ACOUSTICS2008/823 Multilayered non-invasive temperature estimation from backscattered ultrasound

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A major drawback on the application of thermal therapies is the lack of reliable knowledge about temperature in the region under treatment. The most attractive approach is non-invasive temperature estimation (NITE) strategies and, among them, techniques based on backscattered ultrasound (BSU) are a convenient choice for its portability and simplicity. Using BSU some methods have been proposed for temperature estimation basically for homogeneous media, and simple operating situations. More complex scenarios can be explored by non-linear approaches. In this work, a methodology based on neural networks is presented for temperature estimation in a multilayer phantom. A three-layer gel-based phantom was heated at eight intensities, between 0.30 and 2.0 W/cm2(at 1MHz) for 15 minutes. Temperature and BSU signals were acquired from five spatial-points at each 10 seconds. Temporal echo-shifts, induced by temperature change, were computed from the BSU signals, and used as model's input information. Neural models were developed to estimate temperature at four intensities. Then models were validated in data including all the intensities. The best model presents a maximum absolute error of 0.43 °C for untrained situations. To the best of our knowledge this is the first NITE approach in multilayered media.