



DCE - MRI technical Committee

Data Warehouse use case and business application

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DCE – MRI use case

The DCE-MRI Technical Committee of QIBA has developed a DCE-MRI phantom as part of the technical groundwork for developing the first DCE – MRI profile (1).

To facilitate the integration of phantom scans in site qualification and ongoing quality control, as recommended by the profile, an associated analysis software package is needed to enable efficient data analysis after the scanning of the phantom per the profile recommendations.

In order to test the algorithm developed by VirtualScopics as part of the Phase I RSNA/NIBIB contract, QIBA phantom sample data are needed, and there is a need to store those phantom sample data in a data repository or data warehouse accessible for algorithm testing.

This is one specific expression of a use case as described by the Open Image Archive *ad hoc* Committee (2).

>>Use Case 3: Algorithm Development

Imaging biomarker developers have a critical need to work with a large and diverse collection of imaging data as early as possible in the development cycle. This spans a wide range of potentially useful imaging datasets, including synthetic and real clinical scans of phantoms and clinical imaging datasets from patients with and without the disease/condition being measured. It is also important to have sufficient metadata (i.e., additional clinical information) available during algorithm development in order to evaluate full algorithm or algorithm component performance. To further illustrate the needs of algorithm developers, an example description follows outlining a set of data needed to develop an early stage lung cancer therapy assessment algorithm that performs a volumetric analysis of lesion burden in computed tomography scans. While many potential datasets would be useful in this setting, this list is intended to capture a core set of data needed for the development of a robust algorithm. <<

User Requirements for data warehouse

- To provide a data repository/warehouse able to store phantom data in DICOM format.
- To store basic phantom description / user manual together with phantom data.
- To store metadata together with the phantom DICOM data (phantom identifier, phantom manufacturer, etc.)
- To have access to those data by, at least, the QIBA community.
- To have an easy to use user interface to upload and download phantom data.
- To have a fast upload / download mechanism.
- To have the data warehouse available with reasonable downtime (and with user notification of downtime)
- To provide an overview what is stored in the data warehouse for DCE-MRI use.
- To store results of phantom data analyses together with metadata describing the analysis.
- To provide a basic search or reporting functionality.

Business application – QIBA DCE-MRI phantom analysis software

The phantom data shall be analyzed by specific phantom analysis software. It would be beneficial if the QIBA DCE-MRI phantom analysis software (provided by VirtualScopics) could be accessed and run using the sample phantom data. The results should be visualized and should be storable and downloadable upon user request.

DCE – MRI data warehouse use case and applications

It would be beneficial to have the ability to store other phantom analysis software packages in this business application layer/service as well to compare the results from the QIBA DCE-MRI phantom analysis software to those obtained from other software packages.

This can be used as platform for compliance checking of phantom analysis software, new phantoms provided by other manufacturers, or, in general, for phantom scans as part of clinical studies and/or site qualification activities. This would translate into a subunit test for compliance to the overall QIBA DCE-MRI profile.

Next use cases and applications

Synthetic data and data analysis

In the third Phase I QIBA funded project of the DCE-MRI technical committee, a synthetic data set has been developed, including a Digital Reference Object. These data should be stored in the data warehouse as well and can be used for algorithm testing and comparisons of DCE-MRI analysis software packages, i.e., testing and comparing to a minimum achievable standard necessary for demonstrating DCE-MRI profile compliance.

Clinical reference data

The QIBA DCE-MRI profile shall be supported by clinical data showing the results of a profile compliant imaging procedure in a clinical setting for the different manufacturer's MR models. This shall be used as reference for the QIBA DCE-MRI profile

If there is sufficient clinical reference data available, those can also be used for compliance testing against the QIBA DCE-MRI profile.

References:

- (1) http://qibawiki.rsna.org/index.php?title=DCE-MRI_tech_ctte
- (2) http://qibawiki.rsna.org/index.php?title=Committee_on_Open_Image_Archives