QIBA Volumetric CT Group 3A Update
Thursday, February 17, 2011; 11 AM CST
Call Summary

In attendance   **RSNA**
Maria Athelogou, PhD (Chair)   Charles Fenimore, PhD   Joe Koudelik
Andrew Buckler, MS   Ying Tang, PhD   Julie Lisiecki

I. **Project Scope discussed**
    - Using existing studies
    - Activities and time-frames; additional definition needed
    - Project resources and communication
    - Cost, if any?
    - Project Quality
    - Risks
    - Development of a work schedule
    - Experts needed to participate in study design
    - Project will begin with 1A data.

II. **NIST and UCLA to consider hosting informatics project data**
    - More discussion is needed.
    - Algorithm expert to be invited to participate.
    - Idea of a "challenge problem" discussed.
    - Test set data (sequester); Development set data (more available)

III. **Model Study Design after similarly designed successful studies:**
    1. Volcano (Dr. Anthony Reeves)
    2. Bio-Change (Dr Fenimore)

Next steps:
- Dr. Athelogou to draft a "statement of work" and present it to Group 3A
- Dr Athelogou to define group activities (challenge problems) to engage broader participation
- Dr. Fenimore to investigate and follow up with NIST data hosting possibility
- Mr. Buckler to follow up with UCLA data-hosting possibility
- RSNA staff to send reminder to Group 3A and to contact Dr. McNitt-Gray regarding his colleague with algorithm expertise
- Group to look at 3A study design and send suggestions to Dr. Athelogou: MAthelogou@DEFiNiENS.com.
- Drs Reeves and Fenimore to forward Volcano and Bio-Change model details to Dr Athelogou for reference
- Projected completion date for the 3A study is August 2011

Next call: Thursday, March 3, 2011, 11:00 am CST.

QIBA Volumetric CT – Group 3A
March 3, 2011, 11 am CST
Agenda

I.   **Planning the 3A Group Study (Challenge)**
     - a comparative study of algorithms for the measurement of the volume of lung
     lesions using phantom CT data.

II. **Issues for the discussion are:**

     a. Motivation for the Study
     b. Objectives of the Study
     c. Study Design
     d. Dataset
     e. Algorithms
     f. Analysis Protocol
     g. Analysis method
     h. Result presentation
     i. Result evaluation for the QIBA protocol

III. **Open discussion.**

Interalgorithm Study using CT Images of synthetic nodules……….

Objectives of the QIBA 3A Group

- **An** inter-algorithm study**, in the same way QIBA has been working on inter-reader,**inter-scanner**, and** inter-site**. We will also connect it to the analysis section of QIBA** Profile**.**

- **The 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 (see Dr. Petrick's paper , SPIE 2011)**

- **For the impelmentation of the obejctives a challenge could be organized (?)**

