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Estimation for Lesion Depth in Mammograms using Stereotactic Biopsy

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Abstract: Image Detection is typically used to locate objects and boundaries (lines, curves, etc.) in images. Partitioning of an image into several constituent components is called Detection. Detection is an important part of practically any automated image recognition system, because it is at this moment that one extracts the interesting objects, for further processing such as description or recognition. Detection of an image is in practice the classification of each image pixel to one of the image parts. Detection subdivides an image into its constituent regions or objects Lesion detection is one of the challenging task in image processing as most of false positive results are not breast cancer. So to ensure the availability of the lesion Biopsy plays the important role. Stereotactic biopsy plays import role in digital and automatic finding the location of lesion. Stereotactic biopsy uses a pair of digital or analog mammography images obtained from 30 degrees apart to calculate the depth of a target lesion below the surface. In this paper we are presenting the application of parallax method to find the depth of lesion in stereotactic biopsy.

Keywords: Stereotactic biopsy, breast cancer, lesion depth, parallax method.

I. INTRODUCTION

One of the major factors affecting women health in present times is Breast Cancer and breast cancer has been increasing at an exponential rate. It is affecting one in every seven women. A statistics has shown that in 2006 out of an estimated 6000 women diagnosed, 1500 were suffering from breast cancer.

Detecting breast cancer as early as possible is thought to considerably reduce mortality and also may allow the removal of localized cancer without resorting to mastectomy.

Most of the women are suffering from breast cancer. It is very common disease found in the women and the second leading cause of cancer-related mortality. More than 280 000 new cases are diagnosed each year, more than 39 000 women die of breast cancer, and approximately 2.6 million women in the United States have a history of previous breast cancer. The lifetime risk that a woman will develop invasive breast cancer is approximately 1 in 8, and the lifetime risk of dying from breast cancer is 1 in 35. Several clinical studies have shown that screening women using mammography significantly reduces the risk of breast cancer mortality. The beneficial effects of screening are greater in older women, and become more notable when patients are followed-up over longer periods of time. A recent analysis of outcomes over a period of nearly 30 years found that screening mammography reduces a woman's risk of breast cancer mortality by approximately 30%.It is highly need of accurate method that could correct position the lesion. Therefore, most abnormal mammograms are false-positive findings that require additional evaluation. The objective of a breast biopsy is to obtain cells for microscopic evaluation from a suspicious breast lesion. Although very small lesions may be completely removed in some cases as a result of the biopsy procedure, the removal of suspected cancer is not the objective of the biopsy. Examination of biopsy samples by a pathologist is often essential in diagnosing suspicious breast masses, determining how far the patient's cancer has advanced, and deciding on a course of treatment. Stereotactic breast biopsy has increasingly been used as an alternative to surgical biopsy of suspicious breast masses. The stereotactic biopsy procedure is usually fast, relatively pain free, and similar in accuracy to more invasive surgical biopsy. Positioning difficulties and procedural errors during the biopsy process may cause treatment delays and require patients to undergo additional procedures. Stereotactic biopsy basically uses the computer and image processing technique from two planes to localize the target lesion (such as a tumor or micro calcifications in the breast) in three-dimensional space and guide the removal of tissue for examination by a pathologist under a microscope. Stereotactic core biopsy makes use of the underlying principle of parallax to determine the depth or "Z-dimension" of the target lesion.

II. STEREOTACTIC BIOPSY PROCEDURE

Stereotactic breast biopsy uses the method of parallax to calculate the 3-dime lesion in space from a pair of 2-dimensional images.

Parallax is the change in the apparent location of a stationary object that occurs when the object is viewed from different locations. Stereotactic biopsy uses the parallax between 2 mammography images that are offset from one another by 30 degrees to calculate the depth of the lesion below the breast surface, in much the same way as the eyes use binocular vision to calculate depth perception. The location of the lesion in space is typically expressed using rectangular, or cartesian coordinates, with x, y, and z axes that intersect at right angles to one another representing width, height, and depth. Alternatively, the target may be localized using polar coordinates, in which horizontal and vertical orientations are measured from a reference point in angular degrees, and distance is measured in millimeters. Regardless of the specific

