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Comparative Analysis of Lung Cancer using Different Medical Modality

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Abstract: In our country there are various problems regarding food, clear water, financial, sanitation, natural, man-made, transportation, hi-tech web, technical, etc but majorly they all are directly and indirectly connected to one factor health and it is a problem for both rural and urban people. But rural people suffer more as they have lack of facilities, knowledge and financial support. Even if rural people have facilities they are unable to take the advantage of it, the reason could be their unwillingness to get it. Rural people generally dedicated to their work and working hours are long for the good wages as they get daily basis like labors. In that scene they get addicted to strong tobacco and smoking which give they short release through the pain, that's why they frequently smoke or eat tobacco after short duration. So we had provided an algorithm approach for comparing lung cancer caused by smoking diseases by different medical modality for rural health using image processing with the help of MATLAB and Simulink Modelling so that we can provide best of the solutions to rural community.

Keywords: MATLAB, Lung Cancer, Simulink Modelling, Medical Modality.

1. INTRODUCTION

Every citizen in India have some fundamental rights where 'Right to life, is one of them, which gives the right to live with human dignity. This includes rights such as right to education, health, shelter and basic amnesties that the state shall provide. But why this happen that rural people still faces the crisis for even the basis healthcare treatment. Rural Health care is one of the biggest challenges facing by the Health Ministry of India. With more than 70 percent of the population living in rural areas are facing low level of health facilities and mortality rates due to diseases are on a high note. Along with multiple other reasons, the lack of quality infrastructure, non-access to basic medicines and medical facilities are the major reasons which affect the 60% population in India and to avail its reach to these facilities. Majority of rural people lives in India are approximately 700 million, which are directly affected by the condition of recent medical health and medical facilities, which is very disappointing, from them 66% of rural Indians do not have the access to the critical medicines and approx 31% travels 30 kms just to take the basic healthcare services which is not available in rural area.

1.1 Tobacco smoke Tobacco contains various harmful chemical so when tobacco smoke is consumed it cause very serious health issues, mainly known to cause cancers, it is not only dangerous to the smoker but also affecting the person who is consuming it indirectly i.e. passive smokers. It is important to note that passive smoking is more dangerous than active smoking because that who is consuming the smoke directly is more hazardous than releasing it. So other people around near are also affecting, ranging from burning sensation could be in eyes or sometimes in nose, and in throat irritation happen, to cancer, severe asthma, and a decrease in lung function.

The objective from this paper is basically to provide best of the medical imaging health monitoring to the end users in the field i.e. farmers; labors or rural people, By using digital image processing for medical modalities it's a wish to update the skills and understanding with the latest techniques in image analysis. Also reducing the effects and addiction of smoking by spreading knowledge about it in rural people. As there are many techniques to diagnose lung cancer, like Chest (x-ray), computed Tomography (CT), Magnetic Resonance Imaging (MRI scan) etc. But being not only expensive they are also time consuming. On emphasizes the conceptual framework of image analysis and the effective use of image processing tools. Main objectives are:

To study the comparison between the different medical modality like CT, MRI and Ultrasound to check which is best among the them to detect and analysis the lung cancer

1.2 Lung cancer

Smoking is the most common cause due to which lung cancer is occurs; it can be seen by the stats i.e. more than 80% of cases. The reason for this is as cigarette smoke contains many chemicals which affect our body's way of filtering the air in the lungs. Smoke not only irritates lungs but also produce the mucus in large amount which can paralyses the cilia an hair like tiny structure whose purpose is to clean the lungs from dust and dirt. So this leads to accumulation of the toxic dust or dirt due to smoke to blockage and congestion the lungs as paralysis of lung functioning. This kind of symptoms is generally to this extra mucus means chronic bronchitis also called with the name of 'smoker's cough'. Asthma is also one of the major disease causes due to this cigarette smoke like as discussed above about the congestion air passage and filtering. It further calls for the asthma attack. Therefore long term smoking or exposure to it could produce irritations in lung and damage the lung structure. They are so damaged that the walls of airways got broke down and tissues generate oxygen get reduced and transfer the blood

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gets complicated this is known as emphysema. It is mostly found in long term smokers where symptoms affects both all the smokers but amount of affecting the body depend on the consumption and duration. One can't reverse the effect of smoking but can cure and take care quitting it.

