ANALYSIS OF MALIGNANT NEOPLASTIC USING IMAGE PROCESSING TECHNIQUES

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***Abstract*— Breast Cancer is the second most frequently diagnosed cancer, leading to cancer death worldwide. Early detection of breast cancer saves lives. Mammograms play an important tool in early detection of breast cancer. Cancer that originates from the breast tissue is called as Breast Cancer. Cancer originating from the inner lining of milk ducts is called as Ductal Carcinomas (70%). Cancer originating from the lobules which are the glands that produce milk is called as Lobular Carcinomas (15%). Breast Cancer occurs in humans and other mammals. Every 74 seconds, somewhere in the world, someone dies from breast cancer, in which the majority is woman. Approximately 425,000 women around the world died from the disease in 2010. At this rate, 10.6 million women will die from breast cancer during the next 25 years. It is 100 times more common in women than in men. Mammography is a specific type of imaging that uses a low dose X-Ray system to examine breast cancers. Mammography exam is called Mammogram. In our proposed project, Image processing techniques are used in accurate and timely detection of Breast Cancer in high resolution medical images. Collected images from the database are segmented using Marker-Controlled Watershed segmentation method. The segmented image is then enhanced and the features are extracted using Gabor filter. Another methodology of Circular Hough Transform is used to obtain 3-Dimensional image of the Cancer.**

Keyword- Breast Cancer, Carcinomas, Mammogram, Marker–Controlled Watershed Segmentation, Gabor filter, Circular Hough Transform.

I. INTRODUCTION

Cancer is a disease that begins in the cells of the body. Under normal conditions, the cells grow and divide depending on the requirement of the body. This orderly process is disturbed when new cells are formed which is not needed by the body and old cells don't die when they should. These extra cells lump together to form a growth called Tumor. There are two types of cancer, benign and malignant.

A. Benign:

Benign tumors are not cancerous. They can usually be removed and generally don't grow back once they're gone. The cells in benign tumors don't spread and it is rare for a benign tumor to be life-threatening.

B. Malignant:

Malignant tumors, on the other hand, are cancerous. The cells are abnormal and divide randomly and chaotically. The cells behave aggressively and attack the tissue around them. They also can move away from the malignant tumor and enter the bloodstream or lymphatic system to form new tumors in other parts of the body. This type of spread is known as metastasis.

C. Types of cancer:

Depending on which tissue they come from, different types of cancers are,

C1. Carcinomas: These are the most common types of cancer arise from the cells that cover external and internal body surfaces. Lung, Breast and Solon are the most frequent cancers of this type.

C2. Sarcomas*:* These are arising from cells found in the supporting tissues of the body such as bone, cartilage, fat, connective tissue and muscle.

C3. Lymphomas: These arise in the lymph nodes and tissues of the body's immune system.

C4. Leukaemias: These are immature blood cells that grow in the bone marrow and tend to accumulate in large numbers in the bloodstream.

D. Breast:

The breast is the upper ventral region of the torso of a primate, in left and right sides, containing the mammary gland which in a female can secrete milk.

Both men and women develop breasts from the same embryological tissues. However, at puberty, female sex hormones, mainly estrogen, promote breast development, which does not occur in men, due to the higher amount of testosterone. as a result, women's breasts become far more prominent than those of men.

During pregnancy, the breast is responsive to a complex interplay of hormones that cause tissue development and enlargement in order to produce milk. Three such hormones are estrogen, progesterone and prolactin. These are the one which cause glandular tissue in the breast and the uterus to change during the menstrual cycle

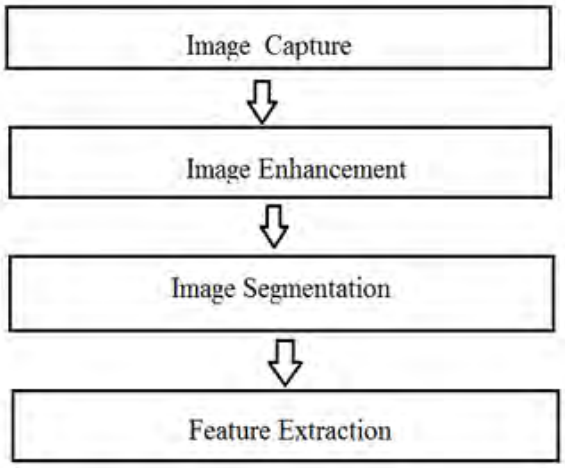
E. Breast cancer:

Cancer that originates from the breast tissue is called as Breast Cancer.

