AbstractID: 6650 Title: Dimension Reduction Analysis of Dose Volume Histogram And Its Potential Application In Predicting Normal Tissue Complication Probability

PURPOSE: Radiation pneumonitis (RP) is a major concern for patients receiving radiotherapy for lung cancer. The present study assesses the possibility of using multiple dose-volume-histogram (DVH) based metrics to predict the likelihood of grade ≥ 2 RP.

MATERIALS AND METHODS: The lung DVH and clinical outcome data from 235 patients were studied. Two linear and four nonlinear statistical dimension reduction analysis methods were applied to the lung DVH to map the data from the original feature space into a 2D or 3D manifold. Then, the question of whether the lung DVH could uniquely predict the likelihood of grade ≥ 2 RP was mapped to the feasibility of separating the populations with and without RP in the 2D/3D manifold.

RESULTS: None of the statistical dimension reduction techniques which preserve the local geometric properties of the original DVH curves was able to clearly separate the patients with and without grade ≥ 2 RP in the 2D/3D manifold. Among the techniques tested, the Local Tangent Space Alignment (LTSA) performed the best. It could almost reduce the original DVH data into a one dimension manifold. Unfortunately the order the LTSA assigned to the lung DVH curves did show clear correlation with patient RP grades.

CONCLUSIONS: The dimension reduction analysis like LTSA which preserve the distance information between DVH curves can be useful in characterizing the complexity of patient DVH data from a lung toxicity study. The lack of clear segmentation between the grade ≥ 2 RP patients and other patients in the dimension-reduced manifold indicates that using lung DVH data only can not generate a satisfactory result in predicting the occurrence of grade ≥ 2 RP among the lung cancer patients after 3D-CRT radiotherapy treatment.

This work was partially funded by NIH grants R01 CA69579 and R01 CA115748.

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