Medical imaging is the technique, process and art of creating visual which defines the interior structure of the body so that further clinical analysis and medical interrogation is done. Medical imaging have the capability to show structures which are hidden by the skin and bones, and after diagnose them it can treat the disease. These imaging technique consist database of the normal anatomy and physiology so that it is possible to determine the abnormalities. Imaging of removed organs and tissues is also done for medical reasons but it is known as the part of pathology instead of medical imaging. Medical imaging equipment is taking on increasingly critical role in healthcares the industry strives to lower patient cost and achieve earlier disease prediction using non invasive means. For the industry goals proper functionalities needs to be meet. Developers are turning to programmable logic devices such as MATLAB programming. So by using these tools we take images of the affected areas or the areas need the medical attention and then we process it by MATLAB Programming. Disease like brain tumor, cancer growth and other area could be detectable by image processing. Recently, image processing techniques are widely used in several medical areas for image improvement for the earlier detection and to stages in the treatment, also time is a key role to detect the abnormalities in the images especially in various cancer tumors such as lung cancer, breast cancer etc.

2. COMPUTER TOMOGRAPHY

Initially imaging is done with help of X-ray in which a cross sectional slice of the body using X-rays is done. X-rays are oldest and best known for the use in medical diagnostics, like astronomy. X-rays are generated from the X-ray tube for the medical image processing consisting a vacuum tube with anode and cathode, by heating cathode, which make free electron to flow in a very high speed toward positive charge anode. When the electron penetrates or strike on nucleus the released energy is known as x-rays radiation.

The penetrating power could be adjusted by applying voltage across the anode, and number of x-rays is controlled by applying current to the filament of cathode. Generation of X-ray images is simply taken by placing the patient between the x-ray source and a film sensitive to x-ray energy. Due this process the intensity of x-ray is modified by the absorption as it pass through the patient and rest resulting energy the photographic film which is developed similar to the image on the film as per the light, then the modernization of the X-ray is done and CT scan is discovered which is known as Computer tomography or computerized axial tomography is a method of forming image from X-rays. They contain the measurement from the X-ray transmitted rays through the body, such that they contain information about body during the path of X-ray beam. In computed tomography (CT), X-ray 2D images are rotated and captured through different angle that produce an 3-D image which is nothing but the CT scan imaging. The image contains the matrix of rows and column consist the information regarding the body attenuation as the body cross section. The attenuation of the matrix elements occurs at the intersection of rows and column. The X-rays pass through the patient and are partially absorbed. The detector response is directly related to the number of photons impinging on it and hence to the tissue density. When they strike the detector, the X-ray photons are converted to flashing. The computer senses the position of the X-ray tube and samples the output of the detector. An estimation based on data obtained from a complete scan is made by the computer. The output unit then produces a visual image on the cathode ray tube.

3. ULTRASOUND

In ultrasound to detect the condition of internal organ of body it used ultrasonic energy. Piezo-electric or magnet ostrictive transducer it produce the bursts of ultrasonic energy which are passed through the skin inside the body. The concept working of ultrasound is understood as the echoes or reflection on transducer from the tissues which is having different acoustical impedance occur when the ultrasonic energy strikes on it. The total wave travelling time is the key on that basis the image of an interior structure is constructed determine by the average sound speed and the energy intensity of the reflected waves.

