AbstractID: 3319 Title: Geometrically Assisted Selection of Optimum Beams in IMRT Planning by Techniques of Computer Vision

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Purpose: To define optimum beam orientations in IMRT by geometric analysis of the PTV and OARs using techniques of computer vision. The method is particularly applicable to situations when one or more OARs are adjacent to the PTV and where non-coplanar beam orientations are employed, but can be used in cases requiring coplanar beams. The selected beam orientations are those that can most effectively yield desirable dose distributions in the PTV, sparing to a maximum extent adjacent OARs.

Method and Materials: For each voxel of a PTV-OAR interface, Gaussian Invariant techniques are used to obtain the two orthogonal components of a vector that defines a tangent plane. A two-dimensional histogram of the number of voxels having specific values of those two vector components is formed. Clusters or peaks in the histogram correspond to dominant plane orientations in the interface. Considering the anatomy of a patient whose PTV and OARs have been projected on the surface of a hemisphere, each histogram cluster gives rise to an arc on that surface. Any beam oriented from a point in that arc towards the isocenter is then a possible optimum beam. At the present stage of development, the planner selects one or more optimum orientations for each OAR by using beam's-eye-view (BEV) tools.

Results: Initial application of the method to clinical cases yields optimizations that are consistent with current clinical practice, with the geometrically assisted definition of optimal beams taking a small fraction of the time usually needed for that task.

Conclusion: The work presented can be the basis of a nearly full automatic method of optimal beam orientation selection in which dominant arcs on the hemispheric surface are found by a self-organizing network and the subsequent BEV analyses are carried out automatically by a rule based system.