

AbstractID: 13620 Title: Image reconstruction in an attenuating medium with two different attenuation coefficients using photoacoustic tomography

Purpose: The goal of this research is to incorporate the effect of attenuation of the surrounding medium and accurately reconstruct the optical absorption distribution of the photoacoustic source.

Method and Materials: Photoacoustic tomography (PAT) reconstructs an image of the optical absorption of an object using the pressure signals that are generated when the object is illuminated via pulsed electromagnetic radiation. The effect of ultrasonic attenuation can be significant since photoacoustic tomography uses broadband detection and the ultrasonic attenuation varies with frequency. Previous studies have related the detected pressure to the optical absorption coefficient when there is uniform attenuation. In this work, we specifically consider the practically important problem of an photoacoustic source embedded in a medium (such as tissue) with an attenuation coefficient, surrounded by a matching medium (such as water) with a different attenuation coefficient. The photoacoustic pressure that is measured by the detector in this case is not directly related to the optical absorption coefficient of the source. We have derived an analytical expression relating the photoacoustic pressure in the contact plane to the pressure in the detector plane. We can then reconstruct an image using the calculated pressure on the contact plane and the standard image reconstruction techniques for PAT.

Results: Preliminary results in 2D suggest that the analytic expression that we derived to relate the photoacoustic pressure on the detection plane with that in the contact plane provides a suitable method for obtaining the photoacoustic source lying in an attenuating medium.

Conclusion: The attenuation effect of the surrounding medium have been incorporated into image reconstruction in photoacoustic tomography. This work will be useful to accurately reconstruct the image in PAT when the attenuation coefficient of the object (such as tumor) differs from that of the surrounding medium (healthy tissue).

Conflict of Interest (only if applicable): None