4. MAGNETIC RESONANCE IMAGING

MRI is discovered and used from the 1980's mathematical sciences in a general way for image processing. In the 1980s, MRI rules on other modality due to some specialities like more informative imaging, Less time of exposure of patient in magnetic field i.e. RF energy also depends only on relatation property of excited magnetic hydrogen nuclei. The energy in which high molecules undergo normal are released into their surroundings, in a process referred to as relaxation. Images are created from the difference in relaxation rates in diff erent tissues, earlier known as nuclear magnetic resonance but the term "nuclear" was removed to avoid any association with nuclear radiation. In MRI systems superconducting magnets are used to provide strong uniform steady magnetic fields. Cooled superconducting magnetic coils equivalent to liquid helium temperature are used to produce very high magnetic fields, where the patient is kept in this gradient field space. There is also transmitter and receiving RF coils consist the image construction. In MRI patient have to surpass from the linear magnetic field gradient and uniform magnetic field superposition. The resonance frequencies of this superposition depend on the positions along the direction of the magnetic field gradient

5. ALGORITHM FOR LUNG CANCER

In lung cancer the medical images are consist of an patch or the spot on the lung which shows the existing of the cancer on the lung, that's why we have to make an

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algorithm which remove all the type of noise from the image and create the edges with an increase intensity and clear visualization. We had proposed a general algorithm for the detection of the lung cancer by image processing which is further evaluate for three medical modality like CT scan, MRI and ultrasound and who gives the better quality of the image for diagnosis. The algorithm consist three major group of analysis like pre-processing post-processing and resultant. Also it consist the operations of statistical analysis for the qualitative analysis of the image. Given below is the algorithm of lung cancer.

Lung Cancer detection by CT scan

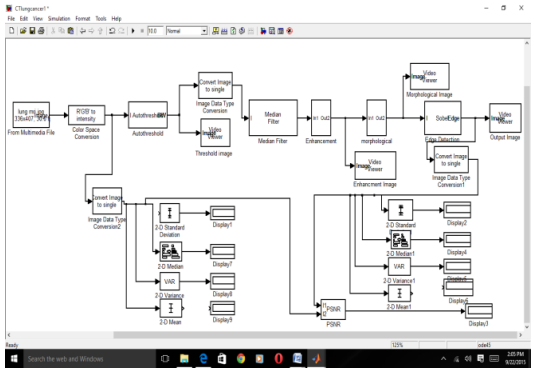

Figure 1: Simulink model of algoritham for lung cancer fromwhich CT scan MRI and Ultrasound images are compared

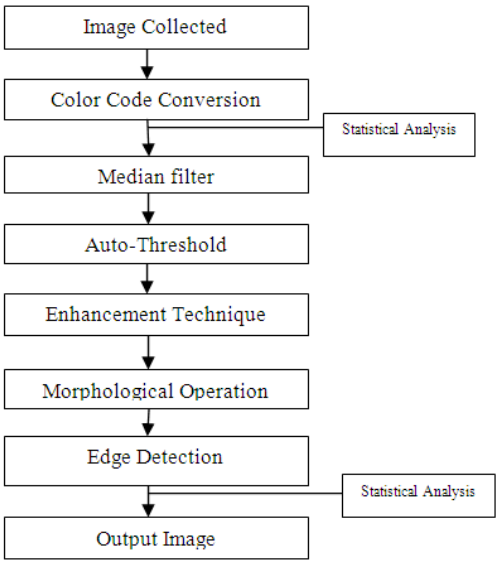

Fig1. Algorithm Design for the analysis of Lung cancer

6. METHODOLOGY

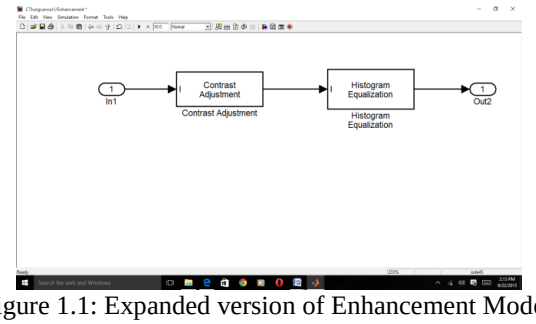

Figure 1.1: Expanded version of Enhancement Model

Image Type: Digital Imaging and Communications in Medicine (DICOM) is a standard which is given to the images containg information or used to storing, printing, and transmitting in medical imaging

