AbstractID: 13961 Title: A Planning Quality Evaluation Tool for Adaptive IMRT Treatment Based on Machine Learning Approach

**Purpose:** To monitor the quality of adaptive IMRT plans, especially dose sparing for the organs-at-risk (OARs), a plan evaluation tool is developed to predict the dose volume histogram (DVH) based on patient's anatomical information and a database of high quality prior treatment plans. The predicted DVH provides a guideline for judging the "goodness" of a new treatment plan.

**Materials and Method:** First, using machine learning to establish a relationship between patient's anatomical information and the DVH curves in a database of high quality treatment plans. Anatomical information and DVHs of the PTV (encapsulates prostate and seminal vesicles) and OARs (rectum and bladder) were extracted from the CT/CBCT images and dose distributions.

Principal Component Analysis (PCA) is used to characterize the DVH and the anatomical information. And a statistical analysis tool is used to seek the correlation between the DVH characteristics and anatomical features.

The second is validation, in which treatment plans outside the database are used to test the performance of the tool.

**Result:** A total of 198 treatment plans were included in the database for machine learning. DVHs of the OARs were characterized by two PCA components that cover 90% variances. Patient anatomical information is reduced to a set of variables, including the two PCA components of the distance volume histogram and organ volumes. Validation test used 14 treatment plans outside the database. The prediction is successful if the actual DVH falls in the 95% confidence band of the predicted DVH curve. Overall, 13 of 14 bladder DVH predications and 12 of 14 rectum DVH predications were successful.

**Conclusion**: An IMRT plan quality evaluation tool based on machine learning is developed to assure the quality of treatment plans. The input is patient's anatomical information, and the output is the predicted DVHs for the OARs.

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