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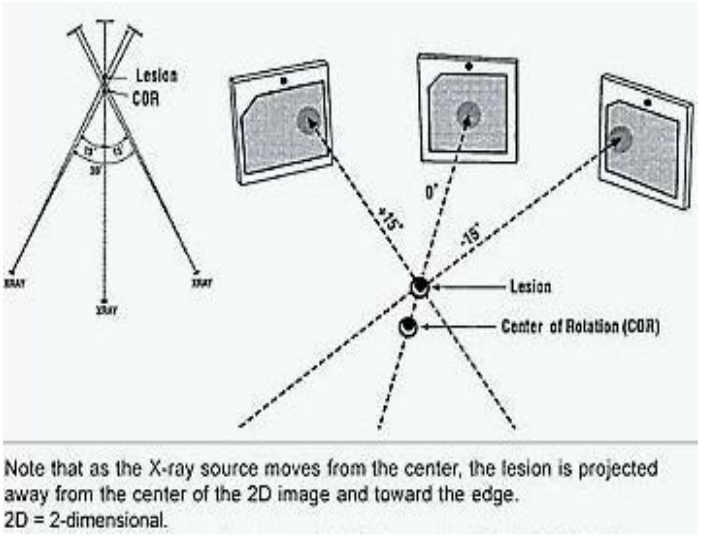
coordinate system used, the lesion must be clearly defined and accurately positioned on both stereo images in order to correctly place the biopsy needle within the breast. Positioning difficulties or the failure to visualize the lesion on both views are most likely to result in calculation errors for the z value (depth).

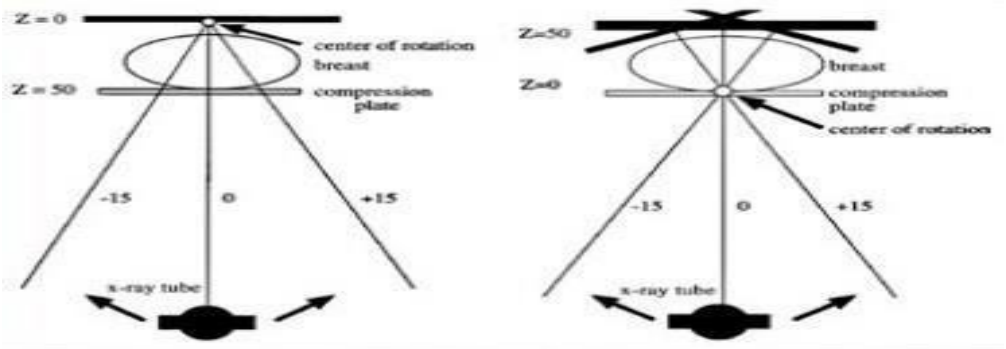


Note that as the X-ray source moves from the center, the lesion is projected away from the center of the 2D image and toward the edge.
2D = 2-dimensional.

Fig1: Projection of an image on a 2D plane at -15^0 , 0^0 and 15^0

The rationale for the stereotactic imaging method, potential sources of imaging error, is the ways to overcome these barriers. The breast is compressed between a compression plate and back breast support in order to ensure that the lesion remains in a fixed point in space. An initial scout image is obtained with the X-ray beam perpendicular to the compression plate. This image is used to center the lesion in the field of view, and 2 additional X-ray images are obtained with the X-ray source positioned at +15 degrees and -15 degrees. The projection of the 3-dimensional location of the lesion onto a pair of 2-dimensional images is shown in Figure 2. Obtaining radiographs at an offset of +15 and -15 degrees results in the shifting of the target on the 2 resulting images. A computer program uses this parallax shift to calculate the depth of the lesion (the distance along the z dimension). However, in order to interpret the relationship between the parallax motion and the target depth, it is essential to know whether the center of rotation is placed in front of or behind the target.

Stereotactic breast biopsy is usually performed using a dedicated prone breast biopsy table with the breast placed through an opening in the underside of the table. Stereotactic biopsy may also be performed with a conventional upright mammogram device using an add-on stereotactic unit. Both the prone and upright approaches have benefits and limitations. Add-on devices have generally been less popular than stand-alone prone tables because the ability of patients to more easily views the procedure.



The relationship between image parallax and target depth depends on the placement of the center of rotation. In the device shown on the left, the center of rotation is behind the breast, with the imaging surface remaining in place. In this case, larger parallax occurs for lesions that are closer to the compression plate (more superficial). For the device shown on the right, the center of rotation is at the compression plate, and the imaging sensors move with the X-ray tube. In this case, larger parallax indicates that the target lesion is farther from the compression plate, or deeper in the breast.

Fig 2: Relation between image parallax and target depth

III. CONCLUSION

Importance for stereotactic biopsy in lesion confirmation is important also this process is painless and accurate it is based on image processing where we find the z depth using logical and mathematical technique when Z Depth is find out The biopsy needle is placed within the lesion, and stereo images are obtained a second time to confirm placement. Tissue

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samples are then collected, and post fire images are obtained with the sample collecting needle in its extended position to ensure that the lesion is adequately sampled. The biopsy probe is withdrawn and a final image is obtained. If the lesion has been mostly or completely removed by the biopsy procedure, a metal clip is placed at the lesion site so that it can be located if the tissue sample reveals that the lesion is cancerous. If the target lesion contains calcifications, a sample radiograph may be performed to verify correct sample acquisition. This methodology can help in the investigation of the early breast cancer detection since both the computation time and the hardware memory size can be largely reduced because of the simple stereotactic biopsy algorithm used to reconstruct the image.

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