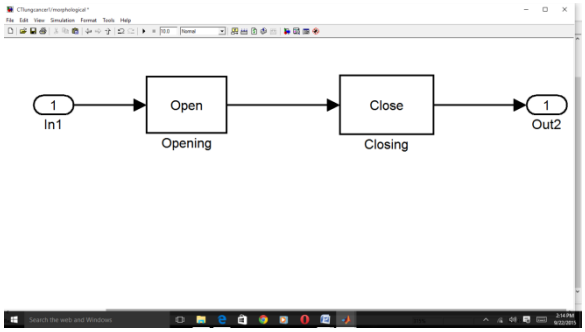

Figure 1.2 Expanded version of Morphological Operation

7. VISUAL COMPARISION

This comparision is done to elborate the conception of the visual effectes and difference. As it can give a basis judgment for the captured image and the infromation collected through this. We had tried here to show this visual comparision between lung cancer image from original image and output image, where output is considered as the after algorithm output image of different medical modality. Below shows the the detail of it:

I. CT scan:

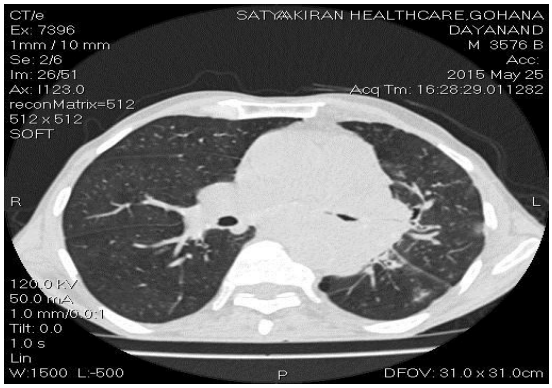

Figure 2 Original image of lung cancer of an CT Scan

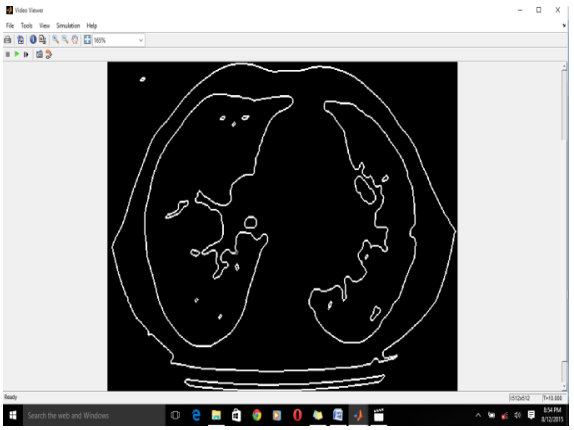

Figure 2.1 Output image of lung cancer of CT scan

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II. MRI :

