

AbstractID: 3399 Title: Mutual Information as a Metric of Multimodality Contrast Agent Efficacy

**Purpose:** Mutual information (MI) has been previously employed for image registration. Assuming *a priori* registration, MI becomes an estimator of image similarity. We apply the concept of MI to the analysis of a feature space formed from multimodality signal intensity distributions. We demonstrate the utility of this concept through the development of a reproducible inter-image metric to evaluate the efficacy of a multimodal contrast agent for x-ray computed tomography (CT) and magnetic resonance (MR) imaging.

**Method and Materials:** MR and CT scans were acquired of an anesthetized rabbit in the presence of a multimodal contrast agent. MR and CT scans were acquired pre- and post-injection at fixed time intervals. For each time interval, the MR and CT images were registered, the multimodality feature space was formed and the mutual information between MR and CT was computed using in-house software. The resulting MI metric was compared with measurements of signal intensity enhancement in user-defined regions-of-interest within the liver, kidneys and aorta.

**Results:** The MI metric correlates with measurements of signal enhancement in MR and CT due to the presence of contrast agent as seen in the liver, kidneys and aorta. Voxels identified as contributing to the increase in MI correspond to areas of visual contrast enhancement observed on MR and CT.

**Conclusion:** We have developed an inter-image metric for the characterization and optimization of a multimodal contrast agent. The computation of the MI metric is automated and can be extended to 3D for the assessment of image volumes and allows for the inclusion of other modalities such as positron emission tomography. Future investigations will further the development of MI and multimodality feature space analysis as a tool in radiation therapy applications including image registration, target definition and treatment response monitoring.