Study Motivation

Motivation for the Study

Study Design

Dataset

Algorithms
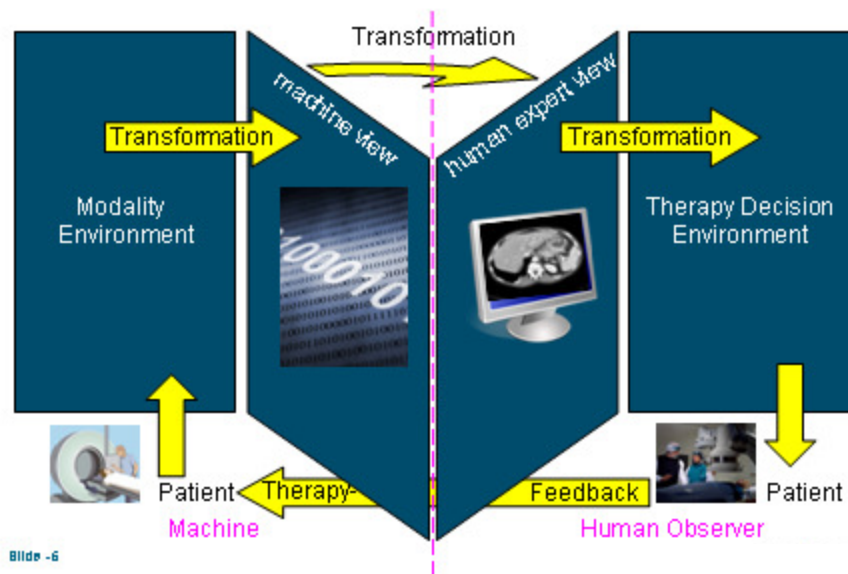
Analysis Protocol

Analysis method

Result evaluation

Result presenation

Result evaluation for the QIBA protocoll

Motivation

Motivation

- Changes in nodules volume is important for diagnosis, therapy planning, therapy response evaluation
- Measuring volume changes requires high accuracy in measurement of absolute volume
- Ground true has to be exact measured. This is not the case by data annotation (inter- and intra-observer variability)
- Volumes of synthetic nodules are measured (high accuracy)
- Therefore it make sense to use such data (as ground true) in order to calculate accuracy measurement of algorithms

- The study results could be combined with the QIBA 1A Group work. This combination will improve the QIBA volumetric CT Profile development.

The study has to be complementary to the study of the 1A Group:

- 1A study: Radiologists and synthetic nodules (inter- inra-observer variability)

- 3A Study: Algorithms and synthetic nodules: intra-algorithms variability)

- Using of the same technological basis (scanner type, Philips (1A Group data, synthetic nodules)) to secure independence for inter-scanner variability (except BIAS between different serial numbers)

Data Set/ Data preparation

- **The same phantom data as used for the 1A Group Study (see Dr. Patrick's publication, SPIE 2011)**

- **? How is the volume of the synthetic nodules calculated/determined? What is exactly BIAS**

Analysis procedure (analysis Protocol according Bio-change or Volcano Challenge?)

- **Describe the overall analysis procedure (use as example the Biochange Challenge Protocol http://www.nist.gov/itl/iad/dmg/biochangechallenge.cfm: How to Participate in Biochange Challenge (Dr Fenimore)**

  Download and read the Biochange Challenge Protocol and email or fax Statement of Interest to NIST.

  Download the BiochangeChallengeSeries from the NIST FTP site and from the NBIA RIDER collection as described in the Protocol.

  Run your change analysis algorithm or CAD tool in your lab on the validation data.

  Report your change results in one of the required formats and send a Participation Agreement signed by the your team leader to NIST by January 18, 2011.

  NIST will analyze the reported results, comparing them to the limited available ground truth as described in the Protocol. NIST will provide Participants with individual analysis of their results. We will publish the results of the evaluation, without publicly identifying individual scores by Participant.

Algorithms

- **Academia and non profit organizations**
- **Industrial vendors**

(for example possible vendors, according to the Volcano 2009 challenge could be: Siemens, Phipps, MeVis, Kitware, Definiens, VIA CAD etc…

- **Description/Classification of the algorithms: according to the grade of user intervention is needed (for example Volcano'09, A. P. Reeves et al):**
  - Totally automatic using seed points
  - Limited parameter adjustment (on less than 15% of the cases)
  - Moderate parameter adjustment (on less than 50% of the cases)
  - Extensive parameter adjustment (more than 50% of the cases)
  - Limited image/boundary modification (on less than 15% of the cases)
  - Moderate image/boundary modification (on less than 50% of the cases)
  - Extensive image/boundary modification (more than 15% of the cases)

Performance is a necessary criterion for algorithm evaluation.

*Time is needed for the dV calculation

* Practicability and other parameters have to be calculated for the algorithm evaluation.

Analysis of the results (data analysis)

- **Box plot (for example: for each data set, nodule volume vs. method, relative Volume)**

$$Vol_{rel} = 100\% * (Vol_{est} - Vol_{true}) / Vol_{true}$$

$$Vol_{rel} = 100\% * (Vol_{alg} - Vol_{synthetic\ nodule}) / Vol_{synthetic\ nodule}$$

Result information for the participants

- **Each participant has to be informed (only the own algorithm results)**

- **Publication of the results (all participants)**

- **Using the results for the QIBA protocol: knowledge exploitation for the QIBA protocol**

Is needed

- **Data preparation, Data management, Data access for participants (risk?)**

- **Academic / non profit organization for the evaluation of the results (NIST?)**

- **The *academic/non profit organization* can share the overall responsibility for the study with QIBA/RSNA**

- **Man power?**

- **Funding?**

- **To Do list for start (next step)**

Next Steps

- **To Do list for start (next step)**
    - **Refinement of the draft (study design)**
        - **We need:**
            - **Next call conf March 17 ? (study design more detailed)**

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