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Detection of Dead tissues in Medical Images Using Image Segmentation

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Abstract: **In the present scenario of the world, the medical imaging plays a major role in the medical imaging science. If we get the information about the dead tissues which are not visible by naked eyes or by machines, well in the time then we can easily prevent the further spreading of disease on the other parts of the body. One of the major problems coming in the medical field is that doctors are not able to detect that infected part which is not visible bye naked eyes and therefore they only operate the visible infected part of the skin and this may cause a major problem like cancer or any dangerous disease in the future. This paper is mainly concerned to overcome this problem by using the techniques of MATLAB using image processing toolbox are used for detection of dead tissues which are visible as well as which are not visible. Up till now the training of such images were done which have sharp variation in the RGB values. Through this project we have trained the images that do not have very sharp variations in the RGB values. For training various techniques such as Edge Detection, Histogram Thresholding and K-means.**

Keywords— **Medical Imaging, MRI, Segmentation, RGB, ANN, Clusters, Edge Detection**

I. INTRODUCTION:

In present scenario of the world day by day we are introduced with the new kinds of medical problems. India is the second most popular country of the world and has changing socio-political demographic and morbidity patterns that have been drawing global attention in recent years. Despite several growths orientated policies adopted by the government, the widening economic, regional and gender disparities are posing challenges for the health sector. About 75% of health infrastructure, medical man power and other health resources are concentrated in urban areas where 27% of the population lives. Contagious, infectious and waterborne diseases such as diarrhea, amoebiasis, typhoid ,infectious hepatitis, worm infestations, measles, malaria, tuberculosis, whooping cough, respiratory infections, pneumonia and reproductive tract infections dominate the morbidity pattern, especially in rural areas. However, non-communicable diseases such as cancer, blindness, mental illness, hypertension, diabetes, HIV/AIDS, accidents and injuries are also on the rise.

The health status of Indians, is still a cause for grave concern, especially that of the rural population. This is reflected in the life expectancy (63 years), infant mortality rate (80/1000 live births), maternal mortality rate (438/100 000 live births).However, over a period of time some progress has been made. To improve the prevailing situation, the problem of rural health is to be addressed both at macro (national and state) and micro (district and regional) levels. This is to be done in a holistic way, with a genuine effort to bring the poorest of the population to the centre of the fiscal policies. Many a times it is seen that medical specialist are not able to clearly visualize the problems that are occurring, for example here we are analyzing the problem of skin infections which is very commonly occurring now a days. Although it is an external disease but still doctors are not able to clearly see it with their naked eyes.

II. MEDICAL IMAGING AND HAZARDS ASSOCIATED WITH IT

Medical imaging is the technique, process and art of creating visual representations of the interior of a body for clinical analysis and medical intervention. Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. This rapidly evolving field of medicine originated in the first decade of the 19th

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century, when Wilhelm Rontgen, a professor of physics at Wurzburg University in Germany, discovered electromagnetic radiation. After the World War Two, the development of computer technology has triggered an amazing revolution in medical imaging techniques. There is a continuous drive not only to improve the diagnostic yield of medical imaging techniques for clinical use, but also the management of the huge amount of digital information available to medical imaging departments[1].

Hazards associated with modern medical imaging are outlined below, and include:

(a) Exposure to ionizing radiation: Radiography and CT use ionizing radiation. Numerous studies, including those on survivors of the atomic bomb attacks in Japan in 1945, have shown that ionizing radiation in large doses is harmful[2]. The risks of harm from medical radiation are low, and are usually expressed as the increased risk of developing cancer as a result of exposure. Radiation effects occur as a result of damage to cells, including cell death and genetic damage. Actively dividing cells, such as are found in the bone marrow, lymph glands and gonads are particularly sensitive to radiation effects.

(b) Anaphylactoid reactions to iodinated contrast media: Most patients injected intravenously with iodinated contrast media experience normal transient phenomena, including a mild warm feeling plus an odd taste in the mouth. With modern iodinated contrast media, vomiting at the time of injection is uncommon. More significant adverse reactions to contrast media may be classified as mild, intermediate or severe anaphylactoid reactions:

- Mild anaphylactoid reactions: mild urticaria and pruritis.
- Intermediate reactions: more severe urticaria, hypotension and mild bronchospasm.

