Functional and Molecular Ultrasound Research Laboratory

PI: Mohammad Mehrmohammadi, PhD
Associate Professor, Department of Biomedical Engineering
Contact: mehr@wayne.edu

http://ultrasoundwayne4.wix.com/mehr-lab
Multi-parametric Imaging of Cervical insufficiencies for more accurate detection of the risk of preterm birth

**Sonography of cervical length**

**Photoacoustic imaging of collagen**

**Elasticity imaging of biomechanics**

- **B-Mode Ultrasound**
- **Spectroscopic Photoacoustic Collagen to Water Ratio (CWR)**
- **Shear Wave Elastography**

**Combined Multi-functional Imaging System**
Early-stage detection of inaccessible cancers

Miniaturized Ultrasound/Photoacoustic Endoscopic Imaging System

A schematic of designed US/PA endoscopic system

A photograph of integrated US/PA endoscopic system

Cervical Cancer

Bladder Cancer

Prostate Cancer
Enhancement of image-guided interventions

Integrating Ablation/Imaging System

Continuous Wave (CW) laser (1470 nm) & Pulsed laser (532 nm)
Catheter coupling system & Ablation catheter
Dichroic optics & Focal lens

Accurate Catheter Tip Tracking (videos)
Ultrasound
Ultrasound + Photoacoustic

Real-Time Temperature Monitoring

PA amplitude (a.u) & Temperature (°C)

Wayne State University
College of Engineering
Towards quantitative Photoacoustic tomography (qPAT)

Full-ring Ultrasound and Photoacoustic Tomography of Breast Cancer

- Water Shell
- Phantom
- US transducer

Laser input
A full ring PAUST imaging system. Where two ring mirrors are used for illumination and a full ring transducer is used for data acquisition.

Acoustic and Optical Compensation

(a) The inverse fluence map used for light fluence compensation. (b) PAT reconstructed assuming a homogeneous SOS of 1450 m sec\(^{-1}\) (c) Fluence and SOS compensation PAT. (d) SNR and (e) CNR comparison between uncompensated PAT and SOS + fluence compensated PAT.

Image Segmentation

(a) The UST SOS map that is used as the foundation for segmentation. (b) The numerical phantom that is generated from a region seeded growing method on the (a).

Oxygen Saturation (sO\(_2\))

(a) In-silico phantom structure. (b) Graph of measured sO\(_2\) values from both fluence uncompensated PA imaging. (c) The sO\(_2\) map as calculated from normal PA. (d) The sO\(_2\) map from fluence compensated PA imaging.
Ultrasound-guided acoustic induced hyperthermia for cancer treatment

Objective: to develop an all ultrasound-based hyperthermia therapy and temperature monitoring system for treatment of soft-tissue sarcoma.

Ultrasound ring-array tomography system with temperature regulated water channel

Initial testing of real-time ultrasound temperature monitoring through detection of changes in speed of sound of water in latex tubes surrounded by room temperature water bath in presence of lamb femur.
• Google Scholar: https://scholar.google.com/citations?user=nhPzu8YAAAAAJ&hl=en