

AbstractID: 3754 Title: Preliminary study to use non-rigid registration for target tracking and dynamic treatment planning

Purpose: to prove the feasibility of non-rigid registration of CT scans taken from a temporal series in thoracic and abdominal radiosurgery.

Method and Materials: for 5 patients 2 CT scans were acquired in end-exhale and end-inhale condition. The radiation oncologist identified the lesion in both examinations. We chose a voxel-based non-rigid registration using B-Splines Free Form Deformation (FFD) with a local rigidity constraint. We created a mask to include only the target and applied the calculated deformation to it to evaluate position and shape of the lesion. We estimated the mass centres of target displacement between two moments of the breathing cycle and evaluated the variation of the volumes.

Results: from the analysis of the mass centre movements it follows that the maximum displacement was in inferior/superior direction. The most relevant case was a lesion placed close to the diaphragm that showed large movements in anterior/posterior direction and also in the inferior/superior direction (18.6 mm). Volume variations were equal to 15% in two cases, 1.5% and 6 % in other two. Only a small lung lesion showed a big increase, due to the fact that this target contained a margin of nearby tissue affected by large deformation during the breathing cycle. The targets obtained by non-rigid registration were similar to those identified by the radiation oncologist.

Conclusion: this study shows the possibility to apply non-rigid registration for a more accurate radiosurgery treatment. In particular, among the applications of this study it should be possible to follow the target movements/deformations and calculate the dose distribution by taking into account the changes of tissues during all the instants of breathing, providing both the complete target tracking and the dynamic treatment planning.