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DETECTION OF INFECTED REGION ANALYSIS USING ADAPTIVE THRESHOLD TECHNIQUE

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Abstract: -

Image thresholding is a common task in many computer vision and graphics applications. Analysing the abnormal region in various medical images is the critical issues because these images contain different types attenuation artefacts. This paper proposes an automatic method to change the representation of an image into something that is more meaningful and easier to analyse. There are several methods that intend to perform identification, but it is difficult to adapt easily and identify the object accurately. To resolve this problem, this paper aims to presents an adaptable thresholding technique that can be applied to any type of medical images. In this approach, structures in the image are assigned a label by comparing their gray level value to one or more intensity thresholds. A threshold that is calculated at each pixel characterizes this class of algorithms. The value of the threshold depends upon some local statistics like range, variance, and surface fitting parameters or their logical combinations. The image gradient magnitude is obtained and threshold surface is constructed by interpolation with potential surface function.

Keywords: Adaptive, Dynamic, Infected Medical Image, Thresholding

I. INTRODUCTION

Biomedical image processing has experienced dramatic expansion, and has been an interdisciplinary research field attracting expertise from applied mathematics, computer sciences, engineering, statistics, physics, biology and medicine. Computer-aided diagnostic processing has already become an important part of clinical routine. Accompanied by a rush of new development of high technology and use of various imaging modalities, more challenges arise; for example, how to process and analyse a significant volume of images so that high quality information can be produced for disease diagnoses and treatment. Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology, nuclear medicine, investigative radiological sciences, endoscopy, (medical) thermographs, medical photography and microscopy. Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magneto encephalography (MEG), electrocardiography (EKG) and others, but which produce data susceptible to be represented as maps can be seen as forms of medical imaging.

Medical imaging is often perceived to designate the set of techniques that noninvasively produce images of the internal aspect of the body. In this restricted sense, medical imaging can be seen as the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect. In the case of ultrasonography the probe consists of ultrasonic pressure waves and echoes inside the tissue show the internal structure. In the case of projection radiography, the probe is X-ray radiation which is absorbed at different rates in different tissue types such as bone, muscle and fat. The influence and impact of digital images on modern society is tremendous, and image processing is now a critical component in science and technology. The rapid progress in computerized medical image reconstruction, and the associated developments in analysis methods and computer-aided diagnosis, has propelled medical imaging into one of the most important sub-fields in scientific imaging thresholding.

II. ANALYSIS

Medical Image Analysis provides a forum for the dissemination of new research results in the field of medical and biological image analysis, with special emphasis on efforts related to the applications of computer vision, virtual reality and robotics to biomedical imaging problems. Medical imaging is a routine and essential part of medicine. Pathologies can be observed directly rather than inferred from symptoms. For example, a physician can non-invasively monitor the healing of damaged tissue or the growth of a brain tumor, and determine an appropriate medical response. Medical imaging techniques can also be used when planning or even while forming surgery. For example, a neurosurgeon can determine the “best” path in which to insert a needle, and then verify in real time its position as it is being inserted.

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A. Lesion

A lesion is an abnormal growth of tissue projecting from a mucous membrane. E.g. Polyps, ulcers, etc., Polyps are commonly found in the colon, stomach, nose, sinus, urinary bladder and uterus. They may also occur elsewhere in the body where mucous membranes exist like the cervix and small intestine .An ulcer is a sore on the skin or a mucous membrane, accompanied by the disintegration of tissue. Ulcers can result in complete loss of the epidermis and often portions of the dermis and even subcutaneous fat. Ulcers are most common on the skin of the lower extremities and in the gastrointestinal tract. An ulcer that appears on the skin is often visible as an inflamed tissue with an area of reddened skin. A skin ulcer is often visible in the event of exposure to heat or cold, irritation, or a problem with blood circulation. They can also be caused due to a lack of mobility, which causes prolonged pressure on the tissues. This stress in the blood circulation is transformed to a skin ulcer, commonly known as bedsores ulcers. Ulcers often become infected, and pus forms.

Skin ulcers appear as open craters, often round, with layers of skin that have eroded. The skin around the ulcer may be red, swollen, and tender. Patients may feel pain on the skin around the ulcer, and fluid may ooze from the ulcer. In some cases, ulcers can bleed and, rarely, patients experience fever. Ulcers sometimes seem not to heal; healing, if it does occur, tends to be slow. Ulcers that heal within 12 weeks are usually classified as acute, and longer-lasting ones as chronic.

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B. Thresholding

Thresholding methods into the following six groups based on the information the algorithm manipulates

In histogram shape-based methods, the peaks, valleys and curvatures of the smoothed histogram are analyzed.In clustering-based methods, where the gray-level samples are clustered in two parts as background and foreground (object), or alternately are modelled as a mixture of two Gaussians. In Entropy of the foreground and background regions, the cross-entropy between the original and binarized image, etc. In object attribute-based methods search a measure of similarity between the gray-level and the binarized images, such as fuzzy shape similarity, edge coincidence, etc. In Spatial methods use higher-order probability distribution and correlation between pixels Local methods adapts the threshold value on each pixel to the local image characteristics."

