

Experimental breast tumor detection using NN-based UWB imaging.

ABSTRACT

This paper presents a system with experimental complement to a simulation work for early breast tumor detection. The experiments are conducted using commercial Ultrawide-Band (UWB) transceivers, Neural Network (NN) based Pattern Recognition (PR) software for imaging and proposed breast phantoms for homogenous and heterogeneous tissues. The proposed breast phantoms (homogeneous and heterogeneous) and tumor are constructed using available low cost materials and their mixtures with minimal effort. A specific glass is used as skin. All the materials and their mixtures are considered according to the ratio of the dielectric properties of the breast tissues. Experiments to detect tumor are performed in regular noisy room environment. The UWB signals are transmitted from one side of the breast phantom (for both cases) and received from opposite side diagonally repeatedly. Using discrete cosine transform (DCT) of these received signals, a Neural Network (NN) module is developed, trained and tested. The tumor existence, size and location detection rates for both cases are highly satisfactory, which are approximately: (i) 100%, 95.8% and 94.3% for homogeneous and (ii) 100%, 93.4% and 93.1% for heterogeneous cases respectively. This gives assurance of early detection and the practical usefulness of the developed system in near future.

Keyword: Ultrawide-Band (UWB); Breast tumor detection; Breast phantom; Breast tissues; UWB signals; UWB imaging.