E1. Types:

1. Ductal Carcinoma:
   Cancer originating from the inner lining of milk ducts is called as Ductal Carcinomas (70%).
2. Lobular Carcinoma:
   Cancer originating from the lobules which are the glands that produce milk is called as Lobular Carcinomas (15%).

II. METHODOLOGY



Images collected from the data base are first enhanced by using Gabor transform. The enhanced image is then segmented using Marker-Controlled Watershed segmentation. Then, the features are extracted from the segmented image

III. IMPLEMENTATION

Images are collected from the available data base of MRI/CT images.

Fig 1: Input Image

A. Image enhancement:

Image enhancement is improving the interpretability or perception of images, for human viewers and providing better input for other automated image processing techniques.

A1. Principal objective of image enhancement:

Sharpening of image features such as boundaries, or contrast, to make an image easy for further analysis (also for visual perception).

A2. Gabor filter:

There are several techniques for image enhancement, in which using Gabor filter shows better output in our proposed project. Image presentation based on Gabor function constitutes an excellent local and multiscale decomposition in terms of logons that are simultaneously localized in both space and frequency domains. A Gabor filter is a linear filter, whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function.

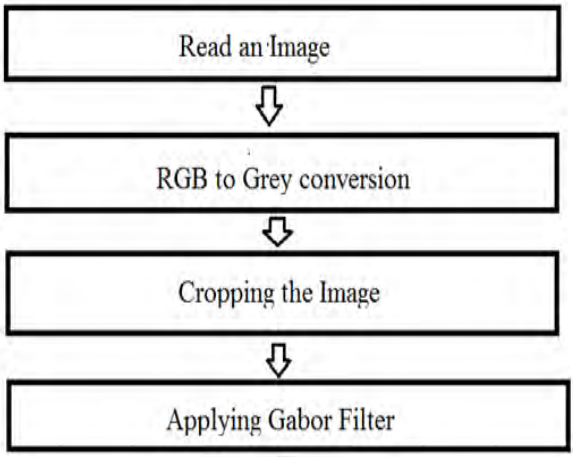


Fig 2: Image Enhancement Process

Fig 3: Enhanced Image.

B. Image segmentation:

The goal of segmentation is to partition a digital image into multiple segments, known as super pixels. In this paper, images is segmented using Marker-Controlled watershed segmentation is used.

B1. Watershed transform:

The watershed transform is computed on the gradient of the original image, so that the catchments basin boundaries are located at high gradient points. It is simple and intuitive, can be parallelized, and always produces a complete division of the image.

Most important drawbacks of watershed transform:

1. Over segmentation

2. Sensitivity to noise

3. Poor detection of significant areas, with low contrast.

4. Under segmentation

In order to overcome these drawbacks, we are going for Marker-Controlled Watershed Segmentation. The proposed scheme also enjoys the advantageous features of shape maintenance, edge preservation and scale-calibration.

B2. Marker-controlled watershed segmentation:

Separating touching objects in an image is one of the more tedious process image processing. This transform finds "catchments basins" and "watershed ridge lines" in an image by treating it as a surface. This is when in an image light pixels are high and dark pixels are low. This modification is carried out by a mathematical morphology operation and geodesic reconstruction, by which the function is modified such that the minima can be imposed by an external function known as the "marker function". All the catchment basins that are not marked are filled by the morphological reconstruction. Then that is transformed into non minima plateaus, which will not produce distinct regions when the final watersheds are calculated. Segmentation using the watershed transforms works well when foreground objects and background locations can be identified or marked.

