

Quantitative Imaging Network

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Special points of interest:

- New Team Members
- New Executive and Coordinating Committees Announced
- SharePoint Items
- Program contacts for Working Groups
- 2013 Face-to-Face Meeting & Poster Session

Inside this issue:

Radiomics at Moffitt (continued)	2
The 2013 Face-to-Face Meeting	2
Document Collaborations for The QIN	3
A Call To Action for QIN Content	3
SharePoint Roll Call for Meetings	3
QIN, The Early Days	4
QIN Data Sharing Chart	4

The QIN is On the Move

The QIN is gaining momentum and expanding membership. The network welcomes four new member teams; the University of California San Francisco (Dr. Nola Hylton), the University of Michigan (Dr. Brian Ross), and the Memorial Sloan-Kettering Cancer Center (Dr. Sadek Nehmeh) have been participating already. New to the network is the Mayo Clinic (Dr. Brad Erickson).

Due to the growth of the network, governance has become an increasingly important aspect for its management and progress. To respond to this administrative challenge, two new committees have been formed to guide and manage the growth; the Executive and Coordinating Committees.

The Executive Committee:

The Quantitative Imaging Network (QIN) Executive Committee (formerly the Steering Committee) consists of all principle investigators from the

QIN research teams. The purpose of the Executive Committee is to oversee the direction of the network and to ensure that all network-wide components are contributing to the mission of the QIN.

The mission of the Quantitative Imaging Network (QIN) is to improve the role of quantitative imaging for clinical decision making in oncology by the development and validation of data acquisition, analysis methods, and tools to tailor treatment to individual patients and to predict or monitor the response to drug or radiation therapy.

The Executive Committee will meet monthly by telephone. They will be discussing ways that QIN can interact with ACIN and various clinical trial groups in the near future. In addition, interaction with the new National Cancer Informatics Program, the Quantitative Imaging Biomarkers Alliance, and quantitative imaging software industry will be discussed and implemented.

The Coordinating Committee:

The Quantitative Imaging Network (QIN) Coordinating Committee consists of the chairs and co-chairs of the various working groups established within the network. The function of this committee is to coordinate the communication and activities among the working groups. The Coordinating Committee will report to the Executive Committee, and will resolve issues that arise between and among the various working groups. The Coordinating Committee will meet by telephone on a regular basis as determined by the committee.

The participation in QIN has reached over 200 individuals, and the new Coordinating Committee will play an important role in coordinating the activities that will move the QIN to the next level of progress and success.

Radiomics at Moffitt

RJ Gillies, D Goldgof, L Hall, RA Gatenby, Y Balagurunathan, S Eschrich

The enormous progress in understanding the molecular causes and pathophysiology of cancer has not generally translated into improved outcomes. One strategy for improving cancer therapy is development of personalized cancer medicine where treatment is tailored to individual patients. As cancers are dynamical systems, this will require measurement tools with the ability to measure key parameters accurately over time. Clinical imaging has the key characteristics necessary for development of personalized cancer therapy, but many challenges remain. One of the biggest challenges is to convert radiological practice from a descriptive and qualitative technique into one that is inherently quantitative.

The overall goal of the Moffitt Radiomics project is to develop standard operating procedures (SOPs) to convert standard-of-care (SOC) medical images into mineable data that are connected to patient demographic, outcome and gene expression databases. High-throughput of data is needed. (Continued on page 2)

Radiomics at Moffitt (from page 1)

We envision the creation of databases with tens of thousands of cases. Furthermore, our approach is *agnostic* in that it attempts to extract all features that can conceivably be quantified with the expectation that the dimensionality of the data can be reduced downstream.

Our QIN project focuses on thoracic CT scans, originally from patients with cancer and more recently expanded to screening populations. SOPs being developed have shown applicability to PET/CT and MRI data. The process of radiomics can be divided into four steps: Acquisition, Segmentation; Extraction and Analysis Progress has been made in all four areas, yet many challenges remain:

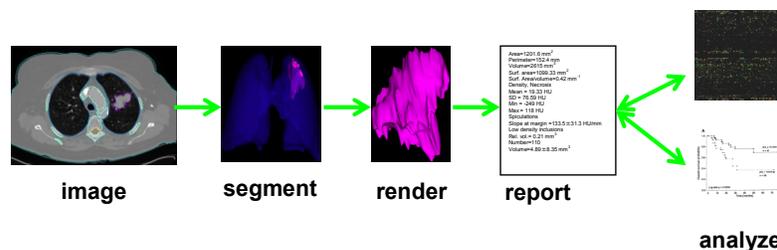
Acquisition: There is a remarkable amount of heterogeneity in the acquisition conditions and reconstruction algorithms encountered in SOC CT scans. It is our challenge to prioritize these parameters for their impact on the quality of the extracted data. We are approaching this problem by (a) archiving the raw data so that it may be reconstructed with variable options; and (b) creating a large enough database. With these available, retrospective analyses will determine the impact of reconstruction algorithms on the quality and diagnostic potential of extracted features.

