Application for Round 3 QIBA Project Funding

Title of Proposal: Second 3A Statistical and Image Processing Analysis	
QIBA Committee/Subgroup: CT Volumetry	
NIBIB Task Number(s) which this project addresses:	
Project Coordinator or Lead Investigator Information:	

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Institution/Company: Elucid Bioimaging Inc.		
Amount Requested:		

Project Description

Quantifying changes in lung tumor volume is important for diagnosis, therapy planning and evaluating response to therapy. Computer algorithms have been developed in order to measure such volume changes in clinical settings. The aim of the first QIBA 3A study was to estimate the inter-algorithm variability on phantom data. The algorithms were applied to FDA acquired CT scans of synthetic lung nodules in anthropomorphic phantoms. Using FDA-supplied physical measurement values as ground truth, we calculate the algorithm measurement accuracy bias and variability. The study was organized as a public "challenge" and consisted of two phases, the pilot and the pivotal one. Both the pilot and the pivotal used anonymous participants from academic and commercial developers associated with QIBA. The participants downloaded High Resolution CT images from QI-Bench, an open source software infrastructure that supports the development of quantitative imaging biomarkers.

This second challenge is undertaken to assess the minimum detectable change of lung lesions imaged on CT using patient datasets as a function of applying different algorithms or methods to the same data. The results from this study will broaden the base of data to support the QIBA profile and its descriptions regarding "best practices" for clinical trials and the reduction of measurement variability. The challenge study builds on prior QIBA studies according to the following:

	Variability due to scanner / participant	*Variability due to algorithm / method*
Phantom data	1A, 1C	First 3A challenge
Clinical data	1B	This (second) 3A challenge

This second 3A challenge uses clinical data sets collected under a no-change condition to determine effects due to differing algorithm or method in the minimum detectable change in size of lung lesions by building on the prior results of QIBA study 1B. CT datasets of 32 non-small cell lung cancer patients scanned twice within 15 minutes and reconstructed as thin transverse slices (publicly available on both TCIA and QI-Bench). One lesion was identified for each patient (32 target lesions). Participants will evaluate each lesion for volumetry. Test-retest repeatability will be evaluated for each participant and across participants by comparing measurements performed on both scans for the same lesion.

Primary goals and objectives

This challenge increases the type of analysis performed to extend beyond evaluation of the volume results (only), to evaluation of the segmentation boundaries or outlines as well. This is necessary to understand why the results are what they are and provide important insights for developers and suppliers on the strengths and weaknesses of their algorithms under certain specific clinical conditions as well as providing a basis for optimization using this information.

This second 3A challenge builds on the methodology to be used in prior QIBA studies in two important ways. First, it adopts standardized statistical analysis modules based on the results of the RSNA-sponsored "Metrology Workshop," which had not taken place when study design shall be performed for the prior studies, but which is available now. Second, it extends the analysis to an evaluation not only of the computed volume result but as well as pixel-wise analysis of the segmentation objects themselves.