Automatic treatment planning implementation using a database of previously treated patients

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Purpose/Objectives

- Using a database of prior patient dose and shape relationships allows for the prediction of dose on future patients.
- Automatic planning improves the speed of treatment planning by providing a good initial plan for the dosimetrist to start from.
- Database driven solutions improve quality by predicting the lowest known achievable critical structure dose from prior patients.
- Safety is improved by showing suggested solutions that are more realistic.
- Toxicity and other planning data can be recorded to improve plan selection.

Materials/Methods

- Database consists of 53 patients from 3 institutions.
- Dose and structure data is available for 46 patients from 2 institutions.
- Prior planning information is stored in an SQL relational database.
- Structures are grouped into PTV, OAR and None.
- For consistency, a tool (Figure 2) is used to map names to a standardized scheme.
- Structures are grouped into PTV, OAR and None.
- Overlap Volume Histograms (Figure 3) are computed for each PTV-OAR.
- For each structure, the patients which have the same or closer shape relationship in the database of equal or closer distance are selected. The lowest achievable dose from this target dose greater or equal to the prescription target dose.
- The interface allows for selection from a predefined set of prescriptions.
- Duplicate structures in the mapping process are identified.
- Selects a dose grid that covers all relevant structures.
- Sets a prescription based upon the selected plan type.
- Places isocenter and pre-defined beam sets.
- Adds ring structures and combines common OARs.
- PTVs and OARs are added to database.
- Uncommon names can be renamed manually.
- Plans can be evaluated with a single click from the planning system.
- Plan evaluation dashboard (Figure 5) is used to check protocol compliance.
- Plans can be further improved by adding more plans to the database.
- The automatic planning tool allows for less experienced planners to generate high quality plans based upon prior patient data.

Results

- Figure 6: Automatic planning reduces cases which exceed protocol specifications.
- Figure 7: Automatic planning tool is currently being used for all pancreas SBRT patients at Johns Hopkins.
- The automatic planning tool allows for faster planning when compared to manual planning with improved quality.
- Using an automatic planning tool allows for less experienced planners to generate high quality plans with improved quality.
- Plan evaluation dashboard allows for rapid evaluation of plans.
- Plans can be further improved by adding more plans to the database.

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