III. MULTILEVEL ADAPTIVE THRESHOLDING

In Multilevel adaptive thresholding process, separating an image into different regions based upon its gray level distribution. Key to the selection of a threshold value is an image's histogram, which defines the gray level distribution of its pixels. The bimodal nature of this histogram is typical of images containing two predominant regions of two different gray levels as objects and background. When dealing with digital pictures, most images are having continuous intensity variation and if only a single threshold level is used then many important regions are lost. It becomes difficult to identify significant regions of such images having multimodal histogram. A better method of Thresholding the gray level image is thus to use multilevel Thresholding instead of bi level thresholding. This is the approach that is taken in the implementation of optimal thresholding.

A. Adaptive Threshold Selection

Thresholding is called adaptive thresholding when a different threshold is used for different regions in the image. This may also be known as local or dynamic thresholding In thresholding process, individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value and as "background" pixels otherwise. This convention is known as threshold above. Variants include threshold below, which is opposite of threshold above; threshold inside, where a pixel is labeled "object" if its value is between two thresholds; and threshold outside, which is the opposite of threshold inside Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." Finally, a binary image is created by coloring each pixel white or black, depending on a pixel's labels.

Thresholding process is the choice of the threshold value. Several different methods for choosing a threshold exist; users can manually choose a threshold value, or a thresholding algorithm can compute a value automatically, which is known as automatic thresholding.simple method would be to choose the mean or median value, the rationale being that if the object pixels are brighter than the background, they should also be brighter than the average. In a noiseless image with uniform background and object values, the mean or median will work well as the threshold, however, this will generally not be the case. A more sophisticated approach might be to create a histogram of the image pixel intensities and use the valley point as the threshold. The histogram approach assumes that there is some average values for both the background and object pixels, but that the actual pixel values have some variation around these average values. However, this may be computationally expensive, and image histograms may not have clearly defined valley points, often making the selection of an accurate threshold difficult. In such cases a unimodal threshold selection algorithm may be more appropriate. One method that is relatively simple, does not require much specific knowledge of the image, and is robust against image noise, is the following iterative method:

An initial threshold (T) is chosen; this can be done randomly or according to any other method desired.

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The image is segmented into object and background pixels as described above, creating two sets:

K1 = {f(m,n):f(m,n)>T} (object pixels)

K2 = {f(m,n):f(m,n)$\leq$T}

The average of each set is computed.

m_1 , m_2= average value of k1and k2.

A new threshold is created that is the average of m_1 and m_2

T' = ($m_1 + m_2$)/2

Go back to step two, now using the new threshold computed in step four, keep repeating until the new threshold matches the one before.

Finally, the image is analysed by using adaptive threshold method which is given by

$$Yn = \sum_{j=0}^{N-1} x_j u_{n-j}$$

Fig 1, Proposed Method- Multilevel Adaptive thresholding

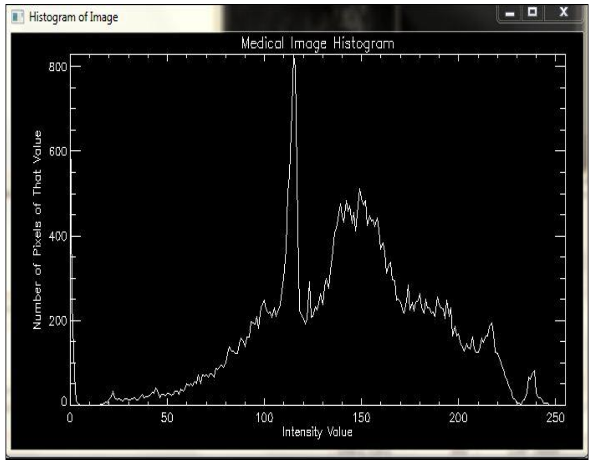

Fig 2, Histogram Analysis

IV. EXPERIMENTAL RESULTS

Our algorithm has been tested for a variety of images. The result shows that our methodology is adaptable to identify lesion structure in various medical images.

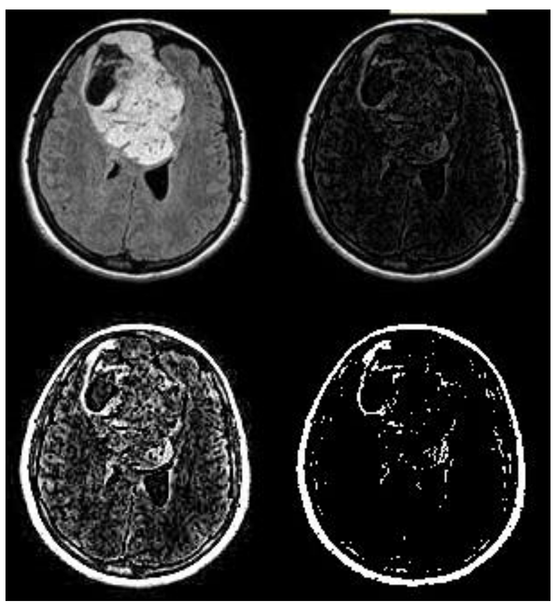

Fig 3, Small object identification

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V. CONCLUSION

This paper proposes an analysis of medical image by using multilevel Adaptive thresholding method. Our algorithm is easily adaptable to identify all types of lesion structure in various medical images. Therefore, we conclude that the proposed method identifies the abnormal objects clearly and contrast effectively.

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