AbstractID: 6987 Title: CT Image Registration in Sinogram Space

Purpose:
Object displacement in a CT scan is generally reflected in CT projection data or sinogram. Conventional registrations in the image space are often adversely influenced by the reconstruction-induced artifacts. A direct sinogram-based registration has been studied.

Method and Materials:
It is found that a rigid motion only affects the projection angle and radial distance of the CT projections instead of the intensity. Simple equations have been successfully deduced.

A simulated 2D phantom model was adopted and modified to test the algorithm. A physical head phantom was scanned using a kV cone beam scanner. Fan beam sinograms were then generated for the central axial plane.

Upon random 2D rigid motions, registrations were carried out in the sinogram space. For every possible motion, the relevant sinogram was generated according to the discovered relationship and compared with the reference sinogram, as a result, the most likely motion was obtained.

Results:
Simulated and experimental results demonstrate that the new registration technique works well for registration of rigid motion in parallel beam sampling and fan beam sampling CT scans. The images were reconstructed from the registered sinograms and the spatial accuracy of this new registration was better than 2 mm.

It is also found that this sinogram registration couldn't be affected by the metal filling, the truncation, or uncompleted projection set. This makes it appealing for various applications in image guided radiation therapy (IGRT).

Conclusions:
The direct relationships between the object motion and the change of CT projection data (sinogram) were studied and this knowledge was successfully applied to a novel algorithm for sonogram-based registration. Calculated and experimental results demonstrate that the new registration technique works well particularly when registering images with metal or truncation artifacts.