Segmentation: Segmentation has to be as automatic as possible. We have developed multiple algorithms which favorably compare to expert manual segmentation. To compare automated algorithms, we have developed a “segmentation challenge” consisting of a curated set of 150 CT scans and a common set of evaluative metrics. This will be announced in the next months where the goal is consistency, as “ground truth” does not exist. We have also determined that texture features are for the most part insensitive to the segmented volume.

Extraction: Generation of features from segmented volumes is relatively straightforward. We have generated a list of 324 quantitative 2-D and 3-D features that are routinely extracted from CT images. More recently, we are adding to this list advanced features that are related to specific hypotheses relating to heterogeneity of “niches” within tumors, as well as characteristics of the parenchyma surrounding tumors. Since the segmented volumes are stored, features can be re-extracted in batch mode at any time and saved with appropriate versioning.

Analysis: We have created a “Radiomics Database” that can house the extracted feature data and have dynamic access to patient demographic, patient outcome and genetic data. This is based on an Oracle-derived Federated database, which will eventually allow for HIPAA-compliant data sharing among partner institutions. Because quantitative radiological data have not yet been archived in this fashion, significant effort must be spent in data curation, for which SOPs have been iteratively developed.

The long-term vision of the radiomics effort is to develop a plug-in to existing PACS systems so that extracted feature data can be obtained prospectively in real time. We also have ongoing international collaboration with other leaders in the area Mastro Clinic, Netherlands and Institute of Automation, Chinese Academy of Sciences, China.



Next Face-to-Face Meeting: March 2013

The next QIN Face-to-Face meeting, scheduled for March 2013, will take place once again at the Natcher Building on NIH Bethesda campus. Additional space over last year’s venue has been acquired, and plans are to expand the poster session.

The Cancer Imaging Program will send information for travel, hotel accommodations, and poster session

logistics in advance to give participants ample time to plan and prepare for the meeting. When the information arrives, please complete your travel activity promptly and return it to NCI early. Budget restrictions will again apply, so each research team will be expected to support the travel for several team members. Program staff will announce the number of travelers from each team

supported on federal funds.

A major goal of this two day face-to-face meeting will be a highlight of data sharing and collaborative research within the QIN. Therefore, joint posters from collaborative teams are encouraged. The agenda and goals of the meeting will be topics for discussion in the Executive Committee over the next few months.

Document Collaborations for the QIN in SharePoint

The QIN has progressed to the point where document collaboration activities are critical for future progress and technical development. While packages such as GoogleDocs provide useful features for document sharing, there is value to having this capability reside in SharePoint.

The current version of SharePoint does provide capabilities for document collaboration with "Work Documents" and "Team Discussion" in the document library for each Working Group page.

Although this capability is good for capturing information from group chat activities, it resides in separate locations within SharePoint making navigation a challenge for users.

The QIN program staff would like to enhance this capability in SharePoint by creating a document collaboration capability where multiple users can work on a document jointly during collaboration sessions and manage version controls for manuscript maturity. The QIN program staff is in discussion with the NCI management

that provides the SharePoint tool to the QIN to create this new capability to assist participants to engage in document development. More will be forthcoming on this feature in the near future.

In the meantime, NCI staff encourages members to consider the work document and team discussion capabilities already in SharePoint in order to become familiar with these functions. As soon as the new document capabilities become available, a test case will be created and exercised.



George Redmond,
QIN Communication
Coordinator

A Call to Action for QIN Content on SharePoint

NCI Program Staff members hope that SharePoint will become an important tool for support of the QIN. To achieve this, the information on the site must be up to date. Each QIN member is encouraged to post information he or she feels is useful to the QIN mission and then to communicate to NCI staff that the posting has been done. This helps to communicate the availability of the information to others.

Each working group

and subgroup has an NCI point of contact (see box at right). Updating working group rosters resulting from turn over of members should be directed to the QIN Communication Coordinator, George Redmond, or the respective Program Director.

Each working group has its own page to communicate among its members and to the entire QIN membership. All working groups should take an active interest in updating

the content on its perspective working group pages. There are still many opportunity links and updates for announcements, blogs, group task, and links that would enhance the content experience for users in general. If each member of a working group spends a little time in updating the content, the site will improve greatly. A static site is not of much value to the network, so active participation is encouraged.