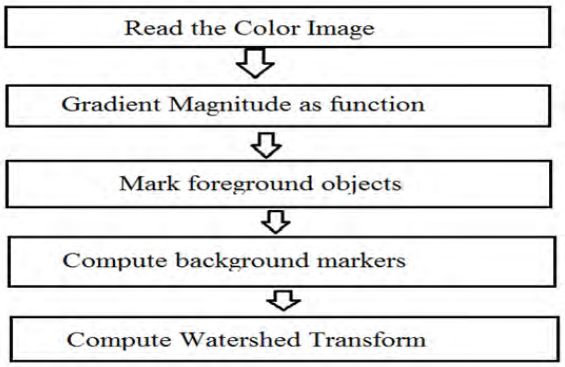


Fig 4: Segmentation Process

B3. Procedure for computing marker controlled watershed segmentation:

1. Compute a segmentation function. This is an image whose dark regions are the objects you are trying to segment.

2. Compute foreground markers. These are connected blobs of pixels within each of the objects.

3. Compute background markers. These are pixels that are not part of any object.

4. Modify the segmentation function so that it only has minima at the foreground and background marker locations.

5. Compute the watershed transform of the modified segmentation function.

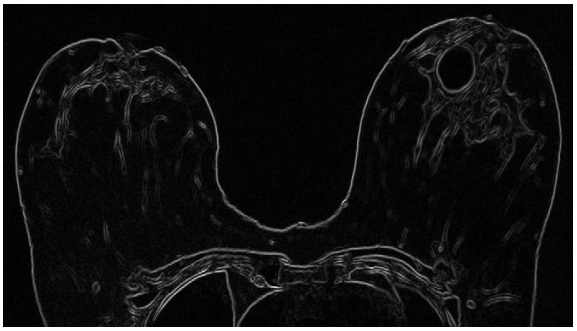


Fig 4: Gradient Magnitude(gradmag)

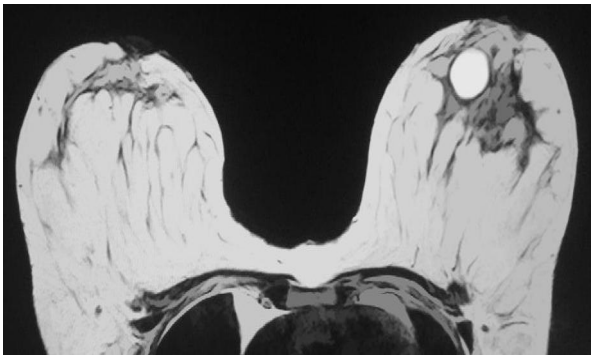


Fig 5: Opening-Closing by Reconstruction (lobr)

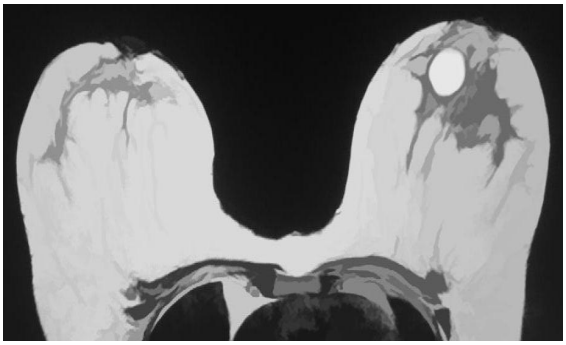


Fig 6: Opening-Closing by Reconstruction (lobrcbr)

Fig 7: Regional maxima of opening-closing by reconstruction

Fig 8: Regional maxima superimposed on original

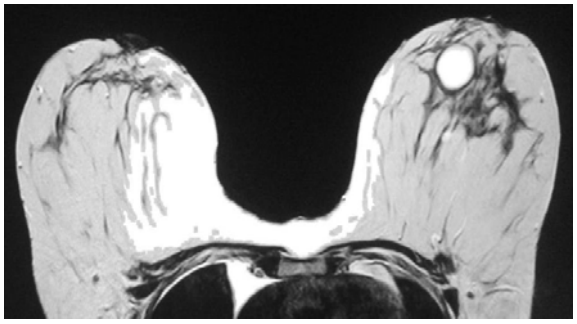


Fig 9: Modified regional maxima superimposed on original image

Fig 10: Threshold opening-closing by reconstruction (bw)

