Medical Imaging

Microwave-Based Breast Cancer Detection Using Hypothesis Testing

View U.S. Patent No. 8,050,740 in PDF format.

WARF: P04337US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method of identifying malignant breast tissue that uses hypothesis testing and microwave backscatter measurements.

Overview

X-ray mammography is currently the most effective method for detecting early-stage breast cancer; however, mammography suffers from relatively high false positive and false negative rates, requires painful breast compression and exposes the patient to low levels of ionizing radiation.

The Invention

UW-Madison researchers have developed a method of identifying malignant breast tissue that uses hypothesis testing and microwave backscatter measurements. Breast tissue is illuminated with an ultrawideband (UWB) microwave pulse. The resulting backscatter contains contributions from possible tumors, clutter due to the heterogeneous properties of normal breast tissue, and noise.

At multiple locations throughout the breast, a hypothesis test is performed to determine if a tumor is present at that location. Under the tumor absent (null) hypothesis, the measured backscatter data is assumed to consist of clutter plus noise. Under the alternative hypothesis, the measured data is assumed to consist of backscatter from a tumor at that location plus clutter and noise. A test statistic is computed for each location in the breast and compared to a threshold to determine which hypothesis is most likely given the measured data. The resulting information indicates the location of detected tumors in the breast.

This approach offers improved patient comfort and safety compared to X-ray mammography and reduced cost compared to MRI. Furthermore, it may offer improved accuracy over conventional X-ray mammography.

Applications

- Breast cancer detection

Key Benefits

- Regular annual screenings using this approach should be more accepted by the public due to the safety of the imaging technique, the comfort of the procedure (no breast compression), the ease of use and the low cost
- May allow reliable detection of extremely small (millimeter-sized) malignant tumors, even in dense breast tissue or in tissue near the chest wall
- Uses non-ionizing microwave radiation
- Because low-power microwave exposure is harmless, exams may be done more frequently than with X-ray mammography.
- Noninvasive – does not require injection of contrast agents or breast compression

- Potentially reduces the number of false positives associated with X-ray mammography, thus reducing the number of unnecessary biopsies
- Uses relatively low-cost hardware to reduce the cost of screening
- May discriminate between malignant and benign tumors
- May identify tumor characteristics such as size or shape
- Uses an antenna array and short pulses to focus the backscatter signal in space and time, significantly enhancing the response from malignant tissue while minimizing the clutter that results from heterogeneous breast tissue
- Data is processed to remove artifacts such as those generated by the skin-breast interface.

Additional Information

For More Information About the Inventors

- Susan Hagness

Related Technologies

- See WARF reference number P01386US for a related microwave-based breast cancer detection method.

Tech Fields

- Medical Imaging : Other diagnostic imaging

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846