SharePoint Roll Call for Meetings

The SharePoint Roll Call for monthly teleconference meetings is ready for use. The capability is easy to use with just a point and click action to generate an attendance record for each meeting. Just click "Roll Call" on the left panel in Sharepoint and "Add new item". This will aid in the development of meeting minutes.

The SharePoint Roll Call will be strongly encouraged for participation on all

QIN teleconference calls starting in September 2012. The Cancer Imaging Program will use the roll call mechanism to determine team participation on committee and working group activities. This will help to determine overall interest in working groups from the various teams, and will measure participation in Executive Committee decisions.

It is important that QIN members be registered in SharePoint to gain access to

the roll call feature. This means keeping user name and password active. If by chance a user is faced with inactive user password, please contact the help desk via email at NCI-Fhelpdesk@mail.nih.gov. It is important that all participants perform the roll call 5 minutes before the schedule working group conference call to facilitate the rapid confirmation of attendees to make the best use of time during the meeting.

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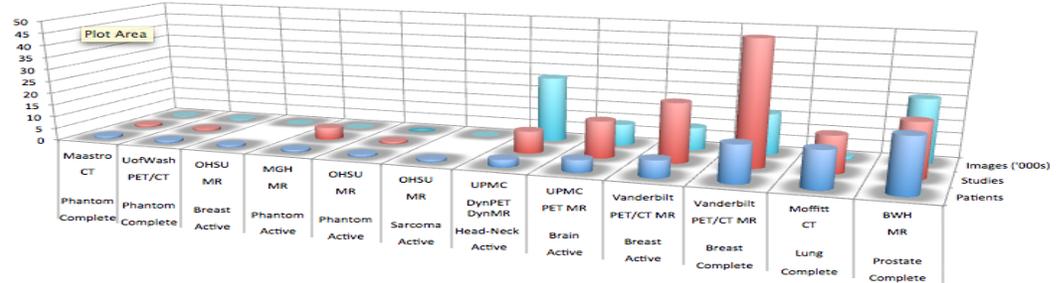
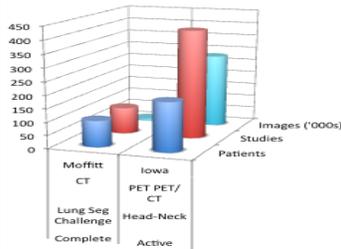
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QIN

QIN Data Sharing on TCIA August 2012



QIN, The Early Days

The Quantitative Imaging Network (QIN) was launched in August 2008 with the publication of the program announcement PAR-08-214. Its mission was simple; to promote research on quantitative imaging of tumor response to cancer therapies in clinical trial settings, with the overall goal of supporting clinical decision making. Response from the research community was enthusiastic and immediate. The program has grown from its initial member, The University of Pittsburgh, to include a total of fifteen top-ranked cancer research centers across the nation. Now, four years later, it is interesting to look back at the birth of QIN.

The first year of QIN was a year of waiting; waiting for the first due date for receipt of applications, waiting for the review process to take place, and waiting for decisions from NCI management on how the U01 applications would be selected for funding. This was back in the days of the old scoring system (100 – 500) and during the time when two amended applications could be submitted.

The first review study section was a rocky one. Reviewers were thinking more

about traditional R01 grant application reviews, rather than about translational research where the importance of performing repeat measurements and the expanded use of phantoms played key roles. Research goals of reducing variance across scanners and improving image registration algorithms replaced the goals of creating exotic new imaging methods. With occasional redirection from Ken Bielat, one of the finest Scientific Review Officers at NCI, the study section completed its task of fair and impartial review. Interestingly, several applications held scores worthy of consideration for funding. However, without associated percentiles in a system trained to place value only on the percentile number, it was impossible to determine which applications, if any, would pass through the gauntlet of NCI Executive Committee review.

The University of Pittsburgh application was selected by the EC, and on September 1, 2009 became the first member of QIN. Shortly thereafter (March 9, April 1, and April 15, 2010) H. Lee Moffitt, the University of Iowa, and the University of Washington entered the network. Stanford

University and Vanderbilt University entered on May 1, 2010.

With the membership at six teams, the first face-to-face meeting was held in the Washington area. At this meeting, the overall mission of the QIN was established, and five working groups were organized. The network was off and running.

The network has continued to grow. The reissue of the program announcement as PAR-11-150 has breathed new life into the program and now fifteen teams are participating in the QIN. Many of these teams entered on their first and even second amended application, so persistence can definitely pay off.

The NCI program staff associated with the QIN program must constantly think about where the network is going from a research perspective, but also must constantly work to grow the membership by encouraging new applications into the program and processing those applications that score well in review.

Now QIN is moving into activities only dreamed of by program four years ago. Data sharing (as shown above) is just one area of network growth.