

# A Survey on Breast Cancer Detection Techniques

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**Abstract**— Breast cancer affects one in eight women. It is undoubtedly dreadful and life threatening disease. The causative agent of breast cancer is still under research. But there are some risk factors such as age, gene, obesity, taking birth control pills and smoking. Generally breast cancer is a malignant tumour that begins in the cells of the breast and eventually it spreads to the surrounding tissues. The disease can be treated if it is detected early. As stages increases, the chance of curing decreases. There are various imaging techniques that play a vital role in detecting breast cancer. This study is an attempt to showcase various breast cancer detection techniques based on image processing technique and an overview about the advantages and disadvantages of each technique is provided.

**Keywords**- Breast cancer, MIP, Grading

## I. INTRODUCTION

Breast cancer is the second important cause of death. After lung cancer breast cancer occur the most. Breast cancer occurs usually in women, very rarely in men. The statistics shows that 6 percent of women in India die due to breast cancer. The disease can be cured if it is detected early. Plenty of work has been done in this field in order to cure this deadliest disease. Cancer begins in the cells which are the basic building blocks of the tissues. In some cases, the growth of cells goes wrong and they do not die as they should. When this occurs, a mass of cells develop they eventually lead to cancer. The medical imaging has revolutionized the field in detecting cancer. It is not only limited to detect cancer, they can also detect other kinds of disease. As mentioned earlier, breast cancer can be cured if it is detected earlier. Here by a survey of various techniques that can detect cancer is presented.

## II. FOUNDATION

As a foundation, the basics of breast cancer and diagnostic tools are explained in this section.

### A. CANCER

Cancer is an abnormal growth of cells that tend to replicate in uncontrolled manner. Cancer is not a single disease. It is a combination of more than 100 different and unique diseases. Cancer can involve any tissue of the body and have many altered forms in each body area.

### B. BREAST CANCER

Breast cancer is a hysterical augmentation of breast cells. The tumour is cancerous if the cells can invade surrounding tissues or spread to remote areas of the body.

## Types of Breast cancer

Breast cancer begins from different parts of the body. They are classified depending upon where they originate.

**Ductal cancer:** A cancer that begins in the duct which carries milk to the nipple.

**Lobular cancer:** A cancer that occurs in the milk producing glands of the breast.

**Inflammatory breast cancer:** An uncommon type of breast cancer. It makes the skin red and feels warm. It makes the skin appear thick and pitted.

**Paget disease of the nipple:** The cancer begins in the ducts of breast and spreads to the skin of the nipple and then to the dark circle around the nipple.

**Phyllodes tumour:** This cancer develops in the stroma of the breast

**Angiosarcoma:** This variety of cancer begins in cells that line lymph vessels or blood vessels.

### C. IMAGE PROCESSING

Image processing is a method to translate an image into its digital form and to get an enhanced image or to extract some of the features; certain operations are on the image.

### D. MEDICAL IMAGE PROCESSING

Medical imaging is the process or technique used to represent the internal structure of human body. Medical imaging seeks to disclose interior structures veiled by the skin and bones, as well as to detect and treat disease.

### E. MEDICAL IMAGE

Medical images are the images that represent the internal structure of the human body. They are captured by using various techniques.

## III. SURVEY

There are various techniques used for detecting breast cancer at early stages. This section describes each technique.

### A. MAMMOGRAPHY

In mammography the X-ray is used as a diagnostic tool. Low-dose X-rays are used to see inside the breast. It involves exposing a part of body to small dose of radiation.

#### 1. DIGITAL MAMMOGRAPHY

It is also called as full-field digital mammography (FFDM). Here the x-ray film is replaced by electronics that convert the x-rays into mammographic pictures of the breast. These images are reviewed by the radiologist.

## 2. COMPUTER AIDED DETECTION

This system searches in the digitized mammographic images for abnormal areas of density, mass that may indicate the presence of cancer.

## 3. BREAST TOMOSYNTHESIS

It is also called as the 3D mammogram and it is an advanced form of imaging where many number of images are captured from various angles and they together form an image set.

## B. THERMOGRAPHY

This method is a non-ionizing method of studying internal structure. The cancer is identified by the thermal indicators in the infrared images. Infrared radiations are emitted from the objects which are above the absolute zero temperature. The radiation is directly proportional to the temperature. It increases as the temperature increases. The infrared images are captured by using the infrared cameras. The high temperature at the skin indicates the presence and level of cancer. This method is sensitive to physiological changes that are the symptoms of cancer or precancerous stage which may lead to the formation of tumour. This method is very simple method to detect cancer. The results can be obtained quickly with less observer bias. But on the other hand the obtained result may not be accurate, as they depend upon the temperature of the body.

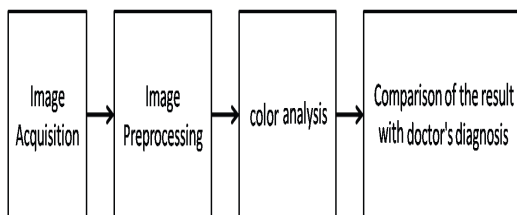


Fig 1 Pictorial representation of process involved in Thermography

## C. SONOGRAPHY

Sonography is a medical imaging tool used for diagnosing or detecting breast cancer. This technique is based on the application of ultrasound. Ultrasound is a sound whose frequency is greater than the human audible frequency (>20,000Hz). The ultrasound images are made by sending pulses of ultrasound into tissues of the body. Then the sound echoes off the tissue and they are recorded and converted into an image. Different tissues reflect varying degree of sound. The transducer is a hand-held device that is used to scan the breast and indicate the flow of blood and movement of tissues. The ultrasound is used for looking at some changes in the breast which are not seen in the mammogram. Ultrasound is the best way to find out if the abnormality is solid or fluid-filled. The Sonography method is less expensive than any other technique and they can detect tumour quickly and easily.

