Variable Prescription Dose Guided IMRT Planning

Purpose: To devise a technique to improve tumor (organ) dose distribution and reduce under and overdosing in IMRT planning by means of iterative adjustment of voxel-specific prescription doses. **Method and Materials:** We use a spatially-dependent penalty scheme based on how well a given voxel satisfies its ideal clinical prescriptions. In this situation both under-dosed and overdosed voxels are penalized with a penalty weight proportional to the amount of the dose departure from the ideal prescription. Alternatively, the method can be interpreted as the iterative adjustment of individual voxel prescriptions in order to produce an improved dose distribution. If a voxel is over (under) dosed then its prescription dose is decreased (increased) and the plan is re-optimized. The procedure is repeated until voxel's dose cannot be improved anymore. Remarkably, guided by a metric such as a dose-volume histogram (DVH), our method is capable of producing significantly improved treatment plans iteratively without expert's intervention. **Results:** A clinical head and neck case was used to test this method. By adjusting voxel prescriptions to compensate for the inequalities between the actual calculated and desired doses, substantial improvements are obtained for the treatment plan as large dose reductions were achieved in almost all of the critical structures present. For instance, we demonstrate fivefold reduction in the maximum dose to the brainstem. Other organs at risk experience dose reduction ranging from 100 to 300 percents. **Conclusions:** Our method can readily be implemented with any treatment planning system and demonstrates fast convergence and significantly improved plans.