

Registration of real-time ultrasound (US) to high resolution CT/MR can give a valuable interventional tool to surgeons. CT data are to be registered and deformed then reconstructed to show beside each US 2D image of the same physical slice. With this goal in mind, one founding step is to reconstruct CT-2D image using US probe tracking data.

The core of this work is to develop an algorithm to construct oblique 2D images from a 3D data set. Three stationary points relative to the US probe are tracked and used to generate the 3D coordinates of reconstruction plane points via cross products. Two different interpolation methods have been investigated: nearest neighbor (NN) and voxel iso-volumetric spheres (VIVS). NN assigns nearest neighboring voxel value to the point (delta sampling). VIVS represent voxels as spheres of the same volume. The intersectional volumes of spheres serve as a weighting factors normalized to their sum. Eliminating directional complexity cuts down the computational cost and reduces jitter.

Several tests of both methods have been done on a digital phantom and clinical data. Self-consistency of the algorithms was tested. IVIS was equivalent to NN in preserving phantom mass within 0.5%. Both were also comparable in basic histogram statistics like degradation of smoothness measure with higher rotation angles. In the combination of rotation and inverse rotation transformation, NN showed more jitter than the VIVS method thus indicating the preference for the later. Implementation of both methods in C++ enables almost real-time processing.