(c) Contrast-induced nephropathy (CIN): Contrast-induced nephropathy (CIN) refers to a reduction of renal function (defined as greater than 25 per cent increase in serum creatinine) occurring within 3 days of contrast medium injection. Most cases of CIN are self-limiting with resolution in 1–2 weeks [3]. Dialysis may be required in up to 15 per cent.

(d) **MRI safety issues**: Potential hazards associated with MRI predominantly relate to the interaction of the magnetic fields with metallic materials and electronic devices. Ferromagnetic materials within the patient could possibly be moved by the magnetic field causing tissue damage. Common potential problems include metal fragments in the eye and various medical devices such as intracerebral aneurysm clips.

(e) **Nephrogenic systemic sclerosis (NSF) due to Gd-containing contrast media:** Nephrogenic systemic sclerosis (NSF) is a rare complication of some Gd-based contrast media in patients with renal failure. Onset of symptoms may occur from one day to three months following injection. Initial symptoms consist of pain, pruritis and erythema, usually in the legs. As NSF progresses there is thickening of skin and subcutaneous tissues, and fibrosis of internal organs including heart, liver and kidneys.

III. SEGMENTATION

Segmentation literally means the process of dividing something into parts or segments, i.e., the formation of many cells from a single cell. The main goal of segmentation is to simplify and/or change the representation into something that is more meaningful and easier to analyze.

In medical, Research efforts have been devoted to processing and analyzing medical images to extract meaningful information such as volume, shape, motion of organs, to detect abnormalities. Image Segmentation can be perform from different ways:

a. otsu's method: In computer vision and image processing, Otsu's method is used to automatically perform clustering-based image thresholding, or, the reduction of a graylevel image to a binary image. The algorithm assumes that the image to be thresholded contains two classes of pixels or bi-modal histogram (e.g. foreground and background) then calculates the optimum threshold separating those two classes so that their combined spread (intra-class variance) is minimal.

b. k-means clustering method: K-Means is a least-squares partitioning method that divide a collection of objects into K groups. The algorithm iterates over two steps:

1. Compute the mean of each cluster.
2. Compute the distance of each point from each cluster by computing its distance from the corresponding cluster mean. Assign each point to the cluster it is nearest to.
3. Iterate over the above two steps till the sum of squared within group errors cannot be lowered any more.

Once the image has been segmented using the K-Means algorithm, the clustering can be improved by assuming that neighboring pixels have a high probability of falling into the same cluster. Thus, even

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if a pixel has been wrongly clustered, it can be corrected by looking at the neighboring pixels.

c. edge detection: Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed *edges*. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction.

***d. histogram thresholding*: T**he histogram thresholding method is a good candidate for achieving segmentation for a wide class of gray level images low computation complexity. Histogram thresholding is based on selecting the middle gray value as the threshold value between the two peaks.

IV MATERIALS AND METHODS

The following image is taken under consideration:

Fig.1- Sample image of a skin disease

This is some kind of skin disease known as Psoriasis. This image is collected from Dr. Nitin Mishra, a skin specialist in Bareilly. This image is of 33 year old man named Arjun Khanna suffering from this disease. A non-contagious rash of red plaques covered with black scales, psoriasis usually affects the scalp, elbows, knees, and lower back. The rash can heal and recur throughout life. The cause of psoriasis is unknown, but the immune system triggers new skin cells to develop too quickly. Treatments include medications applied to the skin, light therapy, and medications taken by mouth, injection or infusion. It is generally considered a genetic disease thought to be triggered or influenced by environmental factors.[2] Psoriasis develops when the immune system mistakes a normal skin cell for a pathogen, and sends out faulty signals that cause overproduction of new skin cells. Analysis using various segmentation techniques:

a. otsu's method: Otsu's method is used to automatically perform clustering-based image thresholding, or, the reduction of a gray level image to a binary image. The algorithm assumes that the image to be thresholded contains two classes of pixels or bi-modal histogram (e.g. foreground and background) then calculates the optimum threshold separating those two classes so that their combined spread (intra-class variance) is minimal.

