Photoacoustic Source Detection and Reflection Artifact Removal Enabled by Deep Learning

ABSTRACT

Interventional applications of photoacoustic imaging typically require visualization of point-like targets, such as the small, circular, cross-sectional tips of needles, catheters, or brachytherapy seeds. When these point-like targets are imaged in the presence of highly echogenic structures, the resulting photoacoustic wave creates a reflection artifact that may appear as a true signal. We propose to use deep learning techniques to identify these type of noise artifacts for removal in experimental photoacoustic data. To achieve this goal, a convolutional neural network (CNN) was first trained to locate and classify sources and artifacts in pre-beamformed data simulated with k-Wave. We finally show that the CNNbased information can be displayed in a novel artifact-free image format, enabling us to effectively remove reflection artifacts from photoacoustic images, which is not possible with traditional geometry-based beamforming.

EXISTING SYSTEM

- In existing system, a neural network to estimate beamforming delay functions in order to reduce artifacts in ultrasound images arising from speed of sound errors.
- Although this approach is among the first to apply neural networks to beamforming, it does not effectively address the multipath reflection artifacts which arise in photoacoustic images.

PROPOSED SYSTEM

- We develop a deep neural network capable of locating both sources and artifacts in the raw photoacoustic channel data with the goal of removing artifacts in the presence of multiple levels of channel noise and multiple photoacoustic sources.
- Finally, we explore how well our network, which is trained with only simulated data, locates sources and artifacts in real experimental data with no additional training, particularly in the presence of one and multiple point sources.

SYSTEM REQUIREMENTS

- **HARDWARE REQUIREMENTS:**
- · Processor - intel core i3
- · RAM - 2GB
- · Hard Disk - 20 GB
- **SOFTWARE REQUIREMENTS:**
- · Tool - MATLAB R2016
- · Operating system - Windows 7,8

REFERENCE

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