

AbstractID: 3058 Title: Development of Image Software Tools for Radiation Therapy Assessment

There has been extensive recent interest in the potential power of emerging imaging tools for early prediction of therapy effectiveness, both related to tumor control and normal tissue damage. These prognostic indicators are the results of combining improved imaging hardware, specialized scanning protocols, and advanced image processing and analysis paradigms.

In order to study and eventually use these tools routinely in the radiotherapy process, serious consideration needs to be given to the software environment necessary for proper data collection and analysis ties to individual patients' treatments. Imaging for therapy assessment (IAT) presents a multidimensional information environment, requiring data from different imaging modalities and acquisition methods, as well as handling temporal data series, combined over short (breathing, dynamic contrast) and long (temporal changes over weeks of treatment) time periods. The information needed for relating these data sets for analysis (non-rigid transformations, proper labeling of studies to measurement states) exceeds the capacities of existing DICOM standards. The extraction of analyzed information and relation to regional (radiation) dose should be multidimensional, and not restricted to voxel-specific regions.

Examples of imaging studies underway for therapy assessment will be presented. Software requirements will be demonstrated through an example system currently in use to support clinical trials at the University of Michigan. This system was designed around the unique needs of IAT, and is able to combine information from multiple sources (e.g., MRI, MRS, CT, PET, radiation dose) and time periods in an intuitive interface. This system has been used for studies of blood flow and volume, regional venous perfusion, vascular permeability, water diffusion, metabolite, and local contrast enhancement for high dose radiotherapy trials in the brain, lung, and liver to date.

#### Learning Objectives:

1. Understanding the unique needs related to imaging for assessment of radiation therapy.
2. Understanding the required tools beyond those found in a typical treatment planning system
3. Understanding a common ground needed for combining efforts of imaging physicists, radiation physicists, physicians and statisticians.
4. Understanding opportunities for novel paradigm and algorithm development