## D. DOPPLER ULTRASOUND

This method is used to monitor the blood flow in the breast. It shows the blood flow through the blood vessels. The Doppler ultrasound waves are passed through the breast and they echo from the tissues. These echoed waves are then converted into an image and displayed in the screen. During

Doppler ultrasound, a hand-held device called transducer is passed lightly over the skin above the blood vessels. It sends and also receives amplified sound waves. The sound waves bounce off from the solid objects, including the blood cells. The movement of blood vessels makes changes in the pitches of the sound waves. If there is no flow of blood, there will not be any change in pitch. By using the reflected sound waves, a graph or a picture is generated and analysed for detection of tumour.

## E. COLOUR DOPPLER

Colour Doppler is a tool which is easy to use and it is available in most ultrasonic imaging devices. It provides information about the vascularisation in tissues. In order to demonstrate very slow flow, it is necessary to apply minimal pressure on the breast, thus avoiding compression of blood vessels. It detects the blocks in the flow of blood and blood flow through the lumps and thus the tumour can be detected early.

## F. MAGNETIC RESONANCE IMAGING

This method consists of magnetic field and radio frequency pulses. MRI produces strong magnetic rays into the body. It is used to test the internal organs, tissues, bones etc..The medical images are displayed in the computer screen and transmitted into electronic signal and the details are printed. This method does not produce any iron radiations and they detect at which stage the cancer is. They can able to capture the image of both the breast simultaneously. It can easily detect any abnormalities, tumour, and lymph nodes in armpits. It easily detects dense breast tissues in younger women.

## G. POSITRON EMISSION TOMOGRAPHY

PET helps to detect the area and cells that are affected. The radiopharmaceutical called Fludeoxyglucose is injected first. It emits gamma rays. The FDG are recorded by the scanner and the images are constructed again and analysed. The suspicious area is found where the signals are strongly accumulated.

## IV. ADVANTAGES

### A. MAMMOGRAPHY

- Mammogram screening can reduce the number of women die due to breast cancer
- Mammogram can able to detect very small cancers at breast before they can be noticed or felt
- It increases the survival rate, it is used widely to detect cancer accurately

### B. THERMOGRAPHY

- Thermography equipment allows large area to be assessed for cancer.
- The area which is affected by cancer can be detected easily by using the colour variations in the infrared images.
- Cancer can be detected quickly thus saving time.
- It is 100% safe method and there is no radiation as in mammography

**C. SONOGRAPHY**

- It is quick and non-invasive
- It is painless and inexpensive
- It is useful for evaluating breast masses

**D. DOPPLER ULTRASOUND**

- Ultrasound examinations are non-invasive.
- They are relatively inexpensive, quick and convenient
- No harmful effects or radiations
- This method is particularly suited for soft tissues.

**E. COLOUR DOPPLER**

- 2D colour Doppler can detect the direction of flow of blood vessels, flow velocity etc..
- Can quickly detect the abnormal flow of blood

**F. MAGNETIC RESONANCE IMAGING**

- Particularly useful for detecting abnormalities in soft tissues
- There is no radiations and it is highly safe
- It can also detect problems related to blood flow

**G. POSITRON EMISSION TOMOGRAPHY**

- Small movements do not ruin the scan

**V. DISADVANTAGES**

**A. MAMMOGRAPHY**

- It is not 100% accurate. There is a chance that the mammogram looks normal even if the cancer is present.
- This Technique uses X-ray so the body is exposed to small amount of radiation which is harmful.
- It makes the patient feel uncomfortable during the test.

**B. THERMOGRAPHY**

- The disease cannot be located accurately because the high temperature in the surface of the breast may be due to some other diseases.
- Not effective for slow growing tumour
- Do not detect the size of the cancer.

**C. SONOGRAPHY**

- They do not produce results that are more accurate.
- The result is approximate and so they cannot determine the grade of cancer

**D. DOPPLER ULTRASOUND**

- The resolution of image is limited
- Ultrasound is reflected strongly on passing from tissue to gas and from gas to tissue

**E. COLOUR DOPPLER**

- Instrument performance affects the quality of blood flow imaging

**F. MAGNETIC RESONANCE IMAGING**

- MRI is done in enclosed surface, so people who are claustrophobic are facing problems with MRI
- While processing it involves loud noise
- They need high electric current

**G. POSITRON EMISSION TOMOGRAPHY**

- The image is not as clear as MRI
- The radioisotope given is only safe for the first couple of times.
- It is expensive

**VI. CONCLUSION**

Breast cancer is the second leading cause of death in women so it is necessary to make research on the techniques to detect breast cancer. Early detection of breast cancer can increase the rate of survival. Thus in this paper we have discussed the various techniques that can detect cancer at the early stage and the advantages and disadvantages are explained.

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