Clinical Deployment of an Automatic Planning Interface for Overlap Volume Histogram Based Treatment Planning

Innovation/Impact: A modular interface is demonstrated which allows for consistently planning patients using data from similar previously treated patients.

Introduction: Automatic planning relies on achievable doses in prior treatment plans. It is assumed that for two patients whose structures which have a similar positional relationship as demonstrated by an overlap volume histogram (OVH), similar doses can be achieved for both plans. To make the use of this type of planning, an interface needs to be produced which can easily query a database of patients to generate dose levels for optimization objectives.

Methods: A group of 34 pancreas patients previously treated at this institution are used to populate a database. This database contains for each patient the regions of interest (ROI), OVHs for each target/organ at risk (OAR) pair, and dose volume histograms (DVHs) for each structure. OVHs are generated by plotting the percentage of overlapped volume for a series of uniform expansions.

To maintain consistency in naming, a renaming interface (Figure 1) is used which maps structure and trial names to a set of common names. Consistent ROI names allow for the database to be queried and find all information about a given structure. Consistent trial names allow for selecting specific trials in the query. Additionally, structures are tagged to indicate which should be included in the database.

![Figure 1: Renaming interface. ROIs and trials are renamed to common names for each site.](image)

A set of planned optimization objectives are used for each patient which specify the objective ROI, type of objective (Dose/DVH), direction (Minimum/Maximum) and volume level if DVH-
based. Dose levels are queried from the database by first determining the set of patient plans which meet the minimum target dose level (i.e. all plans that deliver more than 45 Gy to 95% of the target volume). Of these plans, the set is selected which had a similar or greater overlap between the target and objective ROI at the prescription volume (or 0 in the case of dose-based objectives). For each patient in this set, the dose to the prescription volume is determined for the objective ROI. The lowest dose from this set is the lowest achievable dose listed in the database. The database is queried in this way for every non-target objective.

The GUI (Figure 2) presents this information in a customizable and easy to use way. Each objective is tagged as Target, OAR, or None. Target objectives specify the dose levels used in the target query. Each OAR objective is queried from the database with the prescribed volume level and target information. Results are color coded to indicate if a match was successfully found in the database: Green indicates success, and red indicates no match so the user can input a value manually. The None type indicates other objectives not handled in this interface or structures not stored in the database.

![Figure 2: Auto planning GUI. The list of optimization objectives is listed and dose levels are queried from a database. The generated objectives can be directly loaded into Pinnacle.](image)

In order to obtain high target coverage, a very high target weight is used (100 here). For the OAR objectives, a very low weight is used as these dose levels are selected from achievable plans and should not require much trade off to obtain. After objectives are determined, the objectives are automatically loaded into Pinnacle via script and optimization is started.

The final optimized clinical plan is added to the database. Each additional patient in the database allows for better sampling of points in future queries. As better plans are added to the database, future queries sample the best plan available with a more difficult geometry.

Results: The auto planning GUI and database has been successfully used to produce the clinical treatment plan for one new pancreatic cancer patient. Further patients will be planned as they are recommended for treatment.