AbstractID: 1163 Title: Inverse Treatment Planning with Adaptively Determined Voxel-Dependent Importance Factors

In current inverse planning algorithms it is common to treat all voxels within a target or sensitive structure equally and use structure specific prescriptions and weighting factors as system parameters. In reality, the voxels within a structure are not identical and there exists strong intra-structural competition in these voxels. Inverse planning objective function should not only balance the competing objectives of different structures but also that of the individual voxels in various structures. In this work we propose to model the intra-structural tradeoff through the modulation of voxel dependent importance factors. When it is permissible for each voxel to have its own importance value, a challenging problem is how to obtain a sensible set of importance factors with a manageable amount of computing. This issue was resolved by using an adaptive algorithm, in which, instead of letting the values of voxel dependent importance to vary freely during the search process, they were tied to the local radiation doses through a heuristically constructed relation. The new planning tool was applied to study a hypothetical phantom case and a prostate case and the results were compared with that obtained using conventional inverse planning technique with structure specific importance factors and with that obtained using a commercial planning system. Application of the new technique to a few cases suggests that the dose distributions obtained with conventional inverse planning algorithm based on structurally uniform importance factors are at best sub-optimal and can be significantly improved with the help of the proposed non-uniform penalty scheme.