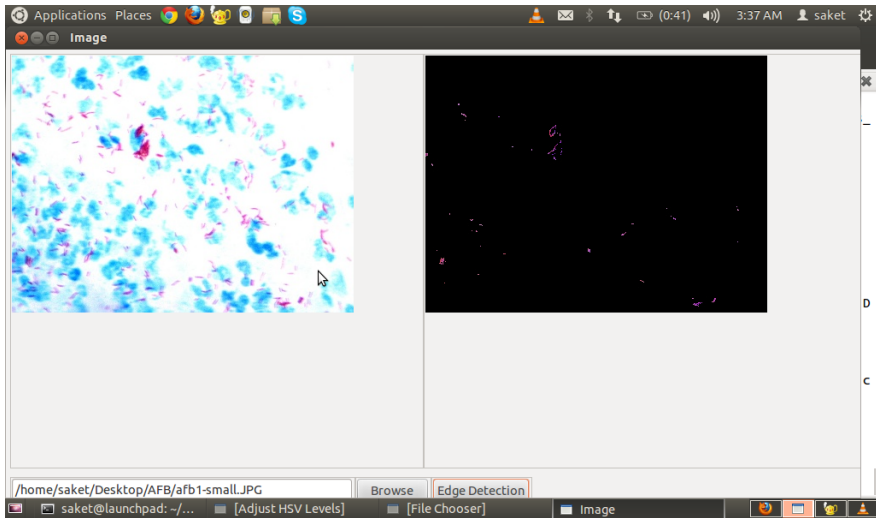


Figure: The Resulting Image

Possible Improvements

- ▶ Zoom Option
- ▶ Neater GUI
- ▶ Enhance the contrast for the result image
- ▶ Clinician Feedback and Machine Learning
- ▶ Direct image sharing by email/internet
- ▶ Subpart of the the automation machinery

Ideas : An Indian Endoscope

- ▶ Endoscopy involves examining the hollow organs of the body through an endoscope
- ▶ Endoscopes used today in India are imported from foreign countries
- ▶ The challenge is to come with low-cost version of the endoscope and its accessories

Ideas : Telemedicine

- ▶ There is a tremendous amount of scope that can be used to improve the doctor-patient interaction through telemedicine
- ▶ A doctor sitting at a hospital can provide consultation to the patient from a remote health centre through an audio-video call
- ▶ A software that would have features like video/audio conferencing, sharing reports/X-ray images in realtime and realtime feedback system

Ideas : Automation of Tuberculosis detection from smear samples

- ▶ The current setup of detecting TB involves the clinician loading the slides on to the microscope , then manually move the slides under the lens till a pink dot(if exists) is visible
- ▶ Being a manual process it may take several minutes before the clinician strikes at the location where bacterium might be present
- ▶ There is a scope for automation here where a robot would pick up a slide from a stack of slides , one by one, adjust it under the lens till a pink spot is visible and mark this position
- ▶ The clinican can then just look at these dots and decide if the bacterium is present
- ▶ . This will considerably reduced the time spent per sample and thus would lead to a speedy diagnosis

Image analysis of digitised Tuberculosis smear samples

- ▶ The bacilli are differently coloured then the rest of the sample
- ▶ Perform color based image segmentation to sepparate the bacilli from the rest of the sample
- ▶ The input for threshold values comes from the user
- ▶ Directory based listing of images
- ▶ Side by Side images for comparison
- ▶ Uses open source python-libraries : wx, opencv
- ▶ Implementations of similar software uses either MATLAB based solutions or machine learning approach

Conclusions

- ▶ An Open source and cross platform solution
- ▶ Currently in its POC stage
- ▶ Needs many iterations for development
- ▶ Better Algorithms possible