CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Gaeun Kim

Project Number

S0816

Project Title

Assessing Treatment Response in Colorectal Cancer Patients through Novel Volumetric Ultrasound Methods

Abstract

Objectives/Goals

The objective of this study was to develop a motion correction algorithm to obtain high-resolution volumetric liver ultrasound images. Combining motion correction with parametric mapping methods, the overarching goal was to accurately assess tumor growth and monitor cancer treatment response.

Methods/Materials

Selected 4D contrast-enhanced ultrasound (4DCE-US) sequences and performed preliminary image processing through standard deviation intensity projection. Use a supervised machine learning algorithm to isolate ultrasound beam from ribs and other organs. Created a binary mask to specify region of interest (ROI) around tumor using fslview and MeVisLab. Registered images using a pyramidal window-to-master-average approach. Used findings to develop a parametric blood perfusion mapping method.

Results

Tumor motion range was reduced by an average of 2.17 pixels, and time-intensity perfusion curve analysis showed that the corrected images were closer to the clinically used manual gold standard. The random forest classifier and pyramidal registration scheme were also confirmed to be robust methodologies, based on a high mutual information (MI) metric between corrected samples and the manually corrected samples.

Conclusions/Discussion

Motion correction through image processing reduces the distortion and movement of 4D volumetric contrast-enhanced ultrasound images, and parametric maps of corrected images provide a clearer view of blood perfusion in the tumor. This research has implications in rapid assessment of treatment response in cancer patients, as well as the early detection of cancer.

Summary Statement

I developed a novel motion correction algorithm and parametric response mapping method for the early assessment of treatment response in colorectal cancer patients.

Help Received

Dr. Ahmed El Kaffas, a postdoc at the lab I intern at (Translational Molecular Imaging Lab at Stanford) taught me how to read ultrasounds and how to use certain computational tools. The project methodology design and execution was done largely on my own.