Fig 11: Watershed ridge lines (bgm)

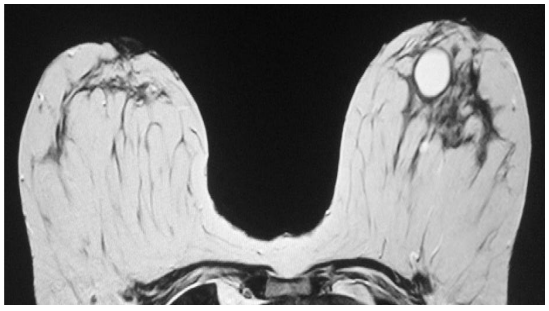


Fig 12: Markers and object boundaries superimposed on original image

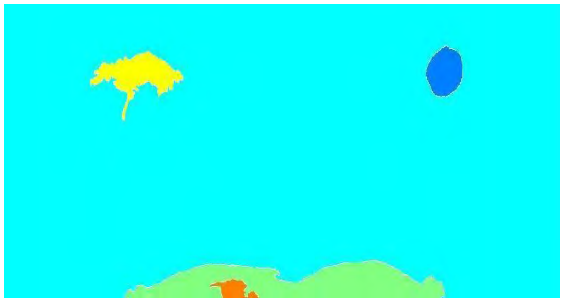


Fig 13: colored watershed label matrix

D. Feature extraction:

Feature Extraction is used to isolate the desired portions from the whole image. Gabor Filter is used here to extract the cancer portion from the entire segmented image. The solid blue color represents the cancerous part, from the background.

Fig 14: Feature Extracted Output

E. Circular Hough transform:

One another for indentifying the exact location of the Cancer a 3-D plot is drawn after performing Circular Hough Transform to the image. This gives a clear location of the cancer by the highest peak, since cancer density will be more than the normal tissue density.

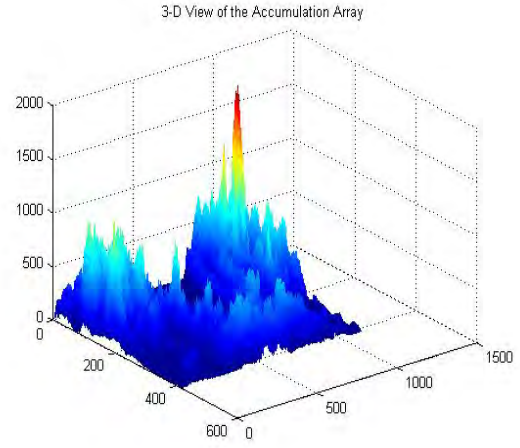


Fig 15: Circular Hough Transform

IV. CONCLUSION

Our system is a content-based image retrieval framework, which utilizes Gabor filters as the principal technique, to analyze the visual properties of cancer images. Gabor filters prove to be effective and able to capture distinct texture patterns of different classifications of images of cancer cells. Our proposed project shows that the watershed by foreground markers is able to segment real images containing severe irregularities in a better way than the standard watershed segmentation. The formulation is based on markers and simple morphology, which easily allows a regularization of the watersheds, and is a flexible approach for further optimization parameters. Our proposed algorithm can be applied on the CT/MR medical images grey, color, aerial images, and a high-resolution satellite images.

V. FUTURE IMPLEMENTATION

The technique can possibly be merged with advanced techniques like wavelet transforms, to improve the results especially in the case of high-resolution images. In future this technique can be used for other Dicom images. One promising next step is to determine, whether the detected tumor is benign or malignant.

This improvement has great potential to bring our system close to the real-world practice. We have a great hope that our framework can be a good start and further development on this project will enable this earlier detection of cancer cells to be employed successfully, as a useful tool, for diagnostic examinations, in daily clinical work in the near future.

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