Tumour Detection Using Contrast Agents and FEM-CSI in Microwave Tomography

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Microwave Tomography (MWT) is a low-cost, portable alternative to conventional imaging techniques such as magnetic resonance imaging (MRI) and computed tomography (CT) that operates using safe, non-ionizing radiation. MWT uses microwave scattering measurements to quantitatively reconstruct the bulk electrical properties, i.e., the permittivity and effective conductivity, of the biological tissues being imaged. These frequency-dependent properties are unique to different tissue types and vary with the tissue's physiological state, offering a new quantifiable factor in the diagnosis and investigation of pathological conditions. The strengths of MWT make it ideal for both early detection of breast cancer and for frequent monitoring of patients undergoing treatment, allowing them to avoid potentially unnecessary invasive treatments of suspicious masses. Due to limitations in the spatial resolution and sensitivity of current instruments it can be difficult to distinguish tissue types that have similar electrical properties, such as tumour and fibroglandular breast tissue [Laze07]. Enhancing the difference in the electrical properties between healthy tissues and tumours may be accomplished through the use of contrast agents. We present a computational study that investigates potential contrast agents at microwave frequencies. This study uses a finite element contrast source inversion algorithm to invert synthetic contrast enhanced breast data in order to determine the location of tumours [Bara13]. Prior information about the anatomy and the electrical properties of the breast model, which is obtained by a blind inversion before adding the contrast agent, is incorporated in order to successfully locate the tumours.

REFERENCES


ADVISOR: Dr. Joe LoVetri, Dr. Vladimir Okhmatoevs