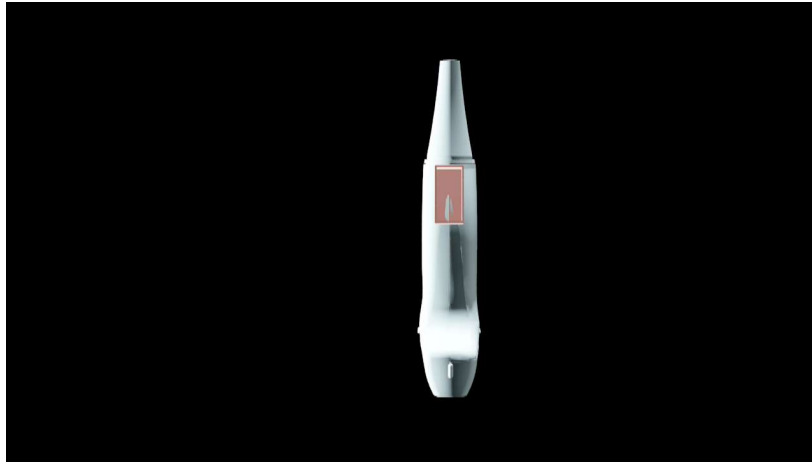


Tracking of active needle with a camera-mounted ultrasound transducer



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Tracking of active needle with a camera-mounted ultrasound transducer

- This project uses a form of sensor fusion (mono-camera and ultrasound) for tool tracking. We previously demonstrated this in a static environment and would now like to extend this to something real-time.
- **What Students Will Do:**
 - Develop real-time data acquisition software
 - Synchronize camera and ultrasound data capture
 - Calibrate the camera to the ultrasound transducer
 - Develop visualization for the tracking result
- **Deliverables:**
 - Real-time data acquisition module
 - Validation of calibration result
 - Experimental demonstration *ex vivo*
- **Size group:** 1-2
- **Skills:** Basic optimization, camera segmentation, Matlab, android programming
- **Mentors:** Alexis Cheng, Younsu Kim, Dr. Emad Boctor

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Echo Spine



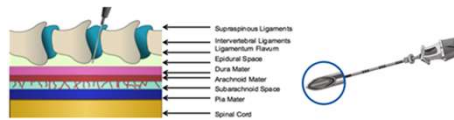
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Echo Spine

- Lumbar punctures (LPs) are performed to collect cerebrospinal fluid (CSF). We design a system using ultrasound and other sensors to help the lumbar puncture process.



- **What Students Will Do, Deliverables:**
 - Improving current system (sensitivity and acquisition speed of PZT needle and other sensors)
 - Designing a surgical protocol
 - *Ex-vivo* or *in-vivo* Experiment
- **Size group:** 1~3
- **Skills:** Matlab/C++, Arduino
- **Mentors:** Emad Boctor (eboctor1@jhmi.edu)
Yoonsu Kim (ykim99@jhu.edu)
Kai Zhang (hzhang61@jhu.edu)

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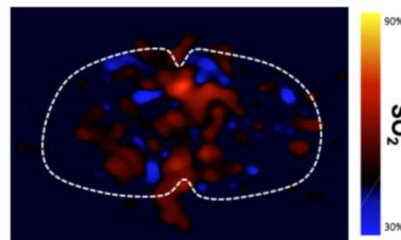
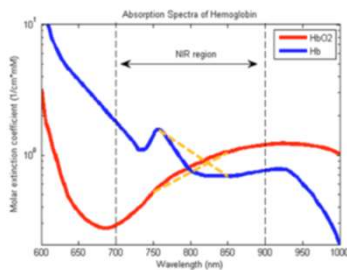
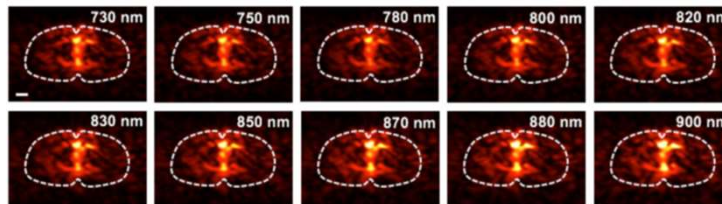


