Image Processing Techniques for Lung Lesion Detection in Chest CT Scans

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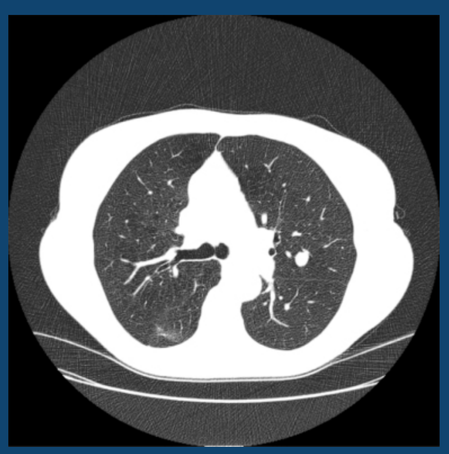
Introduction

Computer Aided Detection (CAD) Systems can be used in medicine to help radiologists detect lesions in the lungs from chest CT scans. The aim of this project was to create such a tool, using image processing techniques.

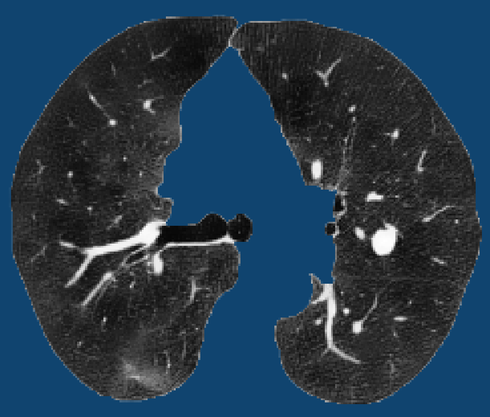
Implementation

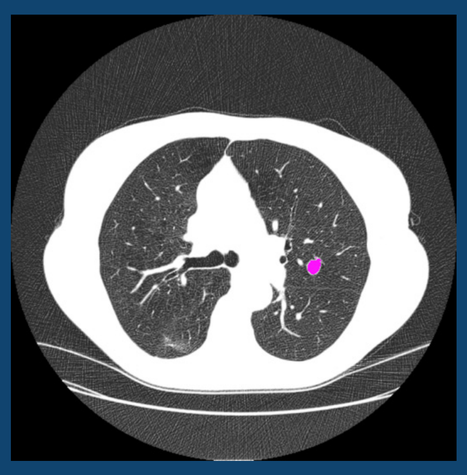
- A series of DICOM files are read. Windowing is applied to remove regions which are not of interest, such as bones, and to obtain a uniform intensity for the same tissue in different CT scans.



- Bilateral Filtering is used to reduce noise. Contrast Enhancement is performed by using Gamma Correction and Contrast Limited Adaptive Histogram Equalisation, such that lesions stand out more.

- The dark background outside the chest cavity is removed by Region Growing. Marker Based Watershed Segmentation is used to segment the lungs from the whole image.





- Detection takes place based on the intensity and the shape of lesions. The output of the system consists of a visible marker where a lesion has been detected.

Results

The CAD system was tested on 25 chest CT scans obtained from a general hospital in Malta, augmented with scans from a public database. The following results were obtained:

True Positive Rate	False Positive Rate	False Negative Rate	Average Time Taken*
76.27%	7.88 Lesions per scan	0.59 Lesions per scan	74.3ms per slice

* when tested on Intel Core i7-6700HQ CPU, clocked at 2.60GHz.