

Application for QIBA Round-2 Project Funding

Title of Proposal: Comparative Study of Algorithms for the Measurement of the Volume of Lung Lesions: Assessing the Effects of Software Algorithms on Measurement Variability		
QIBA Committee/Subgroup: Volumetric CT Technical Committee		
NIBIB Task Number(s) which this project addresses: 1-3 and 5-7		
Project Coordinator or Lead Investigator Information:		
Last Name: Kim	First Name: Hyun (Grace)	Degree(s): PhD
e-mail:	Tel #:	
Institution/Company: UCLA Department of Radiological Sciences		
Amount Requested:		

Please check the primary category for this proposal from among the following:

- 1. Identification of Technical Characteristics and Standards
 - a. Creation and refinement of protocols for image acquisition, analysis, quality control, etc., for specific clinical utility
 - b. Phantom development and testing
 - c. Identification and assessment of intra-reader bias (1) and variance across scanners and centers
 - d. Identification and assessment of inter-reader bias and variance across scanners and centers
 - e. Other (Characterize intra- and inter-algorithm performance using phantoms for ground truth)
- 2. Clinical Performance Groundwork
 - a. Assessment of intra-reader sensitivity and specificity
 - b. Assessment of inter-reader sensitivity and specificity
 - c. Other(Characterize intra- and inter-algorithm performance in volume change using clinical data)
- 3. Clinical Efficacy Groundwork
 - a. Assessment of correlation between new biomarker and 'accepted-as-standard' method
 - b. Characterization of value in clinical trials
 - c. Characterization of value in clinical practice
 - d. Development/merger of databases from trials in support of qualification
- 4. Resources (money and/or people) committed from other sources.

This project focuses on data analysis and contains two parts: (1) analysis of manually collected data from various measurement algorithms and (2) scripted, automated analysis that will be performed using multiple data sets and will utilize a re-usable infrastructure for large-scale algorithm testing. For the latter, the image data server will run batch analyses of different algorithms. Each algorithm will produce a measurement (e.g. volume (3D)) of reference lesions and a description of the level of automation and the algorithm method. The measurements will be provided from anthropomorphic phantoms and clinical image data, which have already been marked up by multiple reading teams. The format of data set will need to be decided. The cleaned and locked quantitative data (e.g. volume measurements) from the different algorithms will need to be provided.

Please provide a one-page summary that includes the following information:

Project Description

QIBA 1A study investigated the bias and variance using CT images of an anthropomorphic phantom and obtained measurements using only one algorithm. However, image processing algorithms have been developed in many organized activities from a number of groups using many different approaches with varying amounts of human interaction and different levels of segmentation success. This study proposes to investigate the effects of different algorithms in bias and variance using reference data sets of both phantoms and patients; in addition, this study proposes to investigate the performance of different methods and degree of automation in the algorithm.

This study can increase knowledge for the QIBA Profile and to provide a context in which multiple parties have incentives to participate. (1) manual analysis in which sites perform required measurement task and manually supply data back to QIBA 3A project personnel and (2) scripted analysis that would apply to multiple data sets to invest in a re-usable infrastructure for large-scale algorithm testing

This project extends other QIBA Volumetric CT committee experiments investigating measurement variability by specifically looking at: (a) the effects of measurement variability due to the measurement-algorithms (b) the effects of the degree of automation and by algorithm method, assessing measurement variability between algorithms (c) apply to multiple data sets by creating a re-usable infrastructure for large-scale algorithm testing. This will allow us to understand variability across algorithms in large datasets.

This project proposes three specific bases to assess the overall variability due to algorithms and by the degree of automation and by the algorithm method:

- (1) Manual Data Set: estimate the bias in the test set from the scans of anthropomorphic phantoms
- (2) Manual Data set: estimate variability from the test data set from the scans of anthropomorphic phantoms and clinical images
- (3) Scripted analysis: set up a statistical code for in a re-usable infrastructure for large-scale algorithm testing

Primary goals and objectives

The primary and first aim of the study is to estimate inter- and intra-algorithm variability by the volume estimation of synthetic nodules from CT scans of an anthropomorphic phantom (according to the work of the QIBA 1A Group). For a long term, the study is to set up a re-usable infrastructure for large-scale algorithm testing and to apply to multiple data sets

Deliverables and Timetable [must include intermediate measureable milestones.]

1. Draft Data analysis plan presented to QIBA VolCT group for approval (2011 Q3; Estimated Aug 15)
2. Data Analysis plan of Manual data set finalized. (2011 Q4; Approx Sep 30)
3. Data Analysis plan of scripted analysis: (2011 Q4; Approx Sep 30)
4. Describe Data Transfer Format for Manual and Scripted set review (2011 Q4; Approx Oct 15)
5. Data analysis
 - a. Manual Data Set: estimate the bias (2011 Q4; Approx Nov 15)
 - b. Manual Data Set: estimate the variability (2011 Q4; Approx Nov 15)
6. Quality Check and run a test case from scripted data using statistical code (e.g. R) (2011 Q4)
7. Internal summary report of data analysis for QIBA members (2011 Q4; Approx RSNA)
8. Set up for an available statistical code for scripted data set (2012 Q1)
9. Submission of results to conferences (e.g. RSNA, SPIE) for presentation (2012 Q1)
10. Submission of peer-reviewed publications based on results (2012 Q2)