Photoacoustic Imaging Using Clinical Ultrasound scanners

- Photoacoustic (PA) imaging is a new modality capable of visualizing functional information. The goal of the project is to develop an algorithm to make PA imaging to be more comprehensive by allowing to use clinical ultrasound scanners.
- **What Students Will Do:**
 - Learn software/hardware background photoacoustic imaging
 - Develop an algorithm to recover synchronization between laser and ultrasound.
- **Deliverables:**
 - Algorithm and software development for real-time PA imaging.
- **Size group:** 1-2
- **Skills:** C++/Matlab, Image Processing
- **Mentors:**
 - H. Kai Zhang (hzhang61@jhu.edu)
 - Emad Boctor (eboctor1@jhmi.edu)



Photoacoustic Imaging Using Clinical Ultrasound scanners



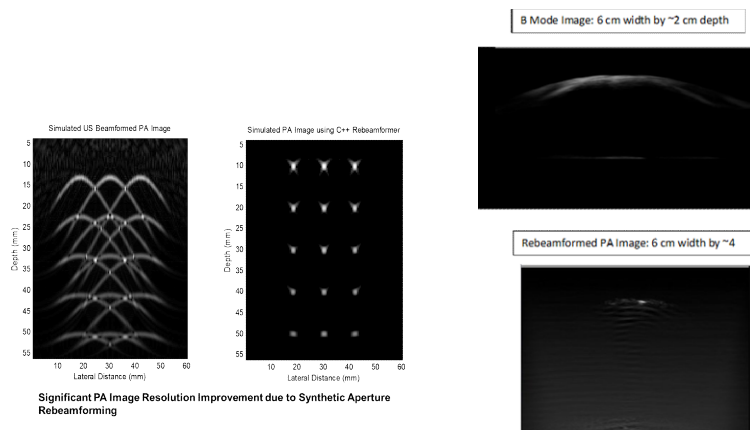
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Photoacoustic Imaging Using Clinical Ultrasound scanners

Last year CIS2



Co-robotic Ultrasound Imaging

- Cooperative robot-ultrasound system to maximize the potential of medical ultrasound.
 - Force assist for mitigating occupational injury
 - Expanding imaging field and image quality for deep tissue imaging
- **What Students Will Do:**
 - Learn robotic ultrasound and ultrasound imaging
 - Integrate these systems
- **Deliverables:**
 - Hand-on experience of robotic arm control
 - Integrate image reconstruction with real-time visualization
- **Size group:** 1-2
- **Skills:** Robotics, Matlab/C++, Image Processing
- **Mentors:**
 - H. Kai Zhang (hzhang61@jhu.edu)
 - Russell Taylor (rht@jhu.edu)
 - Emad Boctor (eboctor1@jhmi.edu)

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Co-robotic Ultrasound Imaging



6 DOF Robotiq FT-150
force/torque sensor

Handheld US device

Ultrasonix US
linear array probe

1 DOF Honeywell
Model 31 load cell

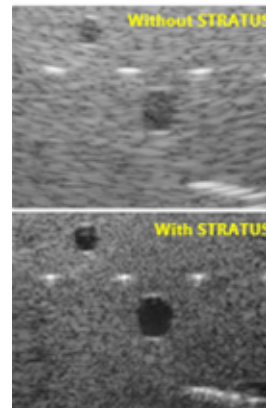
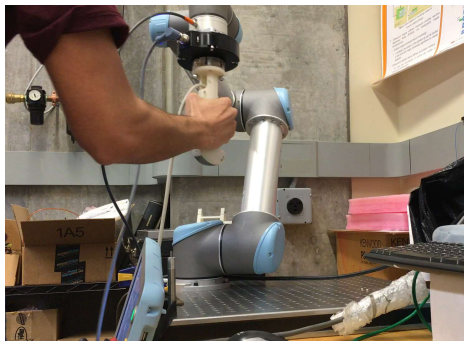
6-axes robots arm
(Universal Robots, UR5)

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Co-robotic Ultrasound Imaging



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