Software-based Approach for Real-time Photoacoustic Imaging using Vendor Independent US Beamformed Data

Computer Integrated Surgery II
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Introduction

• We have developed a fast algorithm for enabling PA imaging using US beamformed RF data.

• The algorithm can process beamformed data independently of any US platform or vendor. Integrated into Ultrasonix Ulterius as a live demo.

• PA imaging is an emerging medical imaging modality whose uses include cancer detection and instrument tracking.

• Our method circumvents hardware costs for PA imaging while boasting high framerates. It also enables PA imaging on any US platform with real-time RF data access.

The Problem

• PA signals can be captured by US systems but are defocused due to differences in travel times.

• Several current methods to enable PA imaging on US systems require channel data acquisition or beamformer reconfiguration (Frame rates of 3-4 Hz).

• These options are not available on many conventional US systems.

The Solution

• Kai’s synthetic aperture PA rebeamforming algorithm allows for fast refocusing of PA signals.

• Implemented the algorithm in C++ and optimized runtime by using precomputed tables. Calibrated algorithm with real RF data.

• To demonstrate its effectiveness, created a PA imaging demo using the SonixTouch US machine.

• Software dependencies for the demo include Cmake, Qt4, OpenCV, and Ultrasonix Sdk6. Coding was done on Visual Studios.

Outcomes and Results

• Live demo produces PA images in real-time with frame rates up to 50 frames per second (for images with lower target depth). Maintains real-time performance for all depths.

Future Work

• Will test system on additional real-time PA imaging setups.

• Optimize performance using parallel computing.

• Integrate future results into report for publication.

Lessons Learned

• UI development for real-time PA imaging.

• Code optimization (for faster rebeamformer).

• Planning and individual project management.

Credits

• Howard Huang (C++ Rebeamformer, Ulterius Demo)

• Mentor: Kai Zhang (Rebeamformer Algorithm)

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References