However this method suffers from the drawback that it becomes too complicate when number of area more than three. Here by using this technique, to some extent we are able to interpret the infected portion but not clearly.

Fig.2- image of sample by Otsu's method

The Figure shows the segmented result using Histogram thresholding. Histogram thresholding is based on selecting the middle gray value as the threshold value between the two peaks, which is diagrammed in the above figure. This method also does not give any result when it is applied to multispectral image. This method is not efficient in our study because it does not give information regarding the dead tissue area detection.

Fig.3- false colour image of sample

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b. histogram thresholding: The histogram thresholding method is a good candidate for achieving segmentation for a wide class of gray level images low computation complexity. This method ignores the spatial relationship information of the pixel that can give improper results. The main advantage of this method is that it does not require prior knowledge regarding the number of objects in the image. It is found out that there are two classic peaks in grey-scale histogram diagram. Then we could select the middle gray value between them. It is encouraged to test the appropriate middle gray value.

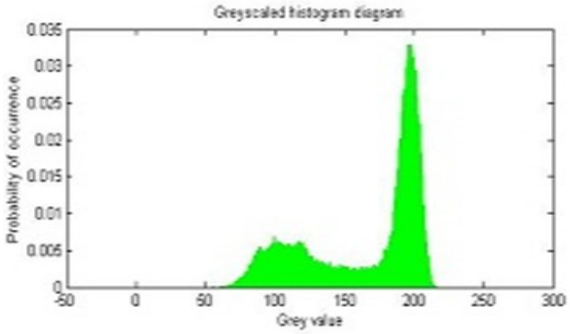

Fig.4- Gray scale image of sample

c. edge detection technique: For the gradient magnitude methods (Sobel, Prewitt, Roberts), is used to threshold the calculated gradient magnitude. The Canny method applies two thresholds to the gradient: a high threshold for low edge sensitivity and a low threshold for high edge sensitivity.

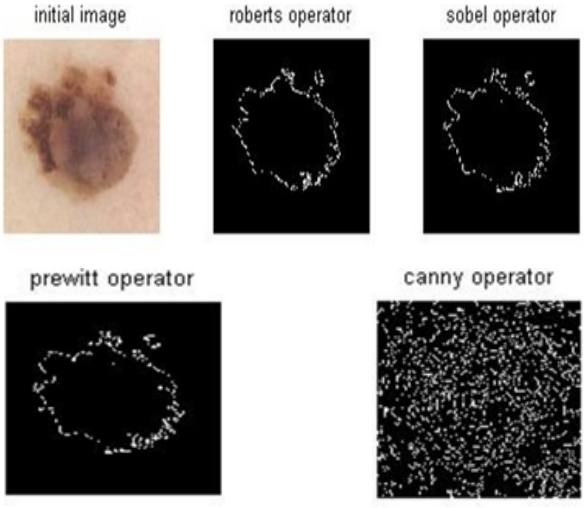

Fig.5- images of sample after applying edge detection techniques

The Figure shows the segmented result using edge detection. By comparisons with segmented results, we can see image detected by canny operator has complete and meticulous edge, which is illustrated in the above figure. Based on qualitative evaluation, canny operator is better at detecting the edges than other three. Finally, all the segmented results show the same thing that canny operator is very suitable to be applied in welding detection because of its unparalleled good detection performance.

V. CONCLUSION

The study shows that analysis can also be done on the images that do not have very sharp variation in RGB values. When various segmentation techniques are applied to such images the results were satisfactory, the proper visualization of the dead tissues of the images is achieved.

However more improved and efficient results can be obtained by using intelligence techniques such as ANN. So we can conclude that the training of such images is also possible even after no sharp variation in their RGB values. Despite having some difficulty, these techniques are very helpful in medical science. The data we have collected will be helpful for doctors to see the clear image of the infected part in the skin as well as that part which are not visible by naked eyes.

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