AHMED SEWIFY

PHD STUDENT | PROGRAM 2
ARC TRAINING CENTRE FOR JOINT BIOMECHANICS

PhD duration: May 2021 to November 2024

My interests: Medical Device Research and Development, Machine Learning, Data Analysis, Software Engineering and Computer-Aided Design. I have interred for several companies performing task automation, computer vision, AutoCAD, GUI designs, web development and product design.

Previous Collaborators: BiVACOR, AOS Group, KIW, Netaware

MEng (QUT) **BEng** (QUT)

Principal Supervisor:
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PROJECT OVERVIEW

Project Title: Automatic ultrasound imaging-based tomography of the shoulder to track bony structures in real-time

THE PROBLEM

Why is conventional shoulder ultrasound a significant problem for sonographers and patients?

Performing a full shoulder ultrasound (US) scan is time intensive and sometimes dangerous for both sonographers and patients. Up to 85% of the sonographers have reported scanning in pain due to resulting musculoskeletal disorders. Expert sonographers are required to maintain stable hands throughout the procedure and understand how several images fit together. The patients also struggle during sonography as they adapt to uncomfortable positions for long periods of time.

Why do we need more research on next-generation ultrasound systems?

- Conventional US scans have limited field-of-view.
- Expert sonographers are required in order for US to be performed and interpreted.
- US scans are subject to variability from the operator-dependent nature of the acquisition and interpretation.

How can automatic, real-time ultrasound tomography of the shoulder bones help?

- A full scan of the rotator cuff region can be performed automatically in real-time, eliminating the time-intensive and laborious aspects of sonography.
- US image acquisition and interpretation will no longer require experts.
- US will be more suited for pre-operative planning.

HYPOTHESIS

Real-time tomographic imaging of the complete shoulder is possible by utilizing capacitive micromachined ultrasonic transducers (CMUTs) along with machine-learning-driven image registration techniques.

PROJECT AIMS

1. Determine the most efficient way to manually combine volumes scanned with a traditional 3D probe post-acquisition.
2. Examine which machine learning techniques are most efficient for automatically combining volumes scanned with a traditional 3D probe in real-time.
3. Employ CMUT arrays, image processing and localization techniques to track shoulder bones in real-time.

OUR SOLUTION & EXPECTED OUTCOMES:

A shoulder strap made of CMUT arrays that can automatically acquire a full scan of the bony structures in the rotator cuff region in real-time.

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