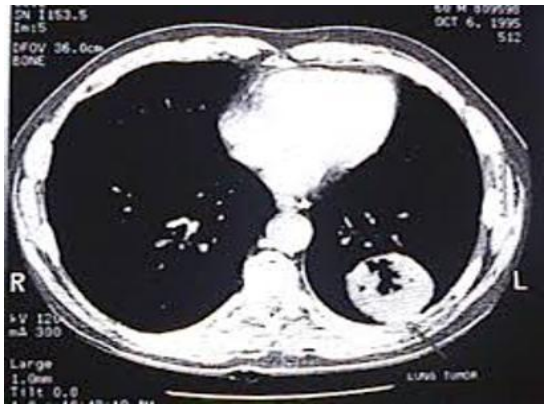

Figure 3 Original image of lung cancer of an MRI

Figure 3.1 Output image of lung cancer of an MRI

III. Ultrasound:

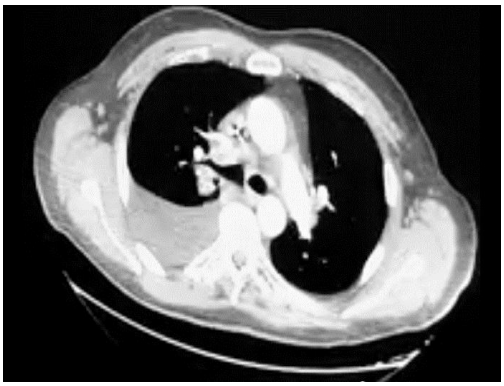

Figure 4: Original image of lung cancer of an ultrasound

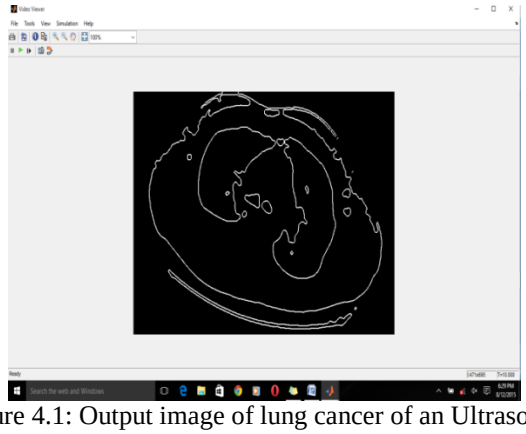

Figure 4.1: Output image of lung cancer of an Ultrasound

8. STATISTICAL ANALYSIS

This analysis is done to describe the feature which is extracted from an image. On that basis we define some parameters and evaluate the quality of an image. As shown below is a comparision table of parameters of the lung cancer image of different medical modality

I. CT scan

Table 3: Statstical parameter to show lung cancer the effect in CT scan Image

Count=262144		
Statics	Input image	After Algorithm
Median	0.2431	0
Mean	0.3801	0.0317
Standard Deviation	0.3421	0.1751
Variance	0.117	0.03064
PSNR	5.786	

II. MRI

Table 4: Statstical parameter to show lung cancer the effect in MRI Image

Count=136752		
Statics	Input image	After Algorithm
Median	0.145	0
Mean	0.3917	0.05279
Standard Deviation	0.3647	0.2236
Variance	0.133	0.05
PSNR	5.354	

III. Ultrasound

Table 5: Statstical parameter to show lung cancer the effect in Ultrasound Image

Count=327345		
Statics	Input image	After Algorithm
Median	0.06667	0
Mean	0.353	0.0336
Standard Deviation	0.3821	0.1803
Variance	0.146	0.0325
PSNR	5.583	

9. RESULT AND CONCLUSION

The proposed algorithm is evaluated on the basis of comparisons done with different approaches for lung cancer and from the values obtained from statistical analysis, applied on the region of interest in the lung cancer for different medical modalities. Statistical analysis for various images of lung cancer consists that highest PSNR is of CT scan images i.e. 5.786 which shows that the CT scan images have improved visual quality compare to others. The median is a measure of the level of pixels which is separating the high intensity value pixels from low intensity value pixel so we can see from here that the difference of this median value CT scan has the better output value. The results of statistical analysis of different medical modalities are given along with the comparison of

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the same algorithms used. The statistical analysis we have extracted and compared are in the Table 5 where, Mean of the pixel values in the defined window, estimates the value in the image in which central clustering occurs and the most stable mean is of CT scan 0.3801. The Standard Deviation is used to estimate the mean square deviation by the grey pixel value with its mean value. Standard deviation is used to define the dispersion around a local region. A low standard deviation indicated that the data points tend to be very close to the mean and here we can see that the CT scan standard deviation value is the lowest among all i.e. 0.1751, whereas the maximum variance in data results in maximum information content which is required for better classification and MRI have the Maximum variance 0.05 but the CT scan count values are more than that of the MRI means the pixel value is more. Variance is a measure of how far a set of numbers is spread out and how far it is from mean. Ultrasound have the maximum count but the image quality of the ultrasound image is not upto the mark also ultrasound is technique of air such that if air is detected that the image get black else any object is there then image is white, so it make the analysis clumsy where as this is not the case with MRI and CT scan.

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