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A Maximum Likelihood Approach to Spatial Compounding of Ultrasound Images

Yair Kerner and Moshe Porat

Department of Electrical Engineering
Technion – Israel Institute of Technology
Haifa 32000, Israel

Abstract

We develop a new method to exploit pairs of ultrasound scans of the same image plane with the aim of enhancing the quality of ultrasound imaging. Each image pair is assumed to be co-registered with 90° separation between the two insonification directions. The motivation for such spatial compounding is the resolution in medical ultrasound imaging, which is significantly worse in the lateral (transverse) direction compared to the axial (longitudinal) direction. The proposed method seeks a Maximum-Likelihood solution for the identification of the system response and the noise variance through the Expectation-Maximization technique, similar to the approach of multi-channel image restoration (MCIR). For the following step of image reconstruction and compounding we take into account the non-linear operations of envelope detection and log-compression that are required for the display of ultrasound images. We show that the best ability to separate close small objects is achieved when the compound image is produced through first using separate Wiener filtering for each RF image, afterwards performing envelope-detection and finally averaging the two envelope-detected images.

Corresponding author:
Moshe Porat,
Dept. of Electrical Engineering,
Technion, Haifa 32000, Israel.
Email: mp@ee.technion.ac.il
Fax: +972-4-832-3041
